PROJECT MANUAL
VOL. 1 - Building

TERMINAL B Renovations

For

ERIE CANAL HARBOR DEVELOPMENT CORPORATION

100% CD Set
June 10, 2021

Prepared by:

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BA Project No. 012774.01

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OWNER / CONTRACTOR AGREEMENT

BETWEEN

ERIE CANAL HARBOR DEVELOPMENT CORPORATION

AND

FOR

ECHDC Outer Harbor Phase 1A

Dated: June 30, 2021

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CONSTRUCTION AGREEMENT

This agreement made this (date) of _____, 20____ between_____ ("Contractor") a corporation authorized to do business in the State of New York, having an office at _____ and the Erie Canal Harbor Development Corporation ("Owner"), a subsidiary of New York State Urban Development Corporation d/b/a the Empire State Development Corporation ("ESDC"), having an office at 95 Perry Street, 5th Floor, Buffalo, NY 14203.

WITNESSETH:

WHEREAS, the Owner and Contractor for the consideration named agree to perform under the terms and conditions set forth herein,

NOW, THEREFORE, in consideration of the mutual covenants hereinafter set forth, Contractor and the Owner hereby agree as follows:

ARTICLE 1

CONTRACT PRICE

Contractor has been selected to provide construction services as denoted in the Drawings, Project Manuals and all other Contract Documents referenced herein ("The Outer Harbor Phase 1A Project" or the "Project") upon the terms and conditions hereinafter provided and agrees to perform all work and labor required, necessary, proper for or incidental to the work and to furnish all supplies and materials required, necessary, proper for or incidental to the work for the total not to exceed the sum of (the "Contract Price"), which sum shall be deemed to be in full consideration for the performance by Contractor of all the duties and obligations of Contractor under the Contract (the "'Project").

ARTICLE 2

SCOPE OF WORK, MATERIALS AND LABOR

2.1 Owner's Representative

The Owner may designate a representative to act on its behalf with respect to certain obligations and duties under this agreement related to the administration of the Project (the "Owner's Representative"). The Owner's Representative may be an employee of the Owner, ESDC or an independent consultant. The Owner may change the designation of the Owner's Representative, in its sole discretion, with written notice to the Contractor. The Owner's Representative shall be the only individual with authority to bind the Owner under the terms of this Agreement. More than one Owner's Representative may be designated by the Owner from time to time during the Project. The Owner's Representative shall be Bergmann Associates. For the purposes of this Agreement, any decision, action or other responsibility of the Architect shall be deemed to be a duty, right or obligation of the Owner's Representative. Furthermore, any decision or action under this Agreement which may bind the Owner may only be made by the Owner's Representative.

2.2 Architect and Construction Manager

(a) For the purposes of this Agreement, the term "Architect" shall mean Bergmann Associates and Trowbridge Wolf Michaels LA as the Architect/Engineer retained by the Owner or ESDC to

provide design or consulting services related to Contractor's Work as the Owner may designate from time to time.

(b) A Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

2.3 Definition of Work

(a) All materials to be furnished and labor and work to be performed and completed by Contractor and all duties and obligations of Contractor as required in the Contract Documents are herein collectively referred to as the "Work". Contractor shall perform and complete for the Owner all Work required by and in conformity with the Contract Documents for this contract.

(c) Pursuant to section 220 (3-a) of the New York State Labor Law, each Contractor and Subcontractor shall maintain payroll records, subscribed and affirmed by him as true, showing the hours and days worked by each worker, laborer, or mechanic, the occupation at which he worked, the hourly wage rate paid and the supplements paid or provided for this project. The Contractor shall submit such payroll records for himself and each of his Subcontractors, 30 days after the issuance of the first payroll and every 30 days thereafter until submission of the last payroll for this project, including weeks not worked. Failure to submit payroll records in the accordance with Section 220 (3-2) of the New York State Labor Law shall be sufficient condition to withhold progress payments, until compliance. The payroll records shall be submitted to the Construction Manager.

2.4 Contract Documents

The "Contract Documents" shall consist of the following:

(a) This instrument (the "Agreement").

(b) Drawings and revisions, if any, as identified in Exhibit E (such Drawings and revisions, as the same may be revised from time to time, are herein referred to as the "Drawings").

(c) Project Manual and Addenda, if any, as identified in the project manual (such

(d) Specifications and Addenda, as the same may be amended from time to time, are herein referred to as the "Specifications").

(e) The Payment Bond and Performance Bond in Exhibit A and B.

(f) Notice to Bidders.

(g) Information to Bidders.

(h) Special Conditions

(i) Bid Form including alternates and unit prices accepted by the Owner as applicable.

(j) Change Orders adopted pursuant to this Agreement.

The Contract Documents form the contract between the Owner and Contractor. Reference in the Contract Documents to "the Contract", "the contract", "this contract", or "the Construction Contract" shall be deemed to include all of the Contract Documents. References to "this Agreement", "the Agreement", or "the agreement" shall refer to this instrument, which is one of the Contract Documents.

2.5 Intent of Contract Documents

(a) The intent of the Contract Documents is to include in the Work all labor and materials, insurance, tools, equipment, permits, licenses, taxes, approvals, transportation, surveys, testing, field engineering, and other professional services water, heat, utilities, transportation and other professional services (other than the services of the architect,

engineers, attorneys and the inspection, survey and testing services of the Owner) whether temporary or permanent and whether or not incorporated or to be incorporated in the work and any other items required to execute and complete the Work satisfactorily and in accordance with the Contract Documents.

Contractor shall perform and complete the Work in accordance with this intent and shall perform all work incidental thereto or as is usually performed in connection therewith, or as is reasonably inferable therefrom, it being the intention that all work usually performed by the trade covered by this Agreement and necessary to produce the intended result be performed by Contractor whether or not specifically covered by the Contract Documents.

(b) The Contract Documents are complementary and what is called for one shall be as binding as if called for by all.

(c) If any conflicts or ambiguities are found or between the Drawings and Specifications, or among any of the Contract Documents, they shall be brought to the attention of the Architect immediately for resolution. The Contract Documents will be interpreted so as to secure in all cases the most substantial and complete performance of the Work as is most consistent with the needs and requirements of the Work such that the best quality or greatest quantity of labor or material is provided. In the event of a conflict between the drawings and the finish schedule, the intent as interpreted by the Architect, shall govern.

(d) Addenda to parts of the Contract Documents are for the purpose of varying, modifying, rescinding or adding to portions of the Contract Documents. Where an addendum modifies a portion of a paragraph or a section, the remaining paragraphs, sections or portions thereof shall remain in force, unless otherwise stated in the addendum.

(e) Captions, headings, cover pages and table of contents contained in the Contract Documents are inserted only to facilitate reference and for convenience and in no way define, limit or describe the scope, intent or meaning of any provision of the Contract.

(f) Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

(g) A typical or representative detail indicated on the Drawings shall constitute the standard for workmanship and material throughout corresponding parts of the Work. Where necessary, and where reasonably inferable from the Drawings or Specifications, Contractor shall adapt such representative detail for application to such corresponding parts of the Work. The details of such adaption shall be subject to prior approval by Architect. Repetitive features shown in outline on the Drawings shall be in exact accordance with corresponding features completely shown.

(h) The layout of utilities, mechanical and electrical systems, equipment, fixtures, piping, ductwork, conduit, specialty items and accessories indicated on the Drawings is diagrammatic and is not complete. Contractor shall be responsible for locating all such items.

(i) It is intended that all mechanical and electrical systems will be complete and in proper operation and that all construction components will be complete and in compliance with accepted construction practice upon completion of the Work. Items normally required for proper operation of mechanical and electrical systems, or to complete otherwise incomplete construction, they shall be included by the Contractor, unless he sought and received contradictory interpretation or clarification from the Architect.

2.6 Completion of Drawings and Specifications

Contractor acknowledges that there are items of Work which may not be drawn or specified with complete detail in the Drawings and Specifications but which are required for the completion of the Work. Any such item, when identified as part of the reasonable development of the Work, shall be drawn or specified by Architect in consultation with Contractor. When such drawing or specification is approved by the Owner, the Drawing or Specification so approved shall thereupon be part of the

Contract Documents and the item of Work shall be performed by Contractor as part of the Work without further action or order of the Owner and without any increase in the Contract Price as if such Drawing and Specification were originally included in the Contract Documents.

2.7 Title to Materials – (INTENTIONALLY DELETED)

2.8 Contractor's Obligations

(a) Contractor shall in a good and workmanlike manner perform all the Work required by the Contract Documents in accordance with the highest standards on the construction industry on projects of similar complexity and direct the Work using its best skill and attention. Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures within the scope of Contractor's Work.

(b) Contractor shall be responsible for the safety, efficiency and adequacy of Contractor's plant, equipment, appliances and methods, and for damage which may result from failure or improper construction, maintenance or operation of such plant, equipment, appliances and methods. Contractor shall comply with all terms of the Contract Documents do, carry on and complete the entire Work under the direction of and to the satisfaction of the Owner.

(c) Contractor shall provide any engineering services, scaffolding, hoists, or any temporary structures, such as bracing and supports, light, heat, power, toilets, water or temporary connections which are required by this Agreement or necessary to perform the Work.

(d) Contractor shall deliver all materials at such times and in such quantities as will insure the speedy and uninterrupted progress of the Work. Contractor shall handle and take care of all materials used in performance of the Work whether furnished by Contractor of the Owner, as the same are delivered to the site and shall be solely responsible for the loss, damage, theft, security and condition of the same. After final completion and acceptance of the Work, or sooner if requested by the Owner, Contractor shall remove all surplus materials (excluding any attic stock required by the Contract Documents) and scaffolding furnished by it which have not been incorporated in the Work.

(e) Unless otherwise provided in the Contract Documents, Contractor shall secure and pay for all permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work. Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the variance with any applicable laws in any respect. Contractor shall promptly notify the Owner, in writing, and any necessary changes shall be accomplished by appropriate modification. If Contractor performs any Work contrary to such laws, ordinances, rules and regulations, it shall assume full responsibility therefore and shall bear all costs attributable to correcting such deficiencies in the Work.

(f) Contractor shall be responsible for keeping the site neat and broom clean on a regular basis.

2.9 "Or Equal" Clause

(a) The products, materials and equipment of manufacturers referred to in the Specifications and on the Drawings are intended to establish the standard of quality and design required by Architect; however, materials of manufacturers, other than as specified, may be used if equivalent and approved by Architect and the Owner.

(b) Architect will review all proposed substitute materials, fabrications or other specified items. Architect will make written recommendations of acceptance or rejection to the Owner. The Owner will then issue to Contractor written approval or rejection of the substitution in the Owner's sole discretion.

(c) If Contractor desires to use a substitute item, Contractor shall make an application to Architect in writing within sufficient lead time (having regard to the progress of the Work, the period of delivery of the goods concerned and adequate time for the Owner and Architect's review)

stating and fully identifying the proposed substitution with substantiating data, samples and brochures of the item proposed. It is Contractor's responsibility to provide sufficient evidence by tests or other means to support any request for approval of substitutions. Any item by the manufacturer other than those cited in the Contract Documents, or of brand name or model number or of generic species other than those cited in the Contract Documents will be considered a substitution.

(d) Prior to proposing any substitute item, Contractor shall satisfy itself that the item Contractor proposes is, in fact, equal to that specified and has demonstrated such equality by at least three years satisfactory service, that it will fit into the space allocated and within the load allocated for the same, that it affords comparable ease of operations, maintenance and services, that its appearance, longevity and suitability for the climate and use are comparable to that specified, and that the substitution requires no change in dimension or design of any other work of Contractor or any other contractor or in the time require for the performance thereof.

(e) Acceptance of substitutions shall not relieve Contractor from responsibility for compliance with all the requirements of the Contract Documents. Notwithstanding an acceptance of a substitution by the Owner, any cost attributable to changes in other parts of the Work or the work of other contractors that are required by substitutions shall be the responsibility of Contractor, including the cost of all design and redesign services related thereto incurred by Architect and its consultants.

(f) The Completion Date shall not be extended by any circumstances resulting from a proposed substitution by the Contractor or evaluation thereof by Architect or Owner, nor shall Contractor be entitled to any compensation for any delay cause thereby or related thereto.

2.10 Dust Hazards

If in the construction of the Work, a harmful dust hazard is created for which appliances or methods of elimination of harmful dust hazards have been approved by the Board of Standards and Appeals, Contractor shall install, maintain and operate said appliances or methods.

2.11 Cutting and Patching

Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work, to make its several parts fit together properly and to make the Work fit together properly with previous and surrounding work. The requirement to cut, fit or patch shall be determined by the Owner; provided, that structural elements of the Project shall not be cut, patched or otherwise altered or repaired without prior authorization by Architect. Authorization to proceed with remedial operations on any damaged or defective element or portion of the Project shall not constitute a limitation or a waiver of the Owner's or Architect's right to require the removal and replacement of any Work which fails to fulfill the requirements of the Contract Documents.

2.12 Nomenclature

The terms Construct, Construction, Build, Work, etc. shall be construed to include all work shown on the plans. The terms Architect, Engineer, Project Architect, Landscape Architect, Corporation's Representative, the Owner, Corporation, the Owner's Representative, and similar derivations exist within the Contract Documents and shall be construed to mean the Owner's Representative.

2.13 Construction Parking

Parking will be allowed on the Project site.

2.14 Construction Traffic

Contractor shall submit a construction traffic plan to the Owner's Representative for approval. The plan must show routes that all construction traffic will follow to minimize any impacts on the adjacent community.

2.15 Hazardous Waste Disposal Transportation

Contractors shall, as part of its Work, in addition to complying with any and all applicable laws, rules or regulations concerning the removal, abatement, handling, transportation and disposal of all hazardous waste (as that term is most broadly defined under local, state or federal laws) encountered in the performance of its Work, be responsible to pay all fees, taxes, levies or assessments; obtain and execute all permits, licenses, manifests, logs, reports, certifications or other documents necessary to effectuate the lawful removal and disposal of such hazardous waste; and obtain an identification number from the United States Environmental Protection Agency or any other necessary identifying information, all in a timely manner to permit the timely performance of the work. The obligations of Contractor under this Section shall be performed as part of the Contract Price without any additional compensation from the Owner. Contractor shall be aware of the presence of contaminated materials and should refer to the Soils Management section of the Project Manual for procedures.

ARTICLE 3

COMMENCEMENT AND COMPLETION OF WORK AND OCCUPANCY

3.1 Start of Work and Completion

(g) Contractor shall commence the Work upon receipt of a written notice to proceed signed by the Owner. Contractor shall thereafter prosecute the Work to be performed hereunder diligently, without interruption, and in accordance with the time requirements of the Project as determined and directed by the Owner.

(h) Contractor shall Substantially Complete, as defined by Section 7.6, all of the Work in accordance with the Contract Documents to the satisfaction of Architect and the Owner on or before _____ **with Final Completion on or before** _____. Contractor hereby acknowledges that the time for the performance of its Work is of the essence. Contractor acknowledges that any failure by it to timely complete the performance of its Work under this Contract will cause significant consequential damages to be incurred by the Owner. The Completion Date shall not be extended except by Change Order issued and signed by the Owner in accordance with this Agreement. The completion date shall not be extended except by Change Order issued and signed by the Owner in accordance with this Agreement. Liquidated Damages will be charge for unexcused delay of Work beyond the date of completion and/or substantial completion. As actual damages for any delay in completion of the work which the Contractor is required to perform under this Contract are impossible to determine, the Contractor shall be liable for an shall pay to the Owner the sum of Five Thousand Dollars **($2500.00)** as fixed, agreed and Liquidated Damages for each calendar day of delay from the date stipulated for completion or substantial completion of Work.

3.2 Project Scheduling

(a) Contractor shall prepare a schedule showing times for performance of all major activities of the Work (the "Project Schedule") within seven (7) days of commencing the Work for review and approval by the Owner. Contractor shall attend all scheduled meetings as directed by the Owner or the Owner's Representative and update the Project Schedule at intervals required by the Owner.

(b) If, in the opinion of the Owner, Contractor falls behind the Project Schedule, Contractor shall take all steps that are necessary to improve its progress and shall, if requested by the Owner, submit operational plans in a CPM schedule format demonstrating how the lost time may be regained subject to the Owner's approval. Contractor is responsible to maintain its schedule so as not to delay the progress of the Project or the schedules of other contractors. If Contractor delays the progress of its Work or the work of other

contractors, it shall be the responsibility of Contractor to increase the number of tradesmen, the number of shifts, the days of work and to the extent permitted by law, to institute or increase overtime operations, all without additional costs to the Owner in order to regain lost time and maintain the Project Schedule then in effect as approved by the Owner. All expenses incurred by the Owner attributable to Contractor's efforts to regain lost time shall be the responsibility of Contractor.

(c) Refer to the Special Conditions and Division 1 – General Requirements for additional requirements.

3.3 Cooperation with other Contractors

(a) During the progress of the Work, other contractors may be engaged in performing work for the Owner. Contractor shall cooperate and coordinate its Work with the work of said other contractors, as applicable, and in such manner as the Owner may direct.

(b) If the Owner shall determine that Contractor is failing to coordinate the Work with the work of other contractors:

1. The Owner shall have the right to withhold any payments due under the Contract until its directives are complied with by Contractor; and

2. Contractor shall indemnify and hold the Owner harmless from any and all claims or judgments for damages and from any costs or damages to which the Owner may be subjected or which the Owner may suffer or incur by reason of Contractor's failure to coordinate its Work with that of other contractors.

(c) If Contractor notifies the Owner in writing that another contractor on the site is failing to coordinate the work of said contractor with Contractor's Work, the Owner shall investigate the charge. If the Owner finds it to be true, the Owner shall promptly issue such directions to the other contractor with respect thereto as the situation may require. The Owner shall not be liable for any damages suffered by Contractor by reason of the other contractor's failure to promptly comply with the directions so issued by the Owner or by reason of another contractor's default in coordinating its work with that of Contractor.

(d) Should Contractor sustain any damage through any act or omission of any other contractor having a contract with the Owner or through any act or omission of any subcontractor of said other contractor, Contractor shall have no claim against the Owner for said damage.

(e) Should any other contractor having, or who shall have, a contract with the Owner, sustain damage through any act or omission of Contractor or through any act or omission of a subcontractor, Contractor shall reimburse said other contractor for all said damages and shall indemnify and hold the Owner harmless from all said claims.

(f) The Owner does not guarantee the performance of any contractor. Contractor acknowledges these conditions and agrees to bear the risk of all delays including, but not limited to, delays caused by the presence of operations of other contractors and the Owner shall not incur any liability by reason of any delay to Contractor's Work by reason of the performance of work or defaults by other contractors.

(g) Where the Contractor shall perform Work in close proximity to work of other contractors, the Contractor shall assist in arranging space conditions to make satisfactory adjustment for the performance of any work in such areas. If the Contractor's Work interferes with work of other contractors, the Contractor shall make changes necessary to correct such conditions.

3.4 Notice of Delay

In addition to any information required elsewhere in this Agreement and without limiting any other provision of this Agreement including Contractor's obligation to Substantially Complete the Work by the Completion Date, should Contractor be, or anticipate being delayed or disrupted in performing the Work hereunder for any reason, including without limitation, its financial condition

or Contractor's general non-payment of its debts as such debts become due, it shall within three (3) days after the commencement of any condition which is causing or is threatening to cause such delay or disruption, notify the Owner in writing of the effect of such condition upon the Completion Date. Contractor shall state why and in what respects the condition is causing or is threatening to cause delay, identify specific contract milestones that will be affected and provide as estimate of the duration of the delay. Failure to strictly comply with this notice requirement shall be sufficient cause to deny Contractor's change in the Project Schedule and/or Completion Date. Nothing in this section or Contractor's compliance with its terms should be deemed to obligate the Owner to grant a change in the Project Schedule or the Completion Date or to restrict the Owner's right to recover damages for delay.

3.5 Extension of Time

Contractor may be entitled to an extension of time for delays in the performance of the Work cause solely by the acts or omissions of Architect or the Owner, or unforeseeable causes beyond the control and without the fault or contributing negligence of Contractor including, but not limited to, acts of God, acts of the public enemy, unforeseen or unforeseeable acts of any government body, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes or unusually severe weather; provided Contractor shall have used its best efforts and diligently sought to have minimized any such period of delay, by taking whatever measures are necessary, including with limitation, if applicable, seeking alternate sources of materials, other subcontractors or other facilities in which to perform the required construction operations; and provided, further, that notice is given to the Owner pursuant to the requirements of the immediately preceding paragraph.

3.6 No Claim for Delay Damages

Contractor agrees to make no claim for damages for delay in the performance of this contract occasioned by any act or omission to act, including active interference, of the Owner or any of its agents, other contractors, or representatives and agrees that any such claim shall be fully compensated for by an extension of time to complete performance of such Work that is delayed in accordance with the provisions for obtaining an extension of time specified herein. Contractor alone hereby specifically assumes the risk of all delays, obstructions, or interferences of any kind or duration whatsoever, whether or not within the contemplation of the parties, and whether or not foreseeable or unforeseeable and agrees that its sole remedy is an extension of time where applicable.

ARTICLE 4

METHOD, SCHEDULE AND TERMS OF PAYMENT

4.1 Contract Payment Breakdown and Requisition

(a) Contractor's applications for partial payments ("Requisitions") and its application for final payment ("Final Requisition") are to be submitted to the Owner, or its designee, and Architect in (6) copies in the manner hereinafter provided (see Exhibit J). Each Requisition must be supported by such data substantiating Contractor's right to payment as the Owner may require.

(b) Prior to the submission of the first Requisition, Contractor shall present to the Owner for approval a contract payment breakdown (the "Contract Payment Breakdown") (See Exhibit N) itemizing the dollar values for the various trades which comprise the Work, including quantities where applicable, which in the aggregate equal the Contract Price. The Contract Payment Breakdown shall be prepared in such form as included in the Contract Documents and supported by such data to substantiate its correctness as the Owner may require. It is understood and Contractor acknowledges that the model contract payment breakdown is included with the Contract Documents as an administrative tool for the purpose of

illustrating a format and minimum level of detail required for the Contract Payment Breakdown shall not be changed or revised in any way without the Owner's written consent and shall become part of this Agreement.

(c) On any Requisition, Contractor shall be entitled to partial payment on account of the Contract Price in an amount equal to the total of:

The value of the portions of the Work completed and acceptable to the Owner and approved by the Owner's representative based upon the percentage of completion of each item specified on the Contract Payment Breakdown, less Retainage specified under Section 4.5 on the total amount so computed, and less any additional withholdings deemed necessary by the Owner pursuant to Section 4.8 hereof, less the total amount of prior partial payments.

(d) Unit Price Renegotiation: In the event that unit prices are used, Contractor will be paid at the unit price bid for the quantity actually used. If the actual quantity exceeds 125% of the amount specified in the Contract Documents, the Owner reserves the right to renegotiate the unit price bid.

4.2 Receipts and Releases of Liens

With each Requisition, Contractor shall furnish the following documents:

(a) Contractor's Receipt and Waiver of Lien (See Exhibit K)

(b) Subcontractor's Receipt and Waiver of Lien (See Exhibit L)

(c) Any other documentation required elsewhere in the Specifications

The Owner may also require Contractor to attach to each Requisition the consent of the surety issuing the Payment and Performance Bonds to such payment.

In addition to the documents required to be furnished by the immediately preceding paragraph, with the Final Requisition, Contractor shall furnish:

(a) Affidavit and Final Waiver of Claims and Liens and Release Rights (See Exhibit M); and

(b) Releases from all subcontractors and Materialmen who provided labor or materials for the Project.

Should any such subcontractor or Materialmen fail or refuse to furnish such release, Contractor will be required to furnish a bond satisfactory to the Owner to indemnify it against any such lien, claim or demand. If any such lien, claim or demand is asserted or remains unsatisfied after Final Payment is made to the Contractor, Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such lien, claim or demand including all costs, expenses and attorney's fees which the Owner may incur in connection therewith.

4.3 Release and Consent of Surety

Notwithstanding any other provision of the Agreement to the contrary, Final Payment shall not become due pursuant to this Agreement until Contractor submits to the Owner a General Release and a consent of Surety to said payment both in form and content acceptable to the Owner.

4.4 Time of Payment

Requisitions shall be submitted by Contractor to the Owner by the thirtieth day of each month for Work completed up to the last day of the previous month, and if such Requisition is properly supported, payment shall be made within thirty (30) days after approval of the Requisition by the Owner. All requisitions shall be subject to the approval of the Owner's Representative and ESDC. Contractor shall submit to and review with the Owner a draft copy of each Requisition on or around the twenty fifth of the month. Contractor shall only be entitled to payment in the amount approved

by the Owner with respect to such Requisition. Each Requisition must be signed by the Owner before payment is due to Contractor. The value of any Work included in a Requisition for partial payment which is found unacceptable by the Owner shall be deducted from that or any subsequent Requisition.

4.5 Retainage

The Owner shall retain five (5%) percent of the portion of the Contract Price covered by each Requisition submitted by Contractor (the "Retainage"). The Owner has the right to increase the amount of retainage held if any breach of the Contract is deemed by the Owner to remain uncorrected after notice of such breach has been provided to Contractor.

4.6 Reduction of Retainage

(a) Upon Substantial Completion, the Retainage shall be reduced to two and one-half (2.5%) percent of the Contract Price or two (2) times the value, as approved by the Owner, of any remaining items of Work to be completed or corrected on the Final Punch-List, as defined in Section 7.6, whichever is greater; and

(b) An amount necessary to satisfy any and all claims, liens or judgments against Contractor.

The Final Punch-List may be expanded to include additional items of Work to be corrected or completed until final acceptance of the Work by the Owner. Additional sums may be withheld in the manner prescribed above to cover the value of these items pursuant to this Section.

4.7 Final Payment

(a) The final balance due Contractor under this Agreement shall be payable to Contractor by the Owner, as final payment hereunder, within thirty (30) days after all of the following have taken place:

1. Final inspection and acceptance by the Owner as evidenced by the Certificate of Completion being delivered to Contractor.

2. Contractor's Final Requisition has been submitted by Contractor and approved by the Owner and Architect.

3. The affidavit attached as Exhibit M hereof has been submitted by Contractor, and any other documents or actions expressly specified in the Contract Documents as preconditions to Final Payment have been submitted or completed.

4. Any inspection or approvals with respect to any of the Work that the Owner deems appropriate or which is required by governmental authorities or by the applicable Board of Fire Underwriters, have been performed or obtained.

(b) Contractor's acceptance of Final Payment will constitute full and final settlement of all obligations of the Owner to Contractor with respect to payments required by this Agreement.

4.8 Withholding of Payments

(a) The Owner may withhold from Contractor any part of any payment as may, in the judgment of the Owner, be necessary:

1. To assure payment of just claims of any persons supplying labor or materials for the Work;

2. To protect the Owner from loss due to defective Work and unsatisfactory work not remedied;

3. To protect the Owner and its representatives from loss due to death or injury to persons or damage to the Work or property of other contractors, subcontractors or others caused by the act or neglect of Contractor or any subcontractors;

4. In the event that there is reasonable evidence that the Work will not be completed for the unpaid balance of the Contract Price;

5. In the event that there is reasonable evidence that the Work will not be completed within the Project Schedule; or

6. In the event that Contractor persistently fails to perform the Work in accordance with the Contract Documents.

In any of such events, the Owner shall have the right to apply any such amounts so withheld in such manner as the Owner may deem proper to satisfy such claims, to secure such protection, complete the Work or to compensate the Owner for any loss suffered by reason on Contractor's delay. Such application shall be deemed payment for the account of Contractor. In the event that the Owner gives Contractor notice that it intends to make such application, Contractor shall be stopped from disputing liability or the amount of liability unless, within three days after receipt of such notice, it indicates to the Owner in writing that it is not liable or that the amount of its liability is different from that set forth in the notice.

(b) The provision of this Section 4.8 is solely for the benefit of the Owner, and any action or non-action by the Owner shall not give rise to any liability on the part of the Owner.

4.9 Right to Audit

Contractor shall maintain and shall keep for a period of at least six years after the date of final acceptance of the Work all records and other data relating to the Work.

The Owner or its designees shall have the right to inspect and audit all records, subcontracts, purchase orders and other data of Contractor relating to the Work at any time and from time to time until the end of such three (3) year period. Contractor shall promptly respond to any inquires of the Owner or any representative of the Owner arising out of any such inspection or audit. If an audit reveals an overpayment by the Owner exceeding two (2%) percent, Contractor shall be responsible to pay the costs associated with the audit incurred by the Owner. Any overpayment to Contractor shall immediately be returned to the Owner.

ARTICLE 5

CONTRACTOR

5.1 Superintendence by Contractor

(a) Contractor shall employ a full-time competent construction superintendent who shall be approved by the Owner and shall be in charge of the Work. The construction superintendent shall be devoted full time to the Work, shall be present at the Site during the time the Work is required to be performed and shall have full authority to accept instructions, make decisions and act for Contractor at all times. Contractor shall submit to the Owner for approval the resume of his proposed superintendent.

(b) If at any time the superintendent is not satisfactory to the Owner, Contractor shall, if requested by the Owner, replace the superintendent with another satisfactory to the Owner within five (5) business days of such request.

(c) Contractor shall not remove or replace the superintendent or person-in-charge of the Work without the consent of the Owner unless he or she is discharged by Contractor or resigns from the employ of Contractor.

5.2 Representations of Contractor

Contractor represents and warrants that:

(a) Contractor is financially solvent and is experienced in, and competent to perform the Work;

(b) Contractor is familiar with all Federal, State, City or other laws, ordinances, orders, rules and regulations, which may in any way affect the Work;

(c) Any temporary and permanent Work required by this Agreement can be satisfactorily constructed and such construction will not injure any person or damage any property extraneous to the Work; and

(d) Contractor has carefully examined the Contract Documents and the site and, from Contractor's own investigations, is satisfied as to the nature and location of the Work, the character, quality and quantity of surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the Work, the general and local conditions, and all other conditions or items which may affect the Work. Based on the foregoing, Contractor represents that the Contract Documents are adequate for the complete performance of the Work.

5.3 Verifying Dimensions and Site Conditions

(a) Before proceeding with the Work, Contractor will accurately check all previous and surrounding work and determine the correctness of same.

(b) Contractor shall take, determine, investigate and verify all field measurements, dimensions, field construction criteria and site conditions for the performance of the Work and shall check and coordinate the information contained in the Contract Documents.

(c) Contractor shall be responsible for determining the exact location of and to verify the spatial relationships of all Work. If any conflicts are found in the Contract Documents, or if Contractor has any questions concerning the foregoing, it shall immediately notify the Owner and shall thereafter perform the Work in accordance with directions from the Owner.

(d) Contractor shall be responsible for locating all utilities on or below the site.

(e) To ascertain the relationship of the Work, Contractor will perform to all Work required by the Contract Documents. The Contractor shall examine the Contract Documents for Work of its contract and any related work of other contracts.

5.4 Site or Subsurface Conditions Found Different

(a) The Contractor acknowledges that the Contract amount includes such provisions which the Contractor deems proper for all subsurface or site conditions the Contractor could reasonably anticipate encountering as indicated in the Contract Documents, or borings reports, rock cores, foundation investigation reports, archeological reports, topographical maps or other information available to the Contractor or from the Contractor's inspection and examination of the Site prior to submission of bids.

(b) The Owner assumes no responsibility for the correctness of any boring or other subsurface information and makes no representation whatsoever regarding subsurface conditions and test borings, reports, rock cores, foundation or archeological investigation and topographical maps which may be made available to the contractor.

(c) Should the Contractor encounter subsurface site conditions at the Site materially differing from those shown on or described in or indicated in the Contract Documents, the Contractor shall immediately give notice to the Owner and the Owner's representative of such conditions and shall not disturb said conditions until authorized to do so by the Owner or the Owner's Representative.

5.5 Copies of Contract Documents for Contractor

The Owner shall furnish to Contractor, without charge, four (4) sets of the Contract Documents. Any sets in excess of the number mentioned above may be furnished to Contractor for the cost of reproduction and mailing.

5.6 Progress Meetings

(a) Job meetings shall be coordinated and scheduled by the Owner during the course of construction as per specification 013100 – Project Management and Coordination.

(b) Contractor's Project Managers and Superintendents shall attend all meetings as directed by the Owner.

(c) Contractor shall require the appropriate subcontractors to attend such job meetings.

(d) The purpose of the job meeting is to ensure proper coordination, determine construction progress, monitor and update progress schedules, review requisitions and change orders, expedite completion of the Project in accordance with the Contract Documents and review other relevant items.

5.7 Reports and Access

(a) Contractor shall furnish daily manpower reports to the Owner and such other reports as may be required.

(b) Architect and the Owner shall have full and free access to the shops, plants and factories of Contractor, any Materialmen and any subcontractors to inform themselves as to the progress of the Work.

(c) The Owner will monitor compliance with the Non-Discrimination, Affirmative Action, Minority Business Enterprise and Minority Workforce Participation Sections of this Agreement.

5.8 Financial Information

Contractor agrees to furnish at the Owner's request, current quarterly and, if available, audited annual financial statements and from time to time, such additional information as the Owner shall deem necessary or desirable to satisfy itself of Contractor's continuing ability to complete the Work.

ARTICLE 6

CONTRACT ADMINISTRATION

6.1 Architect's, and the Owner's Representatives Responsibilities and Functions

(a) Contractor acknowledges that the Owner's Representative, on behalf of the Owner, has immediate responsibility for general administration of the Contract, shall observe the Work for conformity with requirements of the Contract, shall review Contractor's performance of or compliance with other requirements on the Contract and shall issue directives to Contractor in regard to such matters. The Owner's Representative will not be responsible for Contractor's or subcontractor's construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and the Owner's Representative will not be responsible for Contractor's failure to carry out the Work in accordance with the Contract Documents or its failure to fulfill any requirements of the Contract.

(b) Contractor acknowledges that Architect, on behalf of the Owner, shall review all Shop Drawings and samples and other submittals and shall observe the general quality of construction for reasonable conformance with the design scheme of Architect and adherence to the Contract Documents, and may review Contractor's performance for compliance with the requirements of this Agreement.

(c) Architect's and the Owner's Representative's duties and services shall not in no way supersede or dilute Contractor's obligation to perform and complete the Work in full conformity with the Contract Documents.

ARTICLE 7

INSPECTION AND ACCEPTANCE

7.1 Access to the Work

The Owner, the Owner's Representative, Architect, ESDC or any of their authorized agents shall at all times have access to and the right to observe the Work and all facilities where the Work or any part thereof is being fabricated or stored. Contractor shall provide proper facilities for such access and observation, including adequate workspace on site for any designated Owner Representative.

7.2 Required Inspections and Tests

If the Contract Documents, or any laws, rules, ordinances, regulations or any governmental agency requirement, require that any Work be inspected or tested, Contractor shall give the Owner timely notice of readiness of the Work for inspection or testing and the date fixed for such inspection or testing. The responsibility for the cost of inspection and testing shall be in accordance with the provisions of the Specifications and or Project Manual.

7.3 Special Inspections and Tests

Whenever, in the opinion of the Owner or the Owner's Representative, it is desirable to require special inspection or testing of the Work or its individual components, they shall have authority to do so whether or not such Work be then fabricated, installed, covered or completed. If such special inspection or testing reveals a failure of the Work to comply (1) with the requirements of the Contract Documents, or (2) with laws, ordinances, rules, regulations or any order of any public authority having jurisdiction over the Project, Contractor shall bear all costs for the inspection of testing thereof, including Architect's and the Owner's additional services made necessary by such failure and the costs to correct the deficiencies noted; otherwise the Owner shall bear such inspection or testing costs, and an appropriate change order shall be issued.

7.4 Uncovering of Work

(a) If any Work shall be covered or concealed contrary to the request of the Owner, such Work shall, if required by the Owner, be uncovered for examination, inspection or testing. Any examination, testing or inspection shall not relieve Contractor of the responsibility to maintain quality control over the Work. The cost of all such testing including examination, inspection and additional professional services required, and any other expenses incurred by the Owner as a result of such examination, inspection or testing shall be borne by Contractor.

(b) In the event that a typical detail fails inspection or testing, the Owner may require inspection or testing of any or all other such typical details at Contractor's cost and expense.

7.5 Correction of Work

Any Work not approved by the Owner, shall immediately be reconstructed, made good, replaced or corrected by Contractor including all Work of other Contractors destroyed or damaged by such removal or replacement. Rejected material shall be removed immediately from the site. Acceptance of material and workmanship by the Owner shall not relieve Contractor from Contractor's obligation to replace all Work which is not in full compliance with the Contract Documents.

7.6 Certificate of Substantial Work Completion

"Substantial Completion" shall occur when all of the following conditions have been satisfied:

(a) All of the Work has been completed in accordance with the Contract Documents and to the Owner's satisfaction except as noted on the Final Punch List, as defined in Section 7.6 (b), such that the Owner can occupy the site for the intended use and purpose or otherwise take it over for beneficial use;

(b) Contractor and the Owner have agreed in writing upon a comprehensive list of all incomplete, defective or incorrect Work to be completed by Contractor (the "Final Punch List") (or, if they are unable to agree, the Owner shall have prepared and issued the Final Punch List to Contractor).

(c) Contractor has delivered to the Owner a written statement of the Surety (in form and substance satisfactory to the Owner) to the effect that the Owner's payment of unpaid balance of the Contract Price shall not modify or discharge the obligations of the Surety under the Bonds; and

(d) Contractor has submitted written certification that all of the foregoing conditions have been satisfied; and the Owner has approved Contractor's Certification.

7.7 Certificate of Final Completion

Upon receipt of written notice from Contractor stating its belief that the Work is fully performed in conformity with the Contract Documents, and confirming that Contractor has completed any items of Work previously noted to it by the Owner as not being acceptably completed in the Final Punch List or any subsequent punch list, which may amend the Final Punch List, the Owner and Architect shall perform an inspection for purposes of determining whether the Work is finally completed. The Owner and Architect shall commence such inspection within ten (10) days of receipt of such notice and shall pursue and complete it with all due diligence. When Architect and the Owner find, upon inspection, that to the best of their knowledge and belief, the Work is so performed, they shall prepare and sign a Certificate of Final Completion and furnish such Certificate to Contractor. Such Certificate shall specify the date of completion of the Work for purpose of this Agreement and shall constitute final acceptance of the Work by the Owner. The delivery of a Certificate of Final Completion shall not terminate or alter Contractor's guarantees and other obligations under this Agreement to complete the Work in conformity with the Contract Documents and to fulfill all terms and conditions of this Agreement.

7.8 Acceptance

No inspection shall relieve Contractor of the obligation to perform the Work in strict accordance with the Contract Documents. No payment, either partial or full, by the Owner to Contractor shall be deemed an acceptance of the Work or waiver by the Owner of any terms or conditions of this Agreement.

ARTICLE 8

CHANGES IN THE WORK

8.1 Change Orders

Without invalidating this Agreement, the Owner may order extra work or make changes by altering, adding to, or deducting from the Work, the Contract Price being adjusted accordingly. No claims for extra work shall be allowed unless said extra work is ordered in writing by the Owner or the Owner's Representative. No changes in the Work shall be made unless ordered in writing by the Owner or the Owner's Representative and formalized as a change order (a "Change Order"). In the event that a change directed by the Owner requires Contractor to obtain any special or additional license or permit, the Contractor shall procure the same promptly so as not to impede the progress of the Work. Contractor bears all risk associated with any delay related to obtaining licenses or permits necessary to perform work required by a Change Order. Contractor acknowledges that the

Owner has the absolute right to change the sequence of the Work set forth in the Project Schedule for its convenience. If the Owner directs a change to the sequence of the Work for any reason other than due to a default or failure by the Contractor to timely and properly perform the Work, the Contractor shall only be entitled to additional time to complete the Work pursuant to a Change Order, if necessary.

8.2 Changes in Contract Price and Time

(a) The amount by which the Contract Price is to be increased or decreased by any change order shall be determined by the Owner by one or more of the following methods;

1. By accepting an amount agreed upon by both parties;

2. By applying the applicable unit price or prices previously bid and approved. This method shall be used if the Contract contains applicable unit prices;

3. By adding to the Contract Price only the amount of the premium portion of overtime pay resulting from an acceleration of the Work, if required by the Owner and not because of a failure by Contractor to maintain the Project Schedule.

4. By receiving from Contractor a detailed breakdown satisfactory to the Owner, including actual time slips and invoices; itemizing the direct cost of labor and material to perform the changed Work and adding thereto fifteen percent (15%) to cover the profit and all indirect and overhead costs, except that where the changed Work is performed by a subcontractor, the direct cost of labor and material to perform the changed Work plus Fifteen percent (15%) for profit and all indirect and overhead costs to subcontractor and an additional sum for all indirect and overhead costs of Contractor equal to five percent (5%). Such percentage shall be applied to direct costs prior to any mark-ups for subcontractor(s). Where the changed Work involves an increase and a reduction in any contract Work, the above percentage override shall be applied only on the amount, if any, that the cost of the increase exceeds the cost of the reduction. The allowance for overhead and profit shall include supervision (including General Foreman, Foreman and Project Management), field office and general expenses, overhead, and profit.

(b) The compensation specified in a Change Order shall constitute a release and full payment for the extra work covered thereby and for any delay and disruption costs or expense occasioned by reason of said charge in the Work.

(c) No time extension shall be granted Contractor by reason of the issuance of any Change Order unless expressly stated therein.

8.3 Change Order Format

(a) All Change Orders shall be processed, executed and approved on the Owner's Change Order form, (Exhibit C) of this Agreement. No alteration to this form shall be acceptable to the Owner and no payment for extra work shall be due Contractor unless it executes a Change Order on said form.

(b) Five (5) copies of proposed Change Orders shall be submitted to the Owner. All Change Orders shall become part of the Contract only when they are issued and signed by the Owner.

8.4 Changed Conditions

(a) Contractor shall within three (3) days of discovery and before such conditions are disturbed, notify the Owner and its Representative in writing of: (1) subsurface or latent physical conditions differing materially from those indicated in the Contract Documents which could not have been anticipated by Contractor, or (2) unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work provided for in this Agreement. The Owner or the Owner's Representative shall promptly investigate the conditions, and if it finds that such conditions

do materially so differ and cause an increase or decrease in Contractor's cost of, or the time required for performance of any part of the Work under this Agreement, adjustments to Contractor's compensation shall be made in the manner provided for payment with respect to any Change Order and a time extension, if warranted, will be granted.

(b) No claim of Contractor under this clause shall be allowed and shall be deemed waived unless Contractor has given written notice required in (a) above.

ARTICLE 9

SUBCONTRACTS AND PURCHASE ORDERS

9.1 Selection of Subcontractor and Materialmen and Approval of Subcontracts and Purchase Orders

(a) The list of proposed subcontractors submitted by Contractor and approved by the Owner (See Exhibit O) identifies the subcontractors with whom Contractor agrees to contract with respect to the Work and is incorporated by reference herein. Any subcontractor engaged by Contractor shall be skilled and, if necessary, licensed to perform such work that it is retained to perform. Contractor shall incorporate all terms of this Agreement which may be applicable to the subcontractor's work in the subcontract or purchase order for such work.

(b) Any subcontract or purchase order for labor or materials from a person or firm not listed on the above referenced list of proposed subcontractors shall be subject to approval by the Owner. The Owner may approve or disapprove any such subcontract or purchase order by reason of lack of responsibility of the subcontractor or Materialmen or failure to conform to the Owner's non-discrimination, affirmative action, training or minority participation policies and programs. Contractor shall submit such information as the Owner may request in a form acceptable to the Owner concerning each such proposed subcontract or purchase order.

9.2 Access by the Owner and Others

Contractor shall include a provision in all subcontracts and purchase orders, except as may otherwise be specified by the Owner with respect to purchase orders for minor purchases (valued at $500 or less), that, in order to permit verification of Contractor's costs, the Owner shall have the right to have its representatives inspect and audit the books of account and records of the subcontractors and Materialmen, including the right to make excerpts from such books and records. All payments by Contractor to a subcontractor or Materialmen shall be by check specifically indicating that payment is attributable to this Agreement. Contractor shall include a provision in all subcontracts and purchase orders that will enable representatives of the Owner or the State of New York to obtain access during working hours to the appropriate books of account and records of the subcontractors and Materialmen relating to the Work to determine if there is a compliance with the requirements of law or this Agreement.

9.3 Retainage

Contractor may provide for a retainage under any of is subcontracts or purchase orders provided that where a subcontract or purchase order provides for a retainage, the retainage shall be no greater in percentage than that provided for under this Agreement hereof with respect to Contractor itself, unless otherwise approved in writing by the Owner. Contractor shall submit with each Requisition a statement setting forth the amounts of all retainage withheld, if any, under its subcontracts and purchase orders.

9.4 Miscellaneous

(a) Contractor shall be fully responsible for the work, supervision, acts and omission of subcontractors and materialmen, and of any person either directly or indirectly employed by subcontractors and materialmen.

(b) Contractor's use of subcontractors and Materialmen shall not diminish Contractor's obligation to complete the Work in accordance with the Contract Documents. Contractor shall supervise control and coordinate the Work of subcontractors and Materialmen.

(c) Nothing contained in this Agreement shall create any contractual relationship between subcontractors or materialmen and the Owner, nor shall it obligate the Owner to pay or to see to the payment of any sums to any subcontractors or materialmen.

(d) Contractor shall include a provision in all subcontracts and purchase orders requiring the subcontractor, if requested by the Owner until the subcontractor finishes its portion of the Work, to deliver to Contractor unaudited financial statements of the subcontractor similar to the obligation of Contractor hereunder. Promptly upon receipt thereof, Contractor shall deliver copies thereof to the Owner.

ARTICLE 10

ASSIGNMENT

10.1 No Assignment of Duties

Contractor shall not assign this Agreement or the performance of any obligations of Contractor under this Agreement, nor subcontract the Work or any part thereof except in compliance with the terms hereof or with the expressed written consent of the Owner, and each and every such assignment and subcontracting without such compliance or consent shall be void and Contractor shall not be entitled to any compensation for labor or materials provided by its subcontractors in violation of this provision.

10.2 Assignment of Monies

Contractor shall not assign any monies payable hereunder nor execute and deliver any order on payment unless Contractor and the assignee shall have complied with the following terms and conditions: (a) assignee shall be a commercial bank of finance company regularly engaged in the business of providing financing to construction contractors and shall be providing such financing to contractor; and (b) assignee shall, simultaneously with the assignment, execute and deliver to the Owner an undertaking, in favor of the Owner, in form and substance satisfactory to the Owner, providing that (i) assignee will cause Contractor to apply for trust purposes, as defined in Article 3-A of the Lien Law of the State of New York (the "Lien Law"), all funds advanced by assignee to Contractor (ii) assignee will file a copy of the assignment, containing the covenant required by the Lien Law, with the County Clerk of Erie County, (c) assignee agrees that the Owner and Contractor may modify any of the terms of this Agreement, including any of the terms of payment without the consent of assignee; (d) assignee agrees that after the effective date of the assignment, the Owner may make payment directly to any subcontractor, material or equipment supplier without any liability to assignee; (e) assignee will require and cause Contractor to keep his books and records in the form and manner described in Section 75 of the Lien Law; and (f) assignee will indemnify and hold the Owner harmless from and against all loss, claim or expense incurred as a result of any failure or performance in accordance with the terms of such undertaking.

10.3 Assignment to ESDC

This Agreement or any rights of Owner under this Agreement, including any guarantees or warranties or workmanship or material, may at any time be assigned by the Owner to Empire State Development Corporation (ESDC), any subsidiary of ESDC, any successor of ESDC or subsidiary of such successor, or to the State of New York, or any political subdivision or agency of the State.

ARTICLE 11

MECHANIC'S LIENS AND CLAIMS

If any mechanic's lien or other claim should be filed for or on account of the Work, Contractor shall, within thirty (30) days after notification thereof, discharge such lien or claim or otherwise make provision satisfactory to the Owner for its satisfaction. If Contractor fails to comply with this provision, the Owner may take any steps it deems appropriate to discharge such lien or other claim and Contractor shall be obligated to indemnify any costs and expenses associated with the discharge or satisfaction of the lien or other claim incurred by the Owner, including reasonable attorney's fees.

ARTICLE 12

INSURANCE AND CONTRACT SECURITY

12.1 Effect of Insurance

Contractor covenants and agrees that, prior to the commencement of Work, Contractor shall provide, or cause to be provided, and thereafter shall keep in full force and effect, or cause to be kept in full force and effect, all insurance required under this Article until Final Acceptance of all the Work, at no cost to the Owner.

12.2 Certificates of Insurance

Contractor shall furnish to the Owner a certificate or certificates in duplicate of the insurance required hereunder. Said certificates shall be in a form satisfactory to the Owner, shall list the various coverages and shall contain a provision that the policies shall not be changed or canceled and that they shall be automatically renewed upon expiration and continued in force until Final Acceptance unless the Owner is given thirty (30) days written notice to the contrary. Upon request, Contractor shall furnish the Owner or the Owner's Representative with a certified copy of each policy.

12.3 Authorized Insurance Companies

All insurance required to be procured and maintained as aforesaid must be procured from insurance companies authorized to do business in the State of New York with a rating by Bests Insurance Reports of A-1X or better.

12.4 Termination of Insurance

If at any time any of the above required insurance policies should be canceled, terminated or modified so that the insurance is not in effect as above required, then, if the Owner shall so direct, Contractor shall suspend performance of the Work. If the Work is so suspended, no extension of time shall be due on account thereof. If the Work is not suspended then the Owner may, at the Owner's option, obtain insurance affording coverage equal to that required herein, the costs of said insurance to be payable by Contractor to the Owner.

12.5 Insurance Requirements

Contractor and each subcontractor shall secure:

(a) Worker's Compensation Insurance providing statutory New York State benefits, including occupational disease and coverage under other similar employee benefit acts, which are applicable, covering all persons employed in connection with the construction at the premises. Limit of insurance shall be at least $500,000. Longshoremen's and Harbor Worker's coverage shall also be included (if applicable).

(b) Commercial General Liability Insurance (CGL) written on a combined single limit occurrence basis in an amount not less than $1,000,000 and a $5,000,000 umbrella policy. The limit may be provided through a combination of primary and umbrella/excess liability policies. Such insurance to include operations-premises liability, contractors protective liability, blanket contractual liability, (designating the indemnity provisions contained in this contract), broad form property damage liability, completed operations (minimum of two years), independent contractor's coverage and if Contractor is undertaking foundation excavation or demolition work, an endorsement or wording to the effect that "XCU Exclusions" have been deleted. For all subcontractors, Contractor shall be required to ensure that the Comprehensive General Liability coverage shall not be less than $2,000,000. Such insurance to include, if applicable, operations-premises liability, contractor's protective liability, blanket contractual liability, (designating the indemnity provisions contained in this contract), broad form property damage liability, completed operations (minimum of two years), worker's compensation insurance providing statutory New York State benefits, including occupational disease and coverage under other similar employee benefit acts, which are applicable, covering all persons employed in connection with the construction at the premises. Limit of insurance shall be at least $500,000. Coverage must be written on an "Occurrence Form" (no claims-made policies) and could be provided by subcontractor with Prime Contractor named as additional insured along with additional insures as identified in paragraph 12.5 (e) below. Longshoremen's and Harbor Worker's/Jones Act coverage shall also be included, and, that an appropriate certificate of insurance naming the Owner as an additional insured is provided to the Owner (if applicable).

(c) Automobile Liability and Property Damage Insurance for all owned, non-owned and hired vehicles to be used by ESDC, its contractors, subcontractors or by anyone else on its behalf written on a combined single limit occurrence basis in an amount not less than $1,000,000.

(d) **Erie Canal Harbor Development, NYS Office of Parks, Recreation and Historic Preservation, Be Our Guest, Ltd, Bergmann Associates, Architects, Engineers, Landscape Architects & Surveyors, D.P.C., Trowbridge Wolf Michaels Landscape Architects LLP, and Turner Construction Company** and all associated consultants, respective officers, directors employees and agents of the aforementioned parties as Additional Insured's attached to the Insurance Certificate and providing that such insurance is primary and non-contributing insurance as respects the interest of the additional insured and that any other insurance maintained by the additional insured is excess, shall each be named as an additional insured in policies required under paragraphs 12.5 (b) and 12.5 (c) above. Also see Exhibit Q for complete list of Additional Insured.

Waiver of subrogation in favor of Erie Canal Harbor Development Company (ECHDC) and New York State Urban Development Corporation d/b/a/ Empire State Development (ESD) applies.

(e) Policy or policies must be endorsed to be primary as respects the coverage afforded the Additional Insureds and such policy shall be primary to any other insurance maintained by the Owner. Any other insurance maintained by the Owner shall be excess of and shall not contribute with Contractor's or subcontractor's insurance, regardless of the "other insurance" clause contained in the Owner's policy of insurance.

(f) Umbrella and/or Excess Liability policies used to comply with CGL, Automotive Liability and Employers Liability limits shown above may be warranted to be in excess of limits provided by Contractor's primary CGL, Automotive Liability and Employers Liability, but not excess to other insurance maintained by the Owner.

(g) Contractor and/ or subcontractor shall secure, pay for, and maintain Property Insurance necessary for protection against the loss of owned, borrowed or rented capital equipment and tools, including any tools owned by employees, and any tools or equipment, staging

towers, and forms owned, borrowed or rented by Contractor and against the loss of any stored materials. The requirement to secure and maintain such insurance is solely for the benefit of Contractor. Failure of Contractor to secure such insurance or to maintain adequate levels of coverage shall not render the Additional Insureds or their agents and employees responsible for any losses; and the Additional Insureds, their agents and employees shall have no such liability.

(h) Liability Insurance Policies shall include coverage for cross liability.

(i) The property insurance carries a deductible of $1,000, and each Contractor is responsible to pay costs not covered because of such deductible.

(j) Items (g) and (h) must be stated on the certificates of insurance.

(k) Insurance as required for Project permitting and licensing not otherwise satisfied by the requirements previously noted.

(l) Builder's Risk Insurance at a limit equal to the full contract value. Policy to include coverage for material stored off site and while in transit.

(m) Professional Liability Insurance in an amount not less than $5,000,000.

(n) Protection and Indemnity Insurance to cover liability while on the water is not less than $5,000,000.

12.6 Contract Security

Additionally, a "Certificate of Solvency" (Exhibit D) issued by the Superintendent of Insurance, State of New York of the bonding company, which provides any bond or undertaking required by this Agreement will be required. This certificate shall certify that the Surety is authorized to transact the business of insurance in New York State, possesses the necessary capital and funds (not less than $100,000,000) and provides a statement of its loss exposure.

12.7 Additional or Substitute Bond

If at any time the Owner shall become dissatisfied with any surety or sureties then upon the Performance Bond or the Payment Bond, or if for any other reason such bonds shall cease to be adequate security to the Owner, Contractor shall within ten (10) days after the notice from the Owner, substitute an acceptable bond or bonds in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner, except that the penal sum of said bond shall not exceed the Contract Price as adjusted by Change Orders. The premiums on such bond or bonds shall be paid by Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond or bonds to the Owner.

ARTICLE 13

DISPUTES

13.1 Claims for Extra Work

(a) If Contractor is of the opinion that (1) any work which it has been ordered to perform is extra work and not Work as set forth in the Contract Documents, (2) any determination, order or directive of the Owner is contrary to the terms of the Contract Documents and will require the performance of extra work or will cause additional expense to Contractor, or (3) any action or omission of the Owner or Architect is contrary to the terms and provisions of the Contract Documents and will require the performance of extra work or will cause additional expense to Contractor, Contractor shall:

1. not suspend Work, but promptly comply with such determination, order or directive and proceed diligently with the Performance of the Work in accordance with the Owner's instructions;

2. notify the Owner in writing within 72 hours of such determination, order or directive of its reasons for its opinion and request a final determination thereon by the Owner.

If within three (3) business days the Owner determines that the Work is not extra work, the Contractor, in order to reserve its right to claim compensation resulting from the performance of such work or the compliance with such determination, order or directive, must notify the Owner in writing within three (3) business days after receiving notice of the Owner's determination that it is performing such work or complying with such determination, order or directive under protest. In addition to the foregoing, Contractor must submit to the Owner within thirty (30) days after it has performed such work or complied with such determination, order or directive, a detailed statement of the extra expense incurred from the performance of such work or the compliance with such determination, order or directive.

(b) No claims for extra work shall be allowed unless the same was done pursuant to written order approved by the Owner. If Contractor fails to comply with any provisions of the Article:

1. it shall constitute a conclusive and binding determination that such action, omission, determination order or directive does not involve extra work, has not caused extra expense to Contractor, and is not contrary to the terms and provision of the Contract Documents; and

2. it shall be deemed to have waived any claim for compensation resulting from the performance of such work or the compliance with such determination, order or directive.

(c) The value of claims for extra work, if allowed shall be determined by the methods described in the Agreement for Change Orders.

ARTICLE 14

TERMINATION

14.1 Termination for Cause

In the event that any material provision of this Contract is breached by Contractor or by any subcontractor, the Owner may serve a three (3) calendar day written notice upon Contractor, and upon Contractor's surety, if any, of the Owner's intention to terminate the Contract. Said notice shall contain the reasons for said intention to terminate the Contract upon a date specified by the Owner. If said breach shall not be cured by Contractor within three (3) calendar days or arrangements satisfactory to the Owner shall not be made, the Contract shall terminate upon the date so specified by the Owner. In the event of any said termination, the Owner may take over the Work and prosecute same to completion for the account and at the expense of Contractor, and Contractor and Contractor's surety shall be liable to the Owner for all costs occasioned the Owner. In the event of said termination the Owner may take possession of and may utilize such materials or equipment as may be on the site and necessary or useful in completing the Work irrespective of whether such materials or equipment were intended to be incorporated in the Project.

14.2 Termination for Convenience of the Owner

The Owner at any time may terminate the Contract in whole or in part for any reason and without cause. Any said termination shall be effected by delivering to Contractor a notice of termination specifying the extent to which performance of Work under the Contract is terminated and the date upon which said termination becomes effective. Upon receipt of the notice of termination, Contractor shall act promptly to minimize the expenses resulting from said termination. The Owner

shall pay Contractor the costs actually incurred by Contractor in the performance of the Work up to the effective date of said termination, but in no event shall Contractor be entitled to compensation in excess of the total compensation earned through the date of termination. Contractor shall not be entitled to any compensation for lost profits, which may be attributable to such termination. In the event of said termination, the Owner may take over the Work and prosecute same to completion and may take possession of and may utilize such materials and equipment as may be on the Site and necessary or useful in completing the Work.

14.3 The Owner's Right to do Work

The Owner may, after notice to Contractor, without terminating the Contract and without prejudice to any other right or remedy the Owner may have, perform, or have performed by others, all of the Work or any part thereof and may deduct the cost thereof from any monies due or to become due Contractor.

14.4 Suspension of Work

The Owner may at any time and for any reason direct Contractor to suspend, stop or interrupt the Work or any part thereof for any period of time. Such direction shall be in writing and shall specify the period during which the Work is to be stopped. Contractor shall resume the Work upon the date specified in such direction or upon such other date as the Owner may thereafter specify in writing. The period during which the Work shall have been suspended, stopped or interrupted may, if warranted, be added to the time fixed for performance of the Work. A suspension for any consecutive period of 120 days or less during any 365-day period of the Work pursuant to this provision shall not give rise to any claim against the Owner by Contractor for additional compensation; otherwise, Contractor may be entitled to an equitable adjustment of the Contract Price in the Owner's sole discretion.

ARTICLE 15

INDEMNITY AND PROTECTION OF RIGHTS, PERSONS AND PROPERTY

15.1 Accident Prevention

Contractor shall at all times take every precaution against injuries to persons or damage to property and for the safety of persons engaged in the performance of the Work.

15.2 Safety Program

Contractor shall be responsible for the initiation, maintenance and supervision of safety precautions and programs in connection with the Work. Contractor shall submit a safety program to be approved by the Owner or the Owner's Representative and designate a Safety Officer to carry out the approved program.

15.3 Protection of Work and Property

Contractor shall at all times guard the Owner's property from damage or loss in connection with the Work. Contractor shall at all times guard and protect the site, the Work and adjacent property. Contractor shall replace or make good any such loss or injury unless such loss or injury is caused directly by the Owner.

15.4 Delay or Failure

Contractor and its sureties shall be responsible for and pay to the Owner all loss, damage and additional cost incurred at the Project by reason or on account of (i) the unexcused delays of Contractor or (ii) Contractor's failure to fully and completely carry out the terms of this Agreement.

15.5 Adjoining Property

Contractor shall protect all adjoining property and shall repair or replace any such property damaged or destroyed during the progress of the Work by Contractor or any of its subcontractors at Contractor's sole cost and expense.

15.6 Risks Assumed by Contractor

(a) Contractor solely assumes the following distinct and several risks whether such risks arise from acts or omissions (whether negligent or not, and whether supervisory or otherwise) of the Owner, of Architect, of Contractor, of any subcontractor, of third persons or from any other cause, including unforeseen obstacles and difficulties which may be encountered in the prosecution of the Work, whether such risks are within or beyond the control of Contractor and whether such risks involve any legal duty, primary or otherwise, imposed upon the Owner:

1. The risk of loss or damage, direct or indirect, or whatever nature, to the Work or to any materials furnished, used, installed or received by the Owner, Contractor or any subcontractor, materialmen or workmen performing services or furnishing materials for the Work, whether or not such work or materials are stored at the site. Contractor shall bear such risk of loss or damage until final acceptance of the Work by the Owner or until completion or removal of such materials from the site and the vicinity thereof, whichever event occurs last. A portion of the risk of such loss or damage may be insured against under the terms of a "builder's risk" insurance policy maintained by the Owner. Notwithstanding the status of any actual or potential recovery or claim under the said "builder's risk" insurance policy, in the event of any loss or damage, Contractor immediately shall repair, replace or make good any such loss or damage.

2. The risk of claims, just or unjust, by third persons against Contractor, the Owner, the Owner's Representative, and Architect on account of wrongful death, bodily injuries and property damage, economic loss, direct or consequential, and loss or damage of any kind whatsoever arising or alleged to arise out of or as a result of or in connection with the performance by Contractor of the Work or out of or in connection with Contractor's operations or presence at or in the vicinity of the site. Contractor shall bear such risk for all such deaths, injuries, damages or losses sustained or alleged to have been sustained, including indemnity loss, also.

3. A) Contractor assumes the entire responsibility and liability for any and all damage or injury of any kind or nature whatsoever (including death resulting therefrom) to all persons, whether employees of Contractor or otherwise, and to all property caused by, resulting from, arising out of or occurring in connection with the execution of the Work. Contractor shall hold the New York State Urban Development Corporation d/b/a/ Empire State Development corporation (ESDC), the Owner (ECHDC), the Owner's Representative, Construction Manager, Architect, Engineer, the City of Buffalo, County of Erie, Buffalo Sewer Authority, and their consultants, successors, assigns, servants, agents and employees (the "Indemnities") harmless from and shall indemnify them against and for any and all liability, loss, cost, damage or expense, including attorneys' fees, by reason of claims of its employees or employees of its subcontractors for injuries or death, by reason of claims of any other person or persons, including the Indemnities, for injuries to person or property or for death occasioned in whole or in part by any act or omission of Contractor, its subcontractors and their servants, agents or employees. If, however, this indemnification is limited by applicable law, then the said indemnification hereby shall be similarly limited to conform to such law, it being the intention that this indemnification shall be as broad as permitted by applicable law. The Owner may retain any monies due or to become due hereunder sufficient to indemnify the New York State Urban Development Corporation d/b/a/ Empire State Development corporation (ESDC), the Owner (ECHDC), the Owner's Representative, Construction Manager, Architect, Engineer, the City of Buffalo, County of Erie, Buffalo

Sewer Authority, State of New York, and their servants, agents and employees against such injuries, claims, suits, actions, costs or damages should any such claim arise. Contractor shall, at the sole option of the Owner and upon written demand of the Owner, assume the defense in behalf of the Indemnities of any action or proceeding commenced against them whether or not Contractor is named as a party therein as part of Contractor's aforementioned obligation to indemnify and hold them harmless.

(b) Contractor shall not, without obtaining express advance permission of the Owner, raise any defense involving in any way jurisdiction of the tribunal over Contractor, the Owner or any Additional Insured, the governmental nature of the Owner or any Additional Insured or the provision of any statutes respecting suits against the Owner or any Additional Insured.

(c) Contractor's obligations under this Article shall not be deemed waived, limited or discharged by the procurement of any insurance by the Owner or the Contractor.

(d) Neither Final Acceptance of the Work nor making any payments shall release Contractor from Contractor's obligations under this Article. The enumeration elsewhere in this Agreement of particular risks assumed by Contractor or of particular claims for which Contractor is responsible shall not be deemed to limit the effect of the provisions of this Article or to imply that Contractor assumes, or is responsible for, only risks or claims of the type enumerated; and neither the enumeration in this Article nor the enumeration elsewhere in this Agreement of particular risks assumed by Contractor or particular claims for which Contractor is responsible shall be deemed to limit the risks which Contractor would assume or the claims for which Contractor would be responsible in the absence of such enumerations. All of the foregoing obligations of Contractor in this Article shall survive the termination of this Agreement for any reason.

ARTICLE 16

USE OR OCCUPANCY PRIOR TO ACCEPTANCE BY THE OWNER

16.1 Occupancy Prior to Final Acceptance

(a) If, before Final Acceptance of the Work, the Owner desires occupancy of the Project or any part thereof which is completed or partly completed, or to place or install therein equipment and furnishings, the Owner shall have the right to do so, and Contractor shall in no way interfere with or object to such occupancy by the Owner.

(b) Such occupancy: (1) shall not constitute acceptance of space, systems, materials or elements of the Work, nor shall such occupancy effect the start of any guaranty period; and (2) shall not affect the obligations of Contractor under the Contract Documents.

(c) Contractor shall continue the performance of the Work in manner which shall not unreasonably interfere with such use, occupancy and operation by the Owner.

ARTICLE 17

(INTENTIONALLY DELETED)

ARTICLE 18

WARRANTIES AND GUARANTEES

18.1 Guarantees

Contractor shall in all respects guarantee the Work to the Owner and be responsible for all material, equipment and workmanship of the Work. Contractor shall forthwith repair, replace or remedy in a manner approved by the Owner or the Owner's Representative, any said materials, equipment, workmanship, or other part of the Work found by the Owner or the Owner's Representative to be defective or otherwise faulty and not acceptable to the Owner or the Owner's Representative which defect or fault appears during the period of one (1) year from the date of Final Completion as evidenced by the Certificate of Final Completion.

18.2 Specific Guarantees

Specific guarantees shall be as set forth in the Specifications and shall be submitted as indicated.

18.3 Guarantee Inspection

The Owner along with Architect and his consultants and the Owner's Representative will perform a Guarantee Inspection eleven (11) months after issuance of Certificate of Final Completion. Contractor will be forwarded a copy of the guarantee inspection report identifying any noted deficiencies in the Work which must be corrected by the Contractor. Contractor shall proceed with diligence to correct all such work identified on the inspection report within ten (10) days of receipt of the report or as soon thereafter as is reasonably possible.

18.4 Expenses of Correction of Work

(a) In the event that the Owner is required to incur any expense relating to the correction of the Work even if such expense relates to work on the Project not performed by Contractor, all such expense shall be the sole obligation of Contractor and shall be reimbursed to the Owner upon demand, Contractor hereby acknowledging that the Owner may be required to incur substantial expense if correction involves the uncovering, removal or replacement of paving concrete, wiring and piping installed at the Site. If Contractor shall fail to reimburse the Owner for any such expense which may become payable as provided in this paragraph, the Owner shall be entitled to deduct such expense from any payments required to be made by the Owner to Contractor pursuant to this Agreement. Contractor, upon demand, shall pay for all damage to all other work resulting from such defects and all expenses necessary to remove, replace, and repair such other work which may be damaged in removing, replacing or repairing such defects.

(b) If the Owner has requested Contractor to correct any Work and Contractor shall not have completed any correction of the Work as shall be required pursuant to Article 18 within ten (10) working days after receipt of written notice from the Owner specifying the defect or damage required to be removed, repaired and replaced within such ten (10) day period or shall not thereafter with reasonable diligence and in good faith proceed to do such work, the Owner may employ such other person, firm or corporation as it may choose to perform such removal, replacement and repair, and Contractor shall, upon demand, pay to the Owner all amounts which the Owner expends for such work.

(c) The benefits of this Article 18 shall inure to the benefit of the Owner and its respective successors and assigns. In addition, any bond or guarantee which may be required of Contractor or any subcontractor under the Contract Documents shall inure to the benefit of the Owner and its respective successors and assigns.

(d) The rights and remedies afforded the Owner under this Section are in addition to and not in lieu of and do not in any way affect, limit, change, alter, modify, vary or prejudice any right, remedy or recourse which the Owner may have under other provisions of this Agreement or pursuant to statute, common law, or otherwise.

ARTICLE 19

PATENTS AND ROYALTIES

19.1 Patents & Royalties

(a) In the prosecution of the Work, Contractor will not use or furnish any patented appliance, article, device or method of construction unless it has authorization for such use. Contractor shall pay all royalty and license fees.

(b) Contractor shall indemnify and hold harmless the Owner from claims, demands or liabilities of any kind or nature, including costs and expenses, for or on account of any patented plan, design, invention, article, arrangement, appliance, material, or preparation manufactured, used or followed in the performance of or incidental to the Work hereunder, and shall defend any and all actions arising out of the same. In the event of any injunction or legal action by reason thereof, which shall operate to stop or delay the Work, the Owner shall have the right to substitute such other articles of like kind as will enable it to complete the Project, and all costs and expenses occasioned thereby shall be borne by Contractor.

(c) Contractor hereby and presently grants to the Owner an irrevocable and nonexclusive license to utilize all of Contractor's rights in and to:

1. all United States patents and patents registered in any other foreign country;

2. all proprietary knowledge, data and trade secrets;

All engineering data and information in connection with all work performed by Contractor or other contractors hired by the Owner to complete the Work after termination of this Agreement. Each purchase order and subcontract shall contain a similar clause with respect to the rights of the Owner with respect to the subcontractors' rights in and to the foregoing, in form and substance acceptable to the Owner, granting the Owner the aforesaid license. The Owner shall not be obligated to pay any royalties, license fees or any other consideration to Contractor or any subcontractor for this license. Contractor and each subcontractor shall execute a separate license agreement, in form and substance satisfactory to the Owner, concurrently with the execution of this Agreement, or any subcontract or purchase order, or within ten (10) days thereafter embodying the terms of this Section. On request, Contractor and each subcontractor shall furnish the Owner or the Owner's Representative with copies of all related engineering and technical data required to complete the Work.

ARTICLE 20

AS-BUILT DRAWINGS

20.1 As-Built Drawings

Contractor shall provide as-built drawings for all Work it performs including showing changes in conditions from any information reflected in the Drawings or Specifications. At a minimum, as-built drawings shall show locations of any existing foundations or utilities encountered during the Work, actual location of pipes, ducts, conduits and other items as installed, along with true dimensions of the completed Work determined by actual measurement and a record of actual material or product selections made in accordance with the Specifications. As-built drawings shall be provided to Owner as a complete set as follows: (i) in full-size reproducible plans; (ii) in full-size printed plans; and (iii) one complete set of all as-built drawings on CADD disk in a software compatible with the Owner's requirements.

ARTICLE 21

SHOP DRAWINGS AND SAMPLES

21.1 Contractor Submittal

(a) Contractor shall prepare for the Owner's and the Owner's Representative's approval, a submittal schedule, including all information contained in the Project Schedule, for all submittals hereafter required and shall deliver same for approval to the Owner's Representative within seven (7) days of the signing of this Agreement.

(b) Contractor shall submit the Shop Drawings, Product Data and Samples required by the Contract Documents to the Owner's Representative for transmittal to Architect in sufficient time to allow ten (10) calendar days for review by Architect and shall adhere to the approved submittal scheduling requirements with respect thereto. After review of such Shop Drawings, Product Data and Samples by Architect, each of such items shall be returned in accordance with the procedures established herein. If Contractor deviates from the approved submittal schedule, it bears all of the risk for any delay in turn-around by Architect.

(c) Shop Drawings, shall be accompanied by a letter of transmittal to the Owner's Representative requesting review. Contractor shall number transmittals consecutively and indicate, whether the Shop Drawings, are resubmittals, the Owner's Representative's file number of the original submittal. The letter of transmittal shall also set forth the information required in subparagraph (d) thereof.

(d) Each Shop Drawing and letter of transmittal shall contain the following information:

1. The name of the Project.
2. The name of Contractor.
3. The name of the firm or organization preparing the Shop Drawing.
4. The date of submittal.
5. The number of the Shop Drawing.
6. The number and date of each revision, if any.
7. The applicable section of the Specifications.
8. The applicable number of the Contract Drawings and detail.
9. The name of the person and/or persons who prepared the Shop Drawing.
10. Any deviations or changes from the Contract Documents.
11. Each copy of Shop Drawings shall be stamped and signed by Contractor indicating clearly his complete approval and signifying that the Shop Drawings (and product data) do comply with all the Contract Documents.

(e) Shop Drawings shall show the design, dimension, connections and other details necessary to insure an accurate interpretation of the Contract Documents and shall also show adjoining work in such detail as required to provide proper connections with said adjoining work. Where adjoining connected work requires Shop Drawings, such Shop Drawings shall be submitted to the Owner's Representative for transmittal to Architect for review at the same time so that connections can be reviewed.

(f) By submitting Shop Drawings, Product Data and Samples, Contractor represents that it has determined and verified all materials, field measurements and field construction criteria related thereto, that it has checked the Shop Drawings, Product Data and Samples for complete dimensional accuracy, that it has checked to insure that Work contiguous with

and having bearing on the Work shown on the Shop Drawings is accurately and clearly shown, that it has checked the Shop Drawings against the composite drawings, that the Work has been coordinated, that the equipment will fit into the assigned spaces and that it has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. Measurements not available prior to submission of Shop Drawings shall be noted on the Shop Drawings as not available and such measurements shall be obtained prior to fabrication.

(g) Contractor shall submit Product Data when necessary or requested by the Owner's Representative or Architect to explain fully apparatus or equipment required by the Work. The Product Data shall be treated as Shop Drawings. Manufacturer's catalogue numbers alone are not acceptable as sufficient information or compliance with this requirement.

(h) Samples shall be accompanied by a letter of transmittal to the Owner's Representative requesting review. Contractor shall number transmittals consecutively in sequence with Shop Drawing transmittals. Where appropriate, test data and/or manufacturers' certificates shall be referenced and forwarded with the letter of transmittal. Samples without accompanying test data or certificates will be returned without action. The letter of transmittal shall also set forth the information required in subparagraph (i) hereof.

(i) Each Sample shall be labeled, tagged or clearly identified and each Sample and letter of transmittal shall contain the following information:

1. The name of the Project.
2. The name of Contractor.
3. The name of subcontractor and/or supplier, manufacturer, fabricator or processor.
4. The trade designation and the grade or quality of the material or product.
5. The date of submittal.
6. The specific identification of each Sample.
7. A precise reference to the section of Specifications, article and paragraph wherein the material, product or element of the Work is specified.

Each label or tag shall have sufficient clear space to permit the application of the approval stamps of Contractor and Architect.

(j) In the event that a range of variations in textures, graining, color or other characteristics may be anticipated in finished materials, assemblies or elements of the Work, a sufficient number of Samples of such materials or products shall be submitted to indicate the full range of characteristics which will be present in the materials or products proposed for the Work. Any such materials or products delivered or erected prior to approval of full range Samples shall be subject to rejection.

(k) Samples shall be submitted from the same source, which shall actually supply the Project. Samples shall be of adequate size to show quality, type, color, range, finish, texture and other specified characteristics.

(l) Samples of materials or products which are normally furnished in containers or packages which bear descriptive labels and/or application or installation instructions shall be submitted with such labels and/or instructions.

(m) Contractor shall submit copies of Shop Drawings, Product Data and Samples in accordance with the submittal procedure listed below. Reproducible prints shall be sepias or ozalid prints with positive side up that will provide good quality readable prints. Black and white prints shall be black line on white background. The following shall be submitted:

1. Shop Drawings: One reproducible print and (six) black and white prints submitted to the Owner's Representative.

2. When Shop Drawings are submitted in the form of brochures, manufacturer's standard drawings or catalogue cuts not readily available in reproducible form, seven (7) copies of each shall be submitted to the Owner's Representative.

3. Three Samples shall be submitted to the Owner's Representative except as otherwise set forth in other sections of the Contract Documents.

(n) Following Architect's review of each Shop Drawing Submission, the Owner's Representative will retain one black and white print and return the reviewed reproducible print to Contractor with Architect's stamp and signature affixed thereto annotated as follows:

1. Refer to Division 1 Sections “Submittals” for review annotations:

(o) After the review of all Product Data and Samples, the procedures set forth below will be followed:

The Owner's Representative will return three Product Data or two (2) Samples of each set to Contractor with Architect's stamp and signature affixed thereto and annotated in accordance with paragraph (n) above.

(p) Contractor shall have available at the Project site all reviewed Shop Drawings, Product Data and Samples at all times for use by Contractor, its subcontractors, Architect, the Owner, or their designees, to insure that all Work is being installed in accordance with the reviewed Shop Drawings, Product Data and Samples.

(q) The Owner shall be furnished copies of all transmittals during the processing of Shop Drawings. The Owner shall be furnished copies of all "reviewed" (no comments) or "reviewed" (see comments) Shop Drawings and product data by Contractor.

21.2 Contractor’s Responsibility

Architect's review of Shop Drawings, Product Data and Samples shall not relieve Contractor of responsibility for any deviation from the requirements of the Contract Documents. Contractor shall be responsible for the accuracy of the Shop Drawings, Product Data and Samples and for the conformity of Shop Drawings, Product Data and Samples with the Contract Documents unless Contractor has notified the Owner's Representative and Architect of the deviations in writing at the time of submission and has received from the Owner's Representative written approval of the specified deviations. Architect's review shall not relieve Contractor of responsibility for dimensions, errors or omissions in the Shop Drawings, Product Data or Samples. Contractor is solely responsible for the fit of all materials and assemblies.

21.3 Prior Approval of Architect

No portion of the Work shall be commenced until required Shop Drawings, Product Data or Samples are reviewed and approved by Architect.

ARTICLE 22

NOTICES

Any notice required or permitted to be given under this Agreement must be in writing and shall be deemed to have been given when delivered personally or by registered or certified mail, return receipt requested, to the party to whom the notice is given at the address designated below or, if any party subsequently designates a different address for this purpose, at such subsequently designated address. Notices to Contractor shall be addressed and delivered to its address stated at the beginning of this Agreement, or to Contractor's superintendent at the site. Notices to the Owner, the Owner's Representative and Architect shall be addressed and delivered as follows:

To the Owner and the Owner's Representative:

Erie Canal Harbor Development Corporation.
95 Perry Street, 5th Floor
Buffalo, NY 14203
Attention: Steve Ranalli

With a copy to Empire State Development Corporation:

Empire State Development Corporation
633 3rd Avenue
New York, NY 10017
Attention: General Counsel

ARTICLE 23

NON-DISCRIMINATION AND AFFIRMATIVE ACTION

23.1 Non-Discrimination

(a) Contractor shall comply with any and all federal, state and local laws, orders, rules and regulations which prohibit discrimination in employment or hiring because of age, race, creed, color, national origin, sex, disability or marital status of any individual.

(b) Contractor shall make a good faith effort to achieve an overall participation by Minority and/or Women-Owned Business Enterprises, as defined in Exhibit F to this Agreement, and shall make a good faith effort to comply with ESDC's Affirmative Action and Non-Discrimination program and policies, as set forth in Exhibit F to this Agreement.

ARTICLE 24

(INTENTIONALLY DELETED)

ARTICLE 25

STANDARD PROVISIONS

25.1 Provisions Required by Law Deemed Inserted

Each and every provision of law and governmental regulation required by law to be inserted in the Contract Documents shall be deemed to be inserted herein and this Agreement shall read and shall be enforced as though so included therein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, this Agreement shall be deemed to be amended to make such insertion or correction. If this Agreement contains any unlawful provision, the same shall be deemed of no effect and shall, upon the application of either party, be deemed stricken from this Agreement without affecting the binding force of the remainder of this Agreement.

25.2 Compliance with Laws, Rules and Regulations

Contractor and each subcontractor shall comply fully with all applicable laws, rules and regulations pertaining to the Project or the Work including, but not limited to, all environmental laws, rules or regulations promulgated by the federal, state and local governments, in effect at the time of the Work. Contractor bears all risk associated with any deviation from such laws, rules or regulations pertaining to the Work and agrees to indemnify and hold the Owner harmless for, from and against any costs, expenses, fines or judgments which may be incurred by the Owner as a result of Contractor's deviation therefrom.

25.3 Laws Governing this Agreement

The Agreement shall be governed by the laws of the State of New York without giving effect to principles of conflicts of law.

25.4 No Third Party Rights

Nothing in this Agreement shall create or shall give to any third parties any claim or right of action against the Owner's Representative, Architect, the Owner, or ESDC.

25.5 Protection of Lives and Health

(a) Contractor's and subcontractor's attention is specifically called to the rules and regulations, codes and bulletins of the New York State Department of Labor. Attention is also directed to the standards imposed under the Federal Occupational Safety and Health Act of 1970, as amended.

(b) Contractor shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment of work under this Agreement, and shall immediately notify the Owner in writing of any injury which results in hospitalization or death.

(c) Contractor alone shall be responsible for the safety, efficiency and adequacy of Contractor's Work, plants, equipment, appliances and methods, and for any damage or injury which may result from the failure, or the improper construction, maintenance, or operation of such Work, plant, equipment, appliances and methods.

25.6 Waiver of Immunity Clause

Contractor hereby agrees to the provisions of Section 139-a of the State Finance Law, which section requires that upon the refusal of a person, when called before a grand jury, head of a State department, temporary State Commission, the Organized Crime Task Force in the State Department of Law, or other State agency which is empowered to compel the attendance of witnesses and examine them under oath, to testify in an investigation concerning any transaction or contract had with the State, any political subdivision thereof, or with any public department, agency or official of the State or any political subdivision thereof or a public authority, to sign a waiver of immunity against subsequent criminal prosecution or to answer any relevant questions concerning such transaction or contract:

(a) Such person, and any firm partnership or corporation of which such person is a member, partner, director or officer shall be disqualified from thereafter selling to or submitting bids to or receiving awards from or entering into any contracts with the State of any public authority or official thereof, for goods, work or services, for the period of five (5) years after such refusal; and

Any and all contracts made with the State of any public department, agency or official thereof, since the effective date of Section 139-a of the State Finance Law, by such person and by any firm, partnership or corporation of which such person is a member, partner, director or officer may be canceled or terminated for cause without incurring any penalty

or damages on account of such cancellation or termination, but any sums owing for goods delivered or work done prior to the cancellation or termination shall be paid.

25.7 Prohibited Interests

No official of the Owner or ESDC who is authorized in such capacity and on behalf of the Owner or ESDC to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the Work, shall become directly or indirectly interested personally in the Contract. No officer, employee, architect, attorney, engineer, inspector or consultant of or for the Owner or ESDC who is authorized in such capacity and on behalf of the Owner or ESDC to exercise any legislative, executive, supervisory or other similar functions in connection with the Work, shall become directly or indirectly interested personally in the contract, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Work.

25.8 Labor Provisions

(a) It is hereby agreed that all applicable provisions of the Labor Law of the State of New York shall be carried out in the performance of the Work including, but not limited to, Labor Law Sections 220, 220-d and 220-e, as amended (Exhibit I).

(b) The minimum wage rates, if any, herein specified for apprentices shall apply only to persons working with the tools of the trade which such persons are learning under the direct supervision of journeymen mechanics. Except as otherwise required by law, the number of apprentices in each trade or occupation employed by Contractor or any subcontractor shall not exceed the number permitted by the applicable standards of the New York State Department of Labor, or, in the absence of such standards, the number permitted under the usual practice prevailing between the unions and the employer's association of the respective trades or occupations.

(c) All employees of Contractor and each subcontractor shall be paid in accordance with the provisions of the Labor Law. All payments shall be made in cash, except a payment may be by check upon certification of the Industrial Commissioner of the State of New York.

(d) Contractor agrees that, in case of underpayment of wages to any worker engaged in the Work by Contractor or any subcontractor, the Owner shall withhold from Contractor out of payments due an amount sufficient to pay such worker the difference between the wages required to be paid under the Contract Documents and the wages actually paid such worker for the total number of hours worked, and that the Owner may disburse such amount so withheld by the Owner for and on account of Contractor to the employee to whom such amount is due. Contractor further agrees that the amount to be withheld pursuant to this paragraph may be in addition to the percentages to be retained by the Owner pursuant to other provisions of the Contract documents.

(e) Contractor shall immediately notify the Owner and the Owner's Representative of any actual or impending labor disputes which may effect or are affecting the Project Schedule of Contractor or any other contractor's work. In addition, Contractor shall take all appropriate measures to eliminate or minimize the effect of such labor dispute on the Project Schedule.

(f) Any labor, materials, or means whose employment or utilization during the course of this Contract may tend to or in any way cause or result in strike, work stoppages, delays, suspension of Work or similar troubles by workmen employed by Contractor, its subcontractors or material suppliers, or by any of the trades working in or about the premises where Work is being performed under this Contract, or by other contractors, their subcontractors or material suppliers pursuant to other contracts shall not be allowed. Any violation by Contractor of this requirement may in the sole judgment of the Owner be considered as proper and sufficient cause for declaring Contractor to be in default, and for

the Owner to terminate Contractor or take such other action as the Owner may deem proper. Contractor shall include this section in every subcontract and every lower tier subcontract.

25.9 Dispute Procedure

Unless the parties hereto otherwise agree in writing, Contractor shall continue to perform its obligations hereunder, pursue prosecution of the Work and maintain the Project Schedule, if applicable, during any claim, dispute or proceeding arising under or out of this Agreement ("Claim"):

(a) Any Claim not resolved by the parties through negotiation shall be first submitted to non-binding mediation within thirty (30) days of such Claim pursuant to the American Arbitration Association's ("AAA") Construction Industry Dispute Resolution Rules as a condition precedent to litigation in a court of competent jurisdiction in the state and county where the Project is located. If such mediation is not conducted within thirty (30) days of submission to the AAA, the requirement to mediate shall be deemed waived. All disputes not resolved through non-binding mediation may only be submitted to a Court of competent jurisdiction in the state and county where the Project is located.

(b) All sureties of Contractor in connection with the Work shall be bound by any negotiated resolution agreed to by the parties or any judgment rendered by a Court of competent jurisdiction. No such agreement or judgment shall operate in any manner whatsoever to release or discharge any such surety from all or any portion of its liabilities and obligations for which it is a surety.

(c) If the Owner is the prevailing party in any dispute arising under this Agreement, it shall be entitled to recover from Contractor, in addition to any judgment, award or settlement, reasonable attorneys' fees, and expert witness fees, attributable to the prosecution or defense of any Claim.

25.10 Confidentiality

Contractor acknowledges that it or its employees may, in the course of performing its responsibilities under this Agreement, be exposed to or acquire information which is proprietary to or confidential to the Owner, its affiliated entities or third parties to whom the Owner has a duty of confidentiality. Any and all information of any form obtained by Contractor or its employees in the performance of this Agreement shall be deemed to be confidential and proprietary information. Contractor agrees to hold such information in strict confidence and not to disclose such information to third parties or to use such information for any purpose whatsoever other than the provision of services to the Owner as contemplated by this Agreement and to advise each of its employees and subcontractors who may be exposed to such proprietary and confidential information of their obligations to keep such information confidential. Confidential information shall not include information which is: (1) in or becomes part of the public domain other than by disclosure by Contractor in violation of this Agreement; (2) demonstrably known to Contractor previously, without a duty of confidentiality; (3) independently developed by Contractor outside of this Agreement; (4) rightfully obtained by Contractor from third parties without a duty of confidentiality; or (5) which is required to be disclosed by law, statute or regulation. This Section shall survive Final Completion or any earlier termination of this Agreement.

25.11 No Promotion

Contractor agrees that it will not without the prior written consent of the Owner in each instance, (i) use in advertising, publicity, or otherwise, the name of the Owner or any affiliate of the Owner, or any employee of the Owner nor any trade name, trademark, trade device, service mark, symbol or any abbreviation, contraction or simulation thereof owned by the Owner or its affiliates; (ii) take or cause to be taken any photographs of the Project or the site except insofar as same is necessary for the performance of the Work; or (iii) represent, directly or indirectly, that any product or any

service provided by Contractor has been approved or endorsed by the Owner. This Section shall survive Final Completion or any earlier termination of this Agreement.

25.12 Limitation on Actions

No action or proceeding shall lie or shall be maintained by Contractor against the Owner unless such action shall be commenced with six (6) months after the date payment is mailed or otherwise made in respect of the Final Requisition or, if this Agreement is terminated by the Owner, unless such action is commenced within six (6) months after the date of such termination. No action or proceeding shall be commenced by Contractor against the Owner and/or the Owner's Representative except in the Supreme Court of the State of New York.

25.13 Waiver of Remedies

Contractor acknowledges that it can be compensated adequately by money damages for any breach of this Agreement which may be committed by the Owner, the Owner's Representative or Architect. Contractor agrees that no default, act or omission of the Owner, the Owner's Representative or Architect shall constitute a material breach of contract entitling Contractor to cancel or rescind this Agreement or to suspend or abandon performance thereof, other than the failure of the Owner to make a payment of the Contract Price in accordance with the terms hereof solely because sufficient funds to pay the Contract Price have not been appropriated or will otherwise not be made available to the Owner. Except as provided in this paragraph, Contractor hereby waives all rights and remedies to which Contractor might otherwise be or become entitled to become of any wrongful act or omission of the Owner, the Owner's Representative or Architect saving only Contractor's rights to money damages.

25.14 Modification of Agreement

No change in or modification, termination or discharge of this Agreement in any form whatsoever shall be valid or enforceable unless it is in writing and signed by the party to be charged therewith or its duly authorized representative, provided, however, that any change in or modification, termination or discharge of this Agreement expressly provided for in this Agreement shall be effective as so provided.

25.15 Signs and Parking

Contractor agrees that it shall not display on or about the Site any sign, trademark or other advertisement without the written approval of the Owner and to remove the same when so directed by the Owner. Contractor shall not permit any of its subcontractor or materialmen to park vehicles on the Site. Contractor shall be obligated to display at the Site any signage as required by the Owner.

25.16 Entire Agreement

The Contract Documents constitute the entire Agreement between the parties and incorporate all prior understandings in connection with the subject matter hereof.

25.17 Reservation of Rights and Remedies

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by Architect, the Owner, the ESDC, the Owner's Representative or Contractor including, but not limited to, the making of any payment nor permitting Contractor to continue with the performance of the Work shall constitute a waiver of any right or duty afforded any of them under this Agreement, nor shall any such action

or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first above written.

CONTRACTOR:

(SEAL) BY:_____

TITLE: _____

THE OWNER: Erie Canal Harbor Development Corporation

(SEAL) BY:_____

TITLE:_____

ACKNOWLEDGEMENT OF CONTRACTOR

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ___ day of _____ in the year 2021, before me, the undersigned personally appeared _____personally known to me or provided to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledge to me that he/she executed the same in his/her capacity, and that by his/her signature on the instrument, the individual, or person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public

ACKNOWLEDGEMENT OF THE OWNER

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ___ day of _____ in the year 2021, before me, the undersigned personally appeared _____personally known to me or provided to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledge to me that he/she executed the same in his/her capacity, and that by his/her signature on the instrument, the individual, or person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public

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EXHIBIT A

PERFORMANCE BOND

PLEASE TAKE NOTICE:

That _____ (Here insert the name and address or legal title of Contractor) _____ (hereinafter called the "Principal") and _____(Here insert the legal title of Surety) a Corporation created and existing under the laws of the State of _____ having its principal office in the City of _____ (hereinafter called the "Surety") are held and firmly bound unto Empire State Development Corporation its successors and assigns (hereinafter called the "the Owner"), as Obligee, in the amount of _____ ($_____) Dollars, for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has by written agreement dated _____, 2021 entered into a Construction Agreement with the Owner for the following:

Outer Harbor Phase 1A Project prepared by Bergmann Associates and Trowbridge Wolf Michaels LA (hereinafter called the "Project"), which Construction Agreement and all other documents which are defined therein as Contract Documents, are by reference made a part hereof, and are hereinafter referred to as the “Contract”.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain full force and effect.

The Surety hereby waives notice of any alteration in the terms of the contract or extension of time made by the parties thereto.

Whenever Contractor shall be, and declared by the Obligee, to be in default under the Contract, the Obligee, having performed their obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

(1) Complete the Contract in accordance with its terms and conditions; or

(2) Obtain a bid or bids for submission to the Owner for completing the Contract in accordance with its terms and conditions, and under determination by Surety of the lowest responsible bidder, or, if the Obligee of them elects, under determination by the Obligee, and the Surety jointly of the lowest responsible bidder, for a Contract between such Bidder and Obligee, and make available as Work progress (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in this first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by the Obligee, to Contractor under the Contract and any amendment thereto less the amount properly paid by the Obligee to Contractor.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment is made under the Contract.

No right of action shall accrue of this bond to or for the use of any person or Corporation other than the Obligee named herein, or the heirs, executor, administrators, successors or assigns of the Obligee, or to other Contractors, as set forth in Section 3.3 of the aforementioned Construction Agreement.

IN TESTIMONY WHEREOF, the said Principal has hereunto set his (her, their, its) hand and seal and the said Surety has caused this instrument to be signed by its Attorney-in-fact, and its corporate seal to be hereunto affixed, the day and year first above written.

Signed and sealed this ___ day of _____, 2021.

_____	_____
(Witness)	(Principal)
	_____
	(Title)
_____	_____
(Witness)	(Surety)
	_____
	(Title)

ACKNOWLEDGEMENT OF PRINCIPAL, IF A CORPORATION

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ___ day of _____ in the year 2021, before me personally came _____, to me known, who being by me duly sworn, did depose and said that he/she resides in_____; that he/she is the _____ of the _____, the Corporation described in an which executed the above instrument; that he knows the seal of said Corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said Corporation, and that he/she signed his/her name thereto by like order.

(SEAL)

ACKNOWLEDGMENT OF PRINCIPAL, IF A PARTNERSHIP

On this____day of _____in the year 2021, before me personally came_____, to me known, and known to me to be a member of the firm of _____described in and who executed the foregoing instrument, and he/she duly acknowledged to me that he/she executed the same for and in behalf of said firm for the uses and purpose mentioned herein.

(SEAL)

ACKNOWLEDGMENT OF PRINCIPAL, IF AN INDIVIDUAL

On this ___ day of _____ in the year 2021, before me personally came _____, to me known, and known to me to be the person described in and who executed the foregoing instrument and he/she duly acknowledged that he/she executed the same.

(SEAL)

ACKNOWLEDGMENT OF SURETY

On this ___ day of _____ in the year 2021, before me personally came _____, to me known, who being by me duly sworn, did depose and say that he/she resides in_____that he/she is the _____ of _____the _____ the Corporation described in and which executed that above instrument; that he knows the seal of said Corporation; that the seal affixed to said instrument is such seal; that it was so affixed by order of the Board of Directors of said Corporation and that he/she signed his/her name thereto by like order.

(SEAL)

_____	_____
(Witness)	(Principal)
	_____
	(Title)
_____	_____
(Witness)	(Surety)
	_____
	(Title)

EXHIBIT B

LABOR AND MATERIAL PAYMENT BOND

PLEASE TAKE NOTICE:

That _____(Here insert the name and address of Contractor) (hereinafter called the "Principal") and the _____ _____ a Corporation created and existing under the laws of the State of _____ having its principal office in the City of _____ (hereinafter called the "Surety"), are held and firmly bound unto Empire State Development Corporation, its successors and assigns (hereinafter called the "the Owner"), as Obligee, in the full and just sum of ($) Dollars good and lawful money of the United State of America, for the payment of which said sum of money, well and truly to be made and done, the said Principal binds themselves (himself, herself, itself), their (his, her, its) heirs, executors, administrators, successors and assigns, and the said Surety binds itself, its successors and assigns jointly and severally, firmly by these presents: Signed, sealed and dated this A.D.

WHEREAS, said principal has entered into a certain written Contract with the Owner for the following:

Outer Harbor Phase 1A Project (hereinafter called the "Project"), which Construction Agreement and all other documents which are defined therein as Contract Documents, are by reference made a part hereof, and are hereinafter referred to as the Contract and,

WHEREAS, the Owner has required this Bond guaranteeing prompt payment of monies due to all persons furnishing the Principal or any subcontractor of the Principal with labor or materials in the prosecution of the work provided in such Contract;

NOW, THEREFORE, the condition of the foregoing obligation is such that if the Principal shall promptly pay all monies due to all persons furnishing the Principal or any subcontractor of the Principal with labor or materials in the prosecution of the Contract, then this obligation shall be null and void, otherwise to remain in full force and effect;

PROVIDED, HOWEVER, that the said Surety for value received, hereby stipulates and agrees that no change, extension, alteration or addition to the terms of the Contract Documents shall in any wise effect its obligation under this Bond, and it does hereby waive notice of any such change, extension, alteration or addition; and further

PROVIDED, HOWEVER, that the place of trial of any action on this Bond shall be in the county in which the said Contract was to be performed, or if said Contract was to be performed in more than one county, then in any such county, and not elsewhere; and further

PROVIDED, HOWEVER, that this Bond shall be enforceable in accordance with the terms and provisions of Section 137 of the State Finance Law.

IN WITNESS, WHEREOF, the Principal has hereunto set its hand and seal and the Surety has caused this instrument to be signed by its Attorney-in-fact, and its corporate seal to be hereunto affixed, this ___ day of _____, 2021.

Signed and sealed this ___ day of _____. 2021.

_____	_____
(Witness)	(Principal)
	_____
	(Title)
_____	_____
(Witness)	(Surety)
	_____
	(Title)

EXHIBIT C

CONTRACT CHANGE ORDER FORM

To be issued to the successful Contractor.

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EXHIBIT D

CERTIFICATE OF SOLVENCY

To be provided by Contractor's Surety Company in a form acceptable to the Owner.

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EXHIBIT E

SCHEDULE OF DRAWINGS AND SPECIFICATIONS

To be attached upon execution of Contract.

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EXHIBIT F

AFFIRMATIVE ACTION & NON-DISCRIMINATION

To be attached upon execution of Contract.

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EXHIBIT G

MONTHLY EMPLOYMENT UTILIZATION REPORT

To be attached upon execution of Contract.

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EXHIBIT H

TABLE OF APPROVED AUTHORITY AND FACSIMILE SIGNATURES

To be attached upon execution of Contract.

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EXHIBIT I

PREVAILING WAGE RATES

Contractor shall pay prevailing State Wage Rates. Refer to project manual and obtain updates of Prevailing Wage Rates from:

"Prevailing Wage Rate Provisions" **http://www.labor.state.ny.us/** For the latest Federal Wages contact the Owners Representative.

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EXHIBIT J

REQUEST FOR PAYMENT

To be attached upon execution of Contract.

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EXHIBIT K

CONTRACTOR'S RECEIPT AND WAIVER OF LIEN

See following Attachment

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ERIE CANAL HARBOR DEVELOPMENT CORPORATION
Design and Construction Department

CONTRACTOR'S RECEIPT AND WAIVER OF LIEN

_____ Corporation (Contractor), in connection with the construction of a project of the Erie Canal Harbor Development Corporation ("ECHDC") known as Outer Harbor Phase 1A (the "Project") and the payment to _____ ("Contractor") of certain sums requisitioned by the Contractor pursuant to its Request for Payment No. _____ dated _____ 20 ____, the ("Requisition") for work performed or materials supplied for the Project to the date of the Requisition, for the benefit of _____ DOES HEREBY CERTIFY AND ACKNOWLEDGE that it has received all sums due and owing to it in accordance with its agreement with the ECHDC with respect thereto, other than sums, if any, withheld by the ECHDC in accordance with such agreement and approved by the ECHDC, for work performed or materials supplied for the Project to the date of _____ in the amount of _____ ($_____) and DOES HEREBY FOREVER RELEASE AND WAIVE for itself, its successor and assigns any and all rights, claims and demands it has or may have against the ECHDC, including any and all rights which it has or may have pursuant to the New York Lien Law to file and lien or notice of lien against the Project or any property of the ECHDC on account of or deriving from labor performed or materials furnished for the Project to the date of the previously submitted requisition.

IN WITNESS WHEREOF, the Contractor has caused this Certificate to be duly executed and the seal of the contractor to be affixed as of the date of the Requisition by the undersigned duly authorized officer.

Corporation:

_____

Signed by: _____ Title:_____ Date: _____

State of New York)
) ss:
County of New York)

On this _____ day of _____ 20 ____, before me, the subscriber personally appeared _____ to me personally known, who being by me duly sworn, did depose and say that he resides at _____ that he is _____of _____, the corporation described in and which executed the foregoing instrument: that he knows the seal of said corporation; that the seal affixed to said instrument is said corporate seal; that the seal was so affixed by order of the Board of Directors of said corporation; and that he signed his name thereto by like order.

_____
Notary Public – County of:
My Commission expires:

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EXHIBIT L

SUBCONTRACTOR'S RECEIPT AND WAIVER OF LIEN

See following Attachment

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ERIE CANAL HARBOR DEVELOPMENT CORPORATION
Design and Construction Department

SUBCONTRACTOR'S RECEIPT AND WAIVER OF LIEN

_____ ("Subcontractor"), in connection with the construction of a project of the **Erie Canal Harbor Development Corporation ("ECHDC")** known as **Outer Harbor Phase 1A** (the "Project") and the payment to the General Contractor of certain sums requisitioned by the General Contractor pursuant to the General Contractor'' Request for Payment No. _____ dated _____ 20___, (the "Requisition") for work performed or materials supplied for the Project to the date of the requisition, for the benefit of _____ DOES HEREBY CERTIFY AND ACKNOWLEDGE that it has received all sums due and owing to it in accordance with the agreement with the General Contractor with respect thereto, other than sums, if any, withheld by the General Contractor in accordance with such agreement and approved by the Owner and ECHDC, for work performed or materials supplied for the Project to the date of _____ in the amount of _____ ($_____) DOES HEREBY FOREVER RELEASE AND WAIVE for itself, its successor and assigns any and all rights, claims and demands it has or may have against the Owner and ECHDC, including any and all rights which it has or may have pursuant to the New York Lien Law to file any lien or notice of lien against the Project or any property of the Owner on account of or deriving from labor performed or materials furnished for the Project to the date of the previously submitted requisition .

IN WITNESS WHEREOF, the Contractor has caused this Certificate to be duly executed and the seal of the contractor to be affixed as of the date of the Requisition by the undersigned duly authorized officer.

Name of Subcontractor:

_____

Signed By: _____ Title: _____ DATE: _____

State of New York)
) ss:
County of New York)

On this _____ day of _____ 20_____, before me, the subscriber personally appeared _____ to me personally known, who being by me duly sworn, did depose and say that he resides at _____ that he is_____ of _____, the corporation described in and which executed the foregoing instrument: that he knows the seal of said corporation; that the seal affixed to said instrument is said corporate seal; that the seal was so affixed by order of the Board of Directors of said corporation; and that he signed his name thereto by like order.

Notary Public – County of:_____

My Commission expires:_____

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EXHIBIT M

AFFIDAVIT AND FINAL WAIVER OF CLAIMS AND LIENS AND RELEASE RIGHTS

See following Attachment

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ERIE CANAL HARBOR DEVELOPMENT CORPORATION
Design and Construction Department

AFFIDAVIT AND FINAL WAIVER OF CLAIMS AND LIENS
AND RELEASE OF RIGHTS

STATE OF)
) SS:
COUNTY OF)

The undersigned, who is the _____ (designate title) of _____ which is the _____designate whether the subcontractor, supplier or otherwise) for the _____ (designate the type of work, supplies or services rendered) on the improvements constructed or being constructed on the premises hereafter identified, declares that his contract with _____ (name of party contracted with) is in the total amount of $_____, which includes extras and all change orders to the date hereof.

In consideration of the amounts and sums previously received, and the payment of $_____ being full and final payment amount due, the undersigned does hereby waive and release to the Owner, Erie Canal Harbor Development Corporation ("ECHDC") and to _____ any and all claims and liens and rights to liens upon the premises described below (which may be more particularly described by an Exhibit "A" attached), and upon improvements now or hereafter thereon, and upon the monies or other considerations (due or to become due from the Owner, ECHDC of from _____ or from any other person, firm or corporation), said claims and liens and rights to liens being on account of labor, services, materials, fixtures or apparatus heretofore furnished by or which may be furnished at any time hereafter by or at the request of the undersigned. The premises as to which said claims, liens, and rights to liens are hereby released are identified as follows:
Project Name: _____
Address or Project: _____
City: _____ County: _____ State: _____

The undersigned further represents and warrants that he is duly authorized and empowered to sign and execute this waiver on his own behalf and on behalf of the company or business for which he is signing; that he has properly performed all work and furnished all the materials of the specified quality per plans and specifications and in a good and workmanlike manner, fully and completely; that he has paid for all the labor, materials, equipment and services; that he has used or supplied or may hereafter use or supply to the above premises that he has no other outstanding and unpaid payment applications, invoices, retentions, holdbacks, charge-backs or unbilled work or materials, as of the date of the aforementioned last and final payment application of invoice; and that any materials which have been supplied or incorporated into the above premises were either taken from his fully-paid or open stock or were fully paid for and supplied as stated on the statement accompanying the last and final payment application or invoice.

The undersigned further agrees to reimburse and does hold harmless and fully indemnify Owner, ECHDC and _____for any losses or expenses should any such claim, lien, or right to a lien be asserted (by the undersigned or by any laborer, materialman or subcontractor of the undersigned), including, without implied limitation, attorneys' fees incurred in the defense thereof.

In addition, for an in consideration of the amounts and sums received, the undersigned hereby waives, releases and relinquishes any and all claims, rights or causes of action whatsoever arising out of or in the course of the work performed on the above-mentioned project, contract or event.

Signed and delivered this _____ day of _____, 20_____.

_____
Individual or Corporation Name

By: _____

Title:_____

Before me, the undersigned Notary Public in and for said County and State, personally appeared _____, and acknowledged execution of the foregoing affidavit as his voluntary act and deed, and further stated that the facts recited are true of his personal knowledge.

_____
Notary Public

My Commission expires:_____
Residence County: _____

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EXHIBIT N

CONTRACT PAYMENT BREAKDOWN

In the spaces provided below, insert the bid amounts for the various trade divisions listed.

TRADE OR SECTION	AMOUNT
1. Division 1 - General Requirements	$_____
2. Division 3 – Concrete	$_____
3. Division 4 – Masonry	$_____
4. Division 5 – Metals	$_____
5. Division 6 – Wood	$_____
6. Division 7 – Thermal & Moisture Protection	$_____
7. Division 8 – Openings	$_____
8. Division 9 – Finishes	$_____
9. Division 10 – Specialties	$_____
10. Division 12 – Furnishings	$_____
11. Division 13 – Special Construction	$_____
12. Division 22 – Plumbing	$_____
13. Division 23 – HVAC	$_____
14. Division 26 – Electrical	$_____
15. Division 27 – Communications	$_____
16. Division 31 – Earthwork	$_____
17. Division 32 – Exterior Improvements	$_____
18. Division 33 – Utilities	$_____
Total for all items above	**$** _____

**Only the total bid amount written on page two of the Proposal form will be used to determine the low bidder; NOT the bid breakdown and total amount written on this page.*

Note: Please indicate whether you believe that any information supplied herein is confidential and should be exempt from disclosure under the Freedom of Information Law.

❑ Yes ❑ No

If "yes", you must identify the information you feel is confidential by placing an asterisk (*) in front of the appropriate number(s) and you are required to attach an additional sheet(s) upon which the basis for such claim(s) is explained.

_____

Name of Contractor

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EXHIBIT O

APPROVED LIST OF SUBCONTRACTORS

Contractor to attach and is subject to Owner approval.

THIS PAGE INTENTIONALLY LEFT BLANK

EXHIBIT P

BID PROPOSAL

To be attached upon execution of Contract.

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EXHIBIT Q

SAMPLE INSURANCE CERTIFICATE

To be provided by Contractor in form(s) acceptable to the Owner. Refer to Article 12 (Insurance and Contract security).

THIS PAGE INTENTIONALLY LEFT BLANK

EXHIBIT R

PROJECT MANUAL AND ADDENDA

To be attached upon execution of Contract.

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EXHIBIT S

CONTRACTOR'S CERTIFICATION ST-220

To be attached upon execution of Contract.

THIS PAGE INTENTIONALLY LEFT BLANK

EXHIBIT T

W-9 REQUEST FOR TAXPAYER IDENTIFICATION NUMBER & CERTIFICATION

See following Attachment(s)

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INSERT W-9 FORM PDF

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EXHIBIT U

CCA-2 FORM

To be attached upon execution of Contract.

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SECTION 000105 - SPECIAL CONDITIONS

PART 1 – GENERAL

1.1 OWNER'S REPRESENTATIVE

A. The Contractor is advised that the Owner's Representative is:

1. Mark Wendel, Erie Canal Harbor Development Corporation, 95 Perry Street, Suite 500, Buffalo NY 14203, (716) 846-8238.

B. The Contractor is advised that Bergmann Associates is retained as the Architect:

1. Steven J. Kushner; Bergmann Associates; 280 East Broad Street, Suite 200; Rochester, NY 14604.
2. Landscape Architect: Margot D. Chiuten; Trowbridge Wolf Michaels; 1001 West Seneca Street, Suite 201; Ithaca, NY 14850

C. The Construction Manager (CM) will perform the administrative duties, as defined in the Contract Documents, and act as the Owner's principal on-site representative for the Project. The CM is:

1. Tim Magee; Turner Construction Company; 50 Lakefront Boulevard, Suite 200; Buffalo, NY 14202

A. Project Address is to be:

1. 901 Fuhrmann Boulevard, Buffalo NY, 14203.

1.2 ON-SITE COORDINATION:

A. The CM shall provide on-site management to provide contract administration and shall establish and implement coordination and communication procedures among the Owner, Architect / Engineer, Contractors, and other appropriate parties.

1. The CM shall be the party through which all correspondence, change orders, payment requests, requests for information, submittals, and other information shall be processed and communicated from the Contractors to either, the Owner, Architect / Engineer, or both; and from either the Owner, Architect / Engineer, or both, to the Contractors. All communications with on-site parties and Contractor must be either through the CM or with his prior knowledge. There will be no circumventing of these established lines of communication by the Owner, Architect / Engineer, or individual Contractors, with the exception of the miscellaneous day-to-day conversation that must take place between organizations who work together on a job site.
2. The Contractor shall work with and assist the CM as necessary and as directed to assure a smooth, orderly implementation of coordination procedures.
3. The Contractor shall cooperate to the fullest extent with other contractors to facilitate the execution of his Work. The Contractor shall expedite the laying out of his Work when the location of Work by other trades is dependent upon such layout. Whenever the Work of one Contractor is delayed due to the failure of another to lay out his Work or to effect timely completion of any portion of his

Work, the Contractor being delayed shall notify the CM, who shall notify that Contractor to take prompt and effective action to complete the Work, which is causing the delay. If that Contractor fails to take prompt and effective action to complete the Work, causing the delay, the CM shall have the right to authorize another Contractor to complete the Work and charge the Contractor causing the delay for these costs. The CM shall be the sole judge as to the responsibility for the delay.

4. The CM will schedule and designate location of the project meetings. Each designated contractor will be required to have a representative present. As a minimum, project management meetings will be held every two weeks, and superintendent's meetings will be held one day of each week of the project, as scheduled by the CM. During critical periods of the project, meetings will be held more often, as scheduled by the CM. Other special meetings will be scheduled, as necessary, and all designated contractors shall have representatives present.

B. Relationship of Parties:

1. In providing CM Services described herein and elsewhere in the Contract Documents, the CM shall endeavor to maintain a harmonious working relationship with the Contractor and Architect / Engineer on behalf of the Owner. However, it shall not be construed to mean that the CM assumes responsibility for construction means, methods, sequences and procedures used by Contractors in the construction of the Project; the safety of the Contractor's personnel or for the contractor’s performance in accordance with the Contractor Agreement with the Owner. The A/E is solely responsible for the Project design and shall perform in accordance with the A/E's Agreement with the Owner.

1.3 SAFETY

A. The Contractor is responsible for the safety of all personnel on the jobsite. The Contractor shall perform any work necessary to maintain a safe jobsite for all workers and visitors.

B. In addition to this general responsibility of all Contractors, certain specific tasks have been assigned to specific Contractors, as described in the Scope of Work for that Contract. Any Contractor, who alters, removes, damages, or in any way changes, any protection, which is installed by another Contractor, is responsible to immediately repair, rebuild, or otherwise correct the protection to its original conditions and to OSHA standards. Additional protection or safety measures required by the Work are the responsibility of the Contractor performing the Work.

C. The Contractor shall comply with all applicable laws as they apply to maintaining a safe construction jobsite.

D. The Contractor will submit an OSHA-compliant comprehensive safety manual and plan to the CM and will be required to comply with all requirements of said plan. The CM shall have the right to withhold requisition progress payments until the safety manual is on file.

E. The Contractor shall have an OSHA-compliant comprehensive hazard communication program and shall provide and maintain two complete Hazcom manuals at the jobsite, including MSDS sheets for all products used or supplied for the Work. One of the manuals shall be located in the office of the CM, and the other shall be located in the

Contractor's field office. These manuals shall both be maintained and updated, as new MSDS sheets are required. The CM shall have the right to withhold requisition progress payments if the Contractor's MSDS books are not on file and properly updated.

F. The CM is not responsible for the safety of the contractors or their workers; however, the CM and any other representative of the Owner will have the right, but not the responsibility, to stop any action, which is considered to be unsafe, and to direct the contractor to take immediate corrective action.

G. The Contractor shall have no right or recourse, under the terms of the contract, to claim additional cost or delay against the Owner or the CM as a result of any work stoppage directed for a safety related issue.

H. To the fullest extent permitted by laws and regulations, The Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect and Engineer, and their consultants, agents and employees from and against all claims, damages, losses and expenses, direct or indirect or consequential (including but not limited to fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs), arising out of, or resulting from the failure of the Contractor to (1) comply with all applicable laws and regulations of any public body having jurisdiction for the safety of persons or property, or to (2) protect them from damage, injury, or loss, or to (3) erect all necessary safeguards for such safety and protection.

I. The Contractor shall hold "Tool Box" Safety meetings with employees on a weekly basis, on the first working day of the week, or more often as necessary, and shall submit evidence of all safety meetings to the CM.

J. The Contractor shall submit accident and injury reports to the CM no more than 2 hours after any incident.

K. Failure to comply with any element of these safety requirements shall be cause to withhold progress payments until full compliance.

1.4 QUALITY ASSURANCE

A. The Contractor shall submit a comprehensive quality control plan to the CM and will be required to comply with requirements of said plan. No requisition will be processed until the quality control plan is on file.

B. The CM shall establish and implement a program to monitor the quality of the Work, whose purpose shall be to assist the Owner in guarding against defects and deficiencies in the Work of the Contractor. The CM shall reject Work and so notify the non-conforming Contractor when Work is deemed unacceptable by the CM, Architect / Engineer, or Owner. However, the CM is not authorized, under this task, to change or release any requirement of the Contract Documents; and the CM shall not issue instructions contrary to the Agreement between the Owner and Contractor. All changes to agreements between the CM and Contractor, with regard to Quality Assurance, shall not in any way be construed as binding the CM or Owner, or releasing the Contractors from the fulfillment of any of the terms and conditions of the Contract Documents.

C. The CM is not responsible for, nor does the CM control the means and methods of construction for the project. It is understood that the CM's action in providing Quality Assurance, as stated herein, is in an advisory capacity only, to the Owner; and by performing in this manner, the CM assumes no responsibility or liability, in whole or in part, for all or any portion of the Work for the Project. No action taken by the CM shall relieve any or all of the Contractors from their obligation to perform their Work in strict conformance with the Contract Documents and all applicable laws, rules, and regulations.

D. The CM in conjunction with the Architect / Engineer, shall make recommendations for corrective actions on non-conforming Work. The CM shall make recommendations to the Owner and Architect / Engineer in instances where the CM observes Work that, in the CM's opinion, should be rejected as being in non-conformance with the Contract Documents.

E. See also Specification Section 014000 – Quality Requirements for more information.

1.5 GENERAL INFORMATION

A. The Contractor shall be responsible to coordinate his Work with that of preceding, concurrent, and following Contractors and to cooperate with the CM on the overall use of the Project site.

B. Before commencing Work, The Contractor shall provide written acceptance of grades, structures, and/or systems, either existing or installed by other Contractors, adjacent to or upon which this Contractor will be installing his Work. Failure to do so shall constitute automatic acceptance of the existing conditions.

C. Contractor's commercial signage is strictly prohibited on the Project site, except as specifically approved in writing by the CM.

D. Contractors shall provide for their own access to all areas of their Work including vertical transportation and hoisting for all men, materials, and construction debris.

E. The Contractor shall include all provisions necessary to maintain the progress of Work consistent with the Schedules and Schedules of other Contractors.

F. Notify Underground Facilities Protection Organization (UFPO) utility locator service for area where Project is located before commencement of work. In addition to UFPO notifications, the Contractor shall retain the services of a utility locating service that shall be responsible for locating and documenting all underground utilities within the limits of construction. Utility locations shall include their horizontal and vertical location. Utilities shall be located via test pits, ground penetrating radar, ground fault and short detection, and time domain reflection methods. Construction shall not commence until all utilities within the limits of construction have been identified and documented.

1.6 TIME DURATION:

A. Wherever in the Contract Documents, reference is made to “days” as a unit measure of time duration it shall be implied to mean calendar days unless specifically noted.

1.7 JOB OFFICES:

A. Construction staging areas will be allocated by the CM on a as needed basis. Contractors are to assume that space for job trailers will be available and shall be responsible for all costs associated with the set-up, operation, relocation, and removal of all Contractor job site facilities if allowed. Contractors may, at the CM's request, be required to move trailers, shanties and staging areas to allow for follow-up construction work, at no additional cost.

1.8 TELEPHONES AND OFFICE MACHINES

A. Contractors will neither use the telephones or office machines in the CM's field office, or in the Owner's facility. Contractors will be responsible for securing and maintaining their own telephones and office equipment

1.9 STORAGE SPACE

A. The Contractor shall be responsible for providing adequate storage facilities for protection of his materials and/or equipment furnished for this project. All deliveries of material and/or equipment will be scheduled with the CM, and locations will be allocated. If a Contractor delivers materials to the project without approval, that Contractor will be instructed to immediately remove those materials from the site. Cost of said off-site material storage, if required, shall be included in the Contractor's price. Further, if any material and/or equipment stored at the project, with or without consent of the CM, at any time obstructs the performance of any portion of the project, these materials shall be removed and relocated by the Contractor at no additional cost. In the event a Contractor fails or refuses to comply with this Article within a reasonable time, but not more than twenty-four (24) hours, the CM will reserve the right to have those materials removed, and all costs will be charged against the Contractor involved.

1.10 PROTECTION OF FINISH WORK

A. All Contractors shall be wholly responsible for the protection of their own finish work as well as that of others.

B. All finished surfaces shall be protected if there is any possibility of damage resulting from the Work of your contract or other trades and/or from the natural elements.

C. All finished surfaces, including factory finished surfaces, shall be cleaned and not marked upon delivery to the project. The Contractor shall, without extra compensation, refinish and/or replace all damaged surfaces to the satisfaction of the Architect / Engineer.

D. Prior to any work being performed or materials being stored on finished paved surfaces, the Contractor shall obtain approval from the CM. If required, the Contractor shall install a protective barrier over these finished surfaces. Wheelbarrow, carts, dollies, etc., if used in such areas, shall be non-marking rubber-tired.

E. At no time shall materials or equipment be stored on landscape surfaces, existing or new.

F. The Contractor shall be responsible for furnishing to the CM the following information pertinent to his Work:

1. Within 48 hours of direction by the CM, and prior to award of a Contract:

   a. A detailed contract price breakdown of all major categories of work, indicating quantities, material costs, labor costs, and total costs of each item. Breakdowns shall be submitted on ECHDC bid cost breakdown sheets to be issued post-bid.

   b. A list of Subcontractors, suppliers, or vendors they propose to use during the project. This list must be approved by the CM, Architect / Engineer, and Owner before Work can proceed.

2. Within seven (7) days after the Notice to Proceed:

   a. A detailed construction schedule, in accordance with schedule requirements in Article 1.17 of these Special Conditions.
   b. A submittal schedule showing all items requiring submission to indicate the estimated date of submittal, fabrication time, and the delivery date required to maintain the schedule.
   c. A completed Contractor Labor Rate Sheet for each labor classification performing Work under the Contract.
   d. The Contractor's Safety Program for this project, which shall be in accordance with these Special Conditions.
   e. Contractor's cash flow projections for the project.

3. Upon start of Work, the Contractor shall submit a list of its key personnel, with addresses and telephone number for emergency calls.
4. The Contractor shall also provide other specified information and additional information as may be requested by the CM from time to time.
5. Failure to comply with any elements of this Section shall be cause to withhold progress payments.

1.11 HAZARDOUS MATERIALS

A. Any Contractor, who encounters any hazardous materials in the course of his Work that is not identified elsewhere in the contract documents, shall immediately notify the CM. The Contractor shall at all times be bound by all local, state, and federal regulations and laws regarding hazardous materials.

1.12 DISCOVERIES

A. The Contractor shall take special precautions that will allow archeological, historical and scientific investigation to occur prior to subsurface disturbance. If any historical, scientific or archaeological artifacts are found, construction at that particular site will be delayed in accordance with the CM's instructions until the find is fully evaluated by qualified historians, scientists or archaeologists and any discoveries salvaged. In instances of such delays, the Contractor may apply for an extension of contract time pursuant to the agreement between Owner and Contractor.

B. Disposition of any such articles found will be decided by the Owner.

1.13 MAINTAINING OWNER'S OPERATIONS:

A. This Project will be performed adjacent to an open public space and facility. The Contractor shall be responsible for taking necessary precautions to prevent disruption of the facility's services.

B. In order to maintain existing Owner operations or to maintain the construction schedule, it may be necessary to perform some Work out of sequence, on overtime or on weekends. Cost of such out-of-sequence Work shall be included in the Contractor's bid price.

C. Contractors and their employees are not permitted to use any of the Owner's facilities. Offending individuals will be removed from the job site upon notification by the CM.

D. Refer to the Site Access & Use Plan for Contractors' use of the site.

1.14 OWNER'S PROCUREMENT:

A. The Owner reserves the right to purchase and install items associated with the project.

1.15 SITE PLANS – SITE USE INFORMATION

A. All Contractors and subcontractors are responsible for following the requirements for deliveries, staging, storage trailers, office trailers, temporary utilities and parking as directed by the CM. The intent of the Site Use Information is for the CM to control the logistical operations of all contractors and their personnel in an organized manner, for the benefit of the Owner's operations, and for the efficiency of the overall project. The CM will, at various stages of the Project, modify the site use requirements to accommodate current job-site conditions

1.16 GENERAL SITE USE REQUIREMENTS:

A. Notify the Construction Manager of all material and equipment deliveries. Deliveries must be coordinated around the Owner's schedule.

B. All Construction deliveries must be scheduled and coordinated with the CM.

C. Contractors must not block receiving areas, bus lanes, fire lanes, parking lot entrances, roadways, etc.

D. All construction traffic, personnel, material staging, etc., shall be contained within the Contract Limit Lines, as shown on the drawings, unless the CM provides written authorization.

1.17 SCHEDULES AND MILESTONES

A. The schedule information contained herein is for informational purposes only, and provides contractors with a duration to perform and complete their contract. Each prime contractor shall provide detailed schedule information to the Construction to coordinate overall construction activities. Reference 011000 Exhibit A for Milestone Construction Schedule.

B. Contract-Specific Date Information:

1. No work will be allowed on:
   a. Memorial Day weekends (Saturday thru Monday)
   b. July 2 thru July 4, 2022
   c. Labor Day Weekend (Saturday thru Monday)
   d. Work shall cease at 2:00pm on ten (10) work days to accommodate owner operations for concerts (dates TBD).

C. Time Is Of The Essence

1. Time is of the essence in the performance of these Contracts. Time is also of the essence in the performance of every scheduled date referenced in these Contract Documents.

D. Maintaining Owner And Tenant Operations.

1. It is the intent of the Owner to maintain operations in areas adjacent to the work areas throughout the Project. All Contractors are advised to keep noise, dust, fumes, and other disruptive construction operations to a minimum, and to allow access for Owner and tenant operations at all times.

E. Preliminary Scheduling:

1. The Owner's Representative has prepared a Preliminary Construction Schedule, which is included herein. Contractors shall use this to prepare bids as required for the sequence, timing and duration of their Work. Contractors shall include all costs associated with maintaining this schedule. All dates listed in the Preliminary Construction Schedule are considered Milestone Dates and as such, the maintenance of these Milestone Dates shall be condition precedent to the processing and payment of the contractor's monthly requisition. Any contractor who fails to maintain the indicated milestone dates shall be subject to liquidated damages.

2. Project Specific Liquidated Damages (Refer to Owner Contractor Agreement Article 3): $2,500.00 per day

1.18 SUBMISSIONS:

A. Within seven (7) days of the Notice to Proceed, The Contractor shall submit a detailed schedule showing times for submittals, fabrication, delivery and field installation of all aspects of the Work required to achieve the Milestone Dates and Preliminary Construction Schedule provided herein. No requisition will be processed until the above detailed information has been submitted and approved.

B. From time to time during the project, the CM shall require the Contractor to provide focus schedules, which shall focus on specific regions of scheduling concern or on specific times of scheduling concern. The Contractor shall provide all information, and cooperate fully with the CM in the preparation of these focus schedules.

1.19 COMPLETION OF THE WORK:

A. All contractors shall provide written certification (on a form to be provided by the CM) that their work has been completed according to the project design, upon completion of each phase, prior to Owner occupancy of that particular phase. Other test data required by Drawings and Specifications shall also be provided to the CM.

1.20 SCOPE OF WORK

A. All Contractors shall provide labor, material, plant, tools, equipment, and supervision related to or necessarily involved with the performance of the Work, as described in the following Specification Sections, as detailed more specifically in this section and as indicated on any drawing in the Drawing Index.

1.21 ADDITIONAL WORK OF THIS CONTRACT

A. This Contractor shall obtain any and all permits, licenses and inspections required to perform the work of this contract, and shall pay all fees, charges, and service charges. This Contractor shall provide certificates of approval from governing agencies prior to request for final payment.

B. The only exceptions to this are permits (if any) specifically noted in the contract documents that are to be provided by the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 000105

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Multiple Work Packages.
4. Work under Owner's separate contracts.
5. Future work not part of this Project.
6. Owner-furnished/Contractor-installed (OFCI) products.
7. Owner-furnished/Owner-installed (OFOI) products.
8. Contractor's use of site and premises.
9. Work restrictions.
10. Specification and Drawing conventions.

B. Related Requirements:

1. Volume 2 Section 013529 “Health and Safety” for information pertaining to air quality when moving contaminated soils.

2. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

3. Volume 2 Section 017419 “Excavated Soil and Construction Waste Management and Disposal” for restrictions for handling contaminated soils.

1.2 PROJECT INFORMATION

A. Project Identification: **Buffalo Outer Harbor Access and Activation Civic Project – Phase 1: Terminal B Redevelopment**.

1. Project Location: 901 Fuhrmann Boulevard, Buffalo, NY 14203.

B. Owner: Erie Canal Harbor Development Corporation (ECHDC).

1. Owner's Representative:
Kristine Kemmis, AIA, LEED AP
Senior Director of Facilities
95 Perry St., Suite 500
Buffalo, NY 14203
(716) 846-8241
Kristine.kemmis@esd.ny.gov

Mark Wendel, AIA, LEED AP
Senior Director of Design
95 Perry St., Suite 500
Buffalo, NY 14203
(716) 846-8220
mark.wendel@esd.ny.gov

C. Architect: Bergmann Associates, Architects, Engineers, Landscape Architects & Surveyors, D.P.C.

1. Architect's Representative:
Steven Kushner, AIA, LEED AP
Senior Project Manager
280 East Broad St., Suite 200
Rochester, NY 14604
(585) 498-7884
skushner@bergmannpc.com.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Civil Engineering: Bergmann.

a. Representative:
Stephen Harrison, PE
2 Winners Circle, Suite 102
Albany, NY 12205
(518) 556-3625
sharrison@bergmannpc.com.

2. Landscape Architecture: Trowbridge Wolf Michaels Landscape Architects LLP.

a. Representative:
Margot Chiuten, RLA, ASLA
1001 West Seneca St., Suite 201
Ithaca, NY 14850
(607) 210-8361
mdc@twm.la.

3. Structural Engineering: Bergmann.

a. Representative:
Michael Tracey, PE
280 East Broad St., Suite 200
Rochester, NY 14604
(585) 498-7910
mtracey@bergmannpc.com.

4. Environmental Design: Bergmann.

   a. Representative:
      Ariadna Cheremeteff
      280 East Broad St., Suite 200
      Rochester, NY 14604
      (585) 498-7952
      acheremeteff@bergmannpc.com.

5. Mechanical, Electrical, Plumbing, and Fire Protection Engineering: Watts Architecture and Engineering, P.C.

   a. Representative:
      Rick Pettis, PE
      95 Perry St., Suite 300
      Buffalo, NY 14203
      (716) 416-5163
      rpettis@watts-ae.com.

6. Signage Consultant: RSM Design.

   a. Representative:
      Christy Montgomery
      160 Avenida Cabrillo
      San Clemente, CA 92672
      (949) 492-9479 x106
      christy@rsmdesign.com.

E. Construction Manager: Turner Construction Company.

1. Construction Manager Representative:
   Tim Magee
   50 Lakefront Blvd., Suite 200
   Buffalo, NY 14202
   (716) 853-1900
   tmagee@tcco.com.
2. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

F. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Modification of an existing 95,500 square foot cold storage warehouse along the lake edge into an outdoor pavilion and event venue, including removal of existing wall and roof assemblies, retainage of the slab and structure, creation of a new stage and canopy, and associated utilities extensions and site development for outdoor amphitheater and passive recreation, and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under coordinated, concurrent multiple contracts. See Section 011200 "Multiple Contract Summary" for a list of multiple contracts, a description of work included under each of the multiple contracts, and the responsibilities of Project coordinator.

1.4 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Site Work

2. General Construction

3. Mechanical Trades

4. Electrical

C. Future Work Not Part of this Contract: The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project.

1.5 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.

a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.

4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. As per the Drawings.

1.6 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products:

1. As per the Drawings.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits on Use of Site: Adjacent area known as the “Great Lawn” and areas of the Outer Harbor trails system are to remain open and operational during Construction. Access through the Construction area must be maintained during the summer months.
2. Driveways, Walkways, and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Construction Manager and Owner not less than three days in advance of proposed utility interruptions.
2. Obtain Construction Manager's and Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Construction Manager and Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Construction Manager's and Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.

3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 011100
SPECIAL PROVISIONS - ALL CONTRACTS

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b. Exhibit B – Site Logistics Plans (SL-1)
c. Exhibit C – Specification Matrix

1.0 DEFINITIONS

A.) The terms "Prime Contractor", "Contractor" or "Subcontractor" shall mean the entity, which has contracted to perform a portion of the work; the successful bidder to whom the contract has been awarded from the Owner.

B.) The term "Sub-Subcontractor" or "Sub-Tiers" shall mean anyone hired by a subcontractor to perform a portion(s) of their contracted work. Sub-subcontractors do not hold direct contracts with the Owner.

C.) "CM" – Construction Manager

D.) "Furnish" – Purchase and deliver to the project site complete with every necessary accessory and support, as well as any surcharges as may be required to assure that purchased items are free of all liens, claims or encumbrances.

E.) "Install" – Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the work.

F.) "Provide" – Furnish and install.

G.) "Contract Documents" – executed contractual agreement with the Owner and the referenced drawings, specifications and clarification information as issued by La Bella Associates. Additionally, released and approved change orders shall become part of the Contract Documents.

H.) Reference "Definitions and Abbreviations" in Section 014200 for further information

2.0 GENERAL PROJECT DESCRIPTION & NARRATIVE

2.1 Project Description and Narrative

The project site is located in the City of Buffalo, NY respectively. The project consists of major renovations and infrastructure improvements:

The Project Organization is as follows:

OWNER:

Erie Canal Harbor Development
95 Perry Street
Buffalo, NY 14203

ARCHITECT:

Bergmann Associates
40 La Riviere Dr.
Buffalo, NY 14202

Trowbridge Wolf Michaels Landscape Architects
1001 W Seneca St.
Ithaca, NY 14850

CONSTRUCTION MANAGER:

Turner Construction Company
50 Lakefront Blvd., Suite 200
Buffalo, NY 14202

2.2 Construction / Change Documents

A) The successful Contractor will receive one account to access electronic versions of the Contract Drawings and Specifications related to this work at the start of their contract. Any revised documents during the performance of this contract that may affect the scope of original contract work will also be issued electronically to the Prime Contractors. Contractor will be required to sign electronic file transfer agreement from project Architects to obtain digital copy of documents. The Contractor shall be responsible for reproducing prints and specifications for their own use, including any subcontractors and vendors used for the purpose of executing their contract work.

B) The Architect will periodically issue Bulletins, Field Reports, and Request for Information responses, etc.; each Contractor will be responsible to ensure that their personnel are working from the most current release of documents.

C) The Construction Manager will share a full set of posted documents (Drawings, Spec's, Logistics Plans, RFI's, Bulletins, Submittals, etc.) along with other relevant project related information on the shared electronic site. The shared documents can be accessed via Smart Phone/iPhone, Tablets/iPad, (see section 6.4 for phone/iPad requirements) or PC. These shared documents do not alleviate the Contractors responsibility to work from the most current sent of documents nor do they constitute replacement for submission of "as-built" drawings contractually owed to the Owner. If any discrepancies are found, the Contractor is to notify the Construction Manager immediately.

3.0 INFO REQUIRED BEFORE STARTING WORK/GENERAL REQUIREMENTS

3.1 Detailed Work Plan

Within (10) working days after Notice to Proceed, each successful Prime Contractor shall submit a detailed work plan outlining all phases of their work to Construction Manager. At a minimum, this written plan must include:

A.) A Logistics Plan that describes, in detail, the methods that will be used to perform your scope of work. The plan must identify major equipment that will be used, any temporary utilities that will be required to perform your work, and how materials will be brought on-site and/or how debris will be removed from the building and from the site.

B.) A Project Schedule outlining all phases of the work that clearly identifies sequence of work, manpower requirements, duration to complete each major work area, critical starting and ending dates, long lead item approval/release, delivery dates and expected shift work. This shall coincide with the milestone schedule "Exhibit A". As work progresses, updated 2-week look-ahead schedules must be submitted to Construction Manager 36 hours prior to the scheduled project progress meeting dates.

C.) Provide a Submittal Schedule within ten (10) working days of the Notice to Proceed showing a complete listing of all items required by the specifications including, but not limited to shop-drawings and/or catalog cuts, product data certifications, samples, etc. This schedule must specify the estimated dates of submission, fabrication times, ROJ (Required on Job) dates and the delivery dates required to maintain the Project Schedule.

D.) A project specific Staffing Plan that identifies who will manage the overall scope of your work for this project. This plan must identify (by name) the individual staff members you will use on the site. Additionally, the work experience resumes of the listed individuals must be submitted. The Contractor shall provide supervisory personnel consistent with the size and complexity of the project, who shall be fully capable of controlling their workers, coordinating work through The Construction Manager, performing in harmony with other trades, and completing work in accordance with the schedule.

E.) Each Contractor shall furnish a List of Sub-contractors, Sub-subcontractors, Suppliers, and Vendors, which they propose to use on the Project and shall notify the Construction Manager and the Owner of any changes.

F.) The work shall include the obligation of any Contractor, subcontractors and sub-subcontractors, who bids to perform any portion of the work to visit the site of the proposed work, fully acquaint and familiarize itself with the conditions as they exist and the character of the operations to be carried on under the proposed contract, and make such investigation as it may see fit so that it shall fully understand the facilities, physical conditions and restrictions attending the work under the Contract. Each such Contractor shall also thoroughly examine and become familiar with the Drawings, Specifications and ALL associated Bid Documents.

3.2 Safety Procedures Manual

Prior to beginning any work on site, each Contractor shall submit an OSHA compliant **site specific Safety Procedures Manual that incorporates the requirements identified**

in the Site safety plan in section 8.0. This manual will include the **Safety Data Sheets** (SDS) for all potentially hazardous substances that will be used in performing the scope of your work. In addition, a **site specific Hazardous Substance Survey Form** that outlines all of the SDS sheets applicable to this project must be submitted.

3.3 Schedule of Values

No more than (15) working days after Notice to Proceed, the Contractor will submit to Construction Manager a schedule of values for review and approval. This schedule must be submitted on the appropriate AIA Form G-732/CMa and G-703. No payment will be issued until the Schedule of Values is approved. To speed-up the invoicing process, the schedule of values must be broken down by SED number, and building name, with each line item to be broken into labor and material. The Contract total must be broken into a level of detail that may be easily reviewed each month (i.e. by floor, by work category, by area, by materials, etc.). The schedule of values shall include General Condition's line items which will be billed by a % each month based on current project completion. The following values shall be incorporated for each line item:

1. Hold 5% Retainage
2. Hold 0.5% of the Contract value for Submittals (but no less than $1,500)
3. Hold 0.5% of the Contract value for Safety/DCR (but no less than $1,500)
4. Hold 0.5% of the Contract value for Daily Cleanup (but no less than $1,500)
5. Hold 0.5% of the Contract value for Job Meeting Attendance (but no less than $1,500)
6. Hold 0.5% of the Contract value for O&M Manuals (but no less than $1,500)
7. Hold 0.5% of the Contract value for As-Built Documents (but no less than $1,500)
8. *Bonds and Insurance(s)
9. Mobilization and Demobilization
10. Temporary Facilities
11. Field Supervision
12. Final Cleaning
13. Breakout each Contract Allowance(s) listed separately

*The Owner will require supporting documentation for proof of Bonds and Insurance costs. Bonds and Insurance(s) line item will not be approved until all backup and/or invoices from the Contractors insurance company substantiating the value of the payment application line item has been confirmed. A percentage billing with no certified backup is not acceptable.

The owner will hold 2X the value of incomplete work for all open work to complete and punchlist items.

NOTE: Compensation for compliance with the Project safety and cleanup rules and jobsite meeting attendance shall be billed in equal monthly payments. Failure to comply and meet the Contract requirements, will result in the loss of that month's payment via a deduct change order.

3.4 Crane Inspection Report

All Contractors whose work includes the use of material or personnel lifting devices must submit a copy of the **Annual Crane Inspection Report** prior to starting work. The report must conform to either OSHA section 1910.180 or section 1926.550. Note that this is not referring to a Crane Safety Checklist but rather the Annual Crane Inspection Report. If a crane is brought on site without proper documentation or inspection, said crane will be removed at once from the site, with any associated charges borne by the responsible Contractor.

3.5 Insurance Documents

The Contractor and any Subcontractors shall not begin work on site until a signed contract and proof of insurance has been provided to The Construction Manager. With the sole exception of Worker's Compensation Insurance**, all insurances must name, Erie Canal Harbor Development, NYS Office of Parks, Recreation and Historic Preservation, Be Our Guest, Ltd, Bergmann Associates, Architects, Engineers, Landscape Architects & Surveyors, D.P.C., Trowbridge Wolf Michaels Landscape Architects LLP, and Turner Construction Company as additional insured parties**. **ECHDC shall be named as Certificate Holder.** Limits shall be in accordance with the limits as specified in AIA232, Article 11.

No work may continue and no payments to the Contractor will be made after the expiration date noted on the latest insurance certificate on file.

3.6 Pre-Installation Conference

The Contractor shall arrange for a meeting on site with the Construction Manager Project Superintendent prior to the scheduled start of their work. This meeting will discuss:

A.) Review progress of other activities and preparations for the activity under consideration, including schedules, safety, submittals, manufacturer's recommendations, weather limitations, substrate acceptability, compatibility problems, and inspection and testing requirements.

B.) Record significant discussions, agreements, and disagreements of each conference, along with the approved schedule. Distribute the meeting record to everyone concerned. The minutes will verify that the items listed above were discussed, will document the actions taken or required and by whom the action is required. The Contractors are required to review these minutes and submit any objections to The Construction Manager within (3) days. Failure to response within (3) days will constitute acceptance of minutes.

C.) A list of Contractor key personnel, with address and telephone numbers for emergency calls (both work hours and non-work hours).

D.) Contractors are expected to be experienced and familiar with the requirements and conditions imposed during the performance of similar work in this area. Some of these requirements are the performing of normal "out-of-sequence" work, and non-continuous work.

E.) The Contractor shall maintain the progress of his work, consistent with the milestone schedule prepared by The Construction Manager. Failure of the Contractor to maintain such progress shall make the Contractor liable for all costs incurred by Owner as a result of the Contractor's delays including, but not limited to claims by other Contractors and/or penalties imposed by the Owner. In addition, the Contractor is required to provide a recovery schedule within 72 hours of its failure to maintain progress.

F.) Before commencing any work, consult with The Construction Manager regarding the use of the facility, including but not limited to, roads, walks, ramps, garage, parking areas, storage areas, corridors, stairs, etc., that may be required to prosecute work.

3.7 Waiver of Liens – All Contractors, subcontractors, sub-contractors, vendors, and suppliers shall submit an AIA Partial Waiver of Liens with each and every pay application.

3.8 Communications

Any and all communication with the Architect and/or Owner shall flow through The Construction Manager no exceptions. Contractor is warned that any directives and/or authorizations to perform additional work and or changes without the consent or direction of the Construction Manager will not be accepted and will be at the Contractors own expense.

3.9 Conflicting Documents

If there be any conflicting variance between the Drawings and Specifications (including reference standards) the more stringent shall control. Likewise, in the case of conflict between the General Conditions of the Contract or any modifications thereof and the detailed specification requirements (including reference standards) the more stringent shall control. These Special Provisions and Summary of Work (or "Scope of Work") are in addition to the plans and specifications and other contract documents prepared by Bergmann Associates.

Drawings and Specifications are cooperative and supplementary. Portions of the Work, which can best be illustrated by the Drawings, are not included in the Specifications and portions best described by Specifications are not depicted on Drawings. In the event of a direct conflict the specification shall override the drawings All items necessary to complete the Work shall be furnished whether written or illustrated.

3.10 Escalation

The Lump Sum price shall be firm for the life of the project and must include any and all escalating expenses or costs. **The Unit Prices submitted with the Bid are firm for the life of the project and must include any and all escalating expenses or costs.**

3.11 Wage Rates

Within ten (10) working days of the Notice to Proceed, each Contractor shall submit and have approved by The Construction Manager, a complete list of Foremen, Journeymen and Apprentice wage rates for straight and overtime work for each trade corresponding to all subcontractor and sub tier labor to be utilized on the project (see **Exhibit E – Labor Rate Worksheet**). All labor rate work sheets are to be certified as actual cost and submitted to the Construction Manager for review and approval. Rates shall include actual cost and additional markup for recovery. All insurance rates must include a notarized certification from the insurance company. Once approved, these rates will be the basis for Schedule of Value line items and pricing the labor cost of any and all allowances and changes, including time and material changes. Payment for additional work beyond scope of the contract will not be made if the subcontractor has not provided approved certified rates. Any travel expenses, travel time, etc. not identified in the published rates will not be reimbursed to the Contractor or their tiers in any way by either The Construction Manager or the Owner. Such costs are considered as being included in the Contractor's percentage for overhead and profit. For the purposes of changes ONLY, the certified labor rate sheets for each firm will be adjusted in accordance with the annual union scale wage rate increases or adjustments. **NOTE: OH&P is not be included in the certified labor rates.**

3.12 MWBE/EEO

All Contractors, Subcontractors and Sub-subcontractors shall comply with all federal, state and local laws and regulations regarding equal employment opportunity. Reference the ECHDC Procurement forms and project specific requirements for MWBE participation. The Owner stresses that it supports the use of minority/women owned businesses and encourages the participation of these businesses on this project.

3.13 Taxes

New York State Tax is not applicable. Taxes are not to be included on part of the project that becomes a permanent part of the facility. The Contractor does, however have to pay taxes on tools, machinery, equipment or other property leased by the Contractor for use in construction of the new facility. A New York State tax exempt letter will be provided by the Owner upon request.

3.14 Preconstruction Photos and Preconstruction Video

Within (15) working days prior to the commencement of work, all Prime Contractors shall provide (2) copies of dated preconstruction photographs from a digital camera to the Construction Manager on USB Jump Drive prior to mobilizing or starting any work. Document all existing conditions. The Contractor shall take photos of all existing structures (i.e. walls, roofs, windows, sidewalks, pavements, misc. structures, private property dwellings, streets, parking areas, etc…) and any other items necessary to accurately depict existing conditions at each new addition/renovation areas.

4.0 SITE LOGISTICS

4.1 Site Access

Daily sweeping/cleaning by the Sitework Contractor of all adjacent roads/parking lots shall be performed to collect any loose debris (stone, dirt, mud, packaging, etc.) that has been tracked or blown outside of the construction staging area.

Only the Construction Manager has the authority to alter the site logistics for the overall benefit of the project. All Contractors are to be aware of on-going activities surrounding the construction zone and, in some cases, within the construction zone. Access roads, exits and means of egress in general must be kept open and free from materials, equipment, vehicles and debris always.

4.2 Parking

Contractor Parking is permitted in locations as indicated on the site logistics plans.

The Construction Manager Project Superintendent will be solely responsible for making any modifications to the above requirements.

4.3 Truck Routes – (See **Exhibit B**, Site Logistics Plan SL-1)

All construction truck traffic must adhere to the City of Buffalo existing truck regulations. Provide adequate protection for curbs, gutters, and sidewalks over which trucks and equipment pass to reach the job site. Vehicles belonging to a Contractor, its employees, and other construction related vehicles entering the site must use the access route stipulated. Truck traffic shall use major routes Contractor is responsible to clean all access routes (i.e.: mud, dirt and gravel spills, construction debris, etc.) as a result of truck traffic entering and leaving the site.

4.4 Deliveries

All Deliveries must be scheduled and coordinated with The Construction Manager's Superintendent AT LEAST 48-HOURS IN ADVANCE. Contractors must have one or more employees present (and any necessary equipment) **at the time of delivery arrival**, to receive, unload and distribute all deliveries. Unscheduled or out-of-sequence deliveries may be turned away by Construction Manager's Superintendent. No deliveries should be attempted in any area restricted by the Site Logistics Plan without prior review by the Construction Manager and approval by ECHDC.

4.5 Material and Equipment Storage/Staging – (See **Exhibit B**, Site Logistics SL-1)
Construction materials and equipment deliveries must be scheduled with The Construction Manager and are subject to coordination with the Owner and other trades. Contractors are to bring only that material which will be used in a reasonable time frame (or just in time deliveries) as determined by The Construction Manager. Storage/Staging of materials and equipment on site shall be permitted only within designated areas as shown on the Site Logistics plan SL-1 and approved in advance by The Construction Manager and final approved by the Owner.

All other areas of the site outside of the work area are off limits and will not be permitted. If in special circumstances, staging/storing is necessary within these dates then it will have to be coordinated with the Construction Manager and approved by the Owner. If stored material or equipment obstructs the progress of any portion of the work or interferes with the operations of the Construction Manager's Superintendent, they shall be removed or relocated by the Contractor as directed by The Construction Manager without reimbursement of costs. All materials shall be stored in an orderly manner and as specified.

All equipment must be in compliance with all local, state, and federal regulations relating to its safety.

If in the opinion of The Construction Manager, the jobsite cannot accommodate either early or bulk delivery of materials or equipment, the Contractor will make off-site arrangements for safe storage at no additional cost. All required insurance for the offsite storage locations must be obtained by the Contractor. Any payment for stored materials must be in compliance with the requirements of these Special Provisions.

4.6 Equipment Locations
The locations of cranes, mixers, boom trucks, heavy equipment (i.e. bulldozers, excavators, etc.) forklifts, welding machines, generators, field offices, workbenches, cutters, hose lines, etc., must be approved by The Construction Manager prior to utilization on this project. Contractor is responsible to restore any damages to the site and finished landscaping where affected by the equipment listed above. In addition, any Contractor wishing to place a crane upon this project for the purpose of lifting materials or equipment must submit a lifting procedure safety plan and a current monthly and annual inspection certificate along with a copy of the crane operator license. This Contractor will be responsible to erect, remove, maintain and replace any required and safety barriers and temporary protection (such as plywood, steel plates, pads, etc… to protect grass and concrete finish areas). Contractor is responsible to restore any damages to the site and finished landscaping where affected by the crane and/or heavy equipment operations.

4.7 Security
A security watch man service will NOT be provided. Contractors shall remain solely responsible for any loss or damage to their property or operations or employee's property.

During all hours, the Contractor shall safeguard materials and equipment in storage on the project site, including work in place or in process of fabrication against theft, acts of malicious mischief, vandalism, and other losses or damages. The Owner or the Construction Manager will not be liable for any loss or damage.

4.8 Site Fence

For protection of the public, all site fencing installation must be 100% complete prior to any equipment or material mobilization and commencement of any work. **The Site Contractor (BP-1)** shall provide, MAINTAIN, and ultimately remove the following temporary site fencing as indicated on the Site Logistics Plan SL-1. All site fencing is to be provided for the duration of the project per the milestone schedule:

Temporary Portable Chain Link Fencing: All portable fencing shall be 6'-0" high chain link panels with base stands, sand bags and clamps. Fencing shall be erected with a minimum of (2) 30lb each "S Type Bigfoot Ballast weights per base stand for stability and each panel section shall be secured with fence clamps to the next to prevent unauthorized movement/removal of fence panels. Visit (www.oxfordplasticsusa.com) or call 1-800-567-9182. Contractor shall designate specific sections of the fence panels as the "Gate entry access" as depicted on the site logistics plan and shall provide chains and padlocks to secure access. All locks shall be keyed alike and welded to chains to prevent loss. Contractor shall maintain and lubricate locks monthly to ensure proper operation. (6) Gate keys for each lock should be provided and turned over to the Construction Manager.

Temporary Driven Post Chain Link Fencing: All temporary post driven fencing shall be 6'-0" high chain link fabric with 1 5/8" diameter (min.) fence posts driven into place. Fence posts shall be erected at 10'-0" O.C. (max.) with the chain link fencing fabric secured with heavy gauge fence wiring (no zip ties will be allowed) to prevent unauthorized movement/removal of fence. Contractor shall designate specific sections of the fencing as "gate entry access" as depicted on the site logistics plan and shall provide additional posts, brackets and hinges, etc. for fully functional gate. All gate posts are to be installed in concrete 24" Diameter by 4' deep footers to maintain gate integrity and shall remain plumb at all times. Provide chains and padlocks to secure access. All locks shall be keyed alike and welded to chains to prevent loss. Contractor shall maintain and lubricate locks monthly to ensure proper operation. (6) Gate keys for each lock should be provided and turned over to the Construction Manager.

Water's Edge Debris Fence: Debris Fence shall be 6' high fastened to the top of a concrete jersey barrier. Reference the site logistics plan SL-1 for the extent of this fence location.

The **Site Contractor** shall provide continuous maintenance of fencing (i.e.: cleanup and replacement of broken fence panels, base stands, weights, orange fencing, fence posts, clamps, fasteners, tighten and/or replacement of tie wires, barrels etc.) and immediate repair of fencing if the site's integrity or security is compromised. This includes fencing repairs due to negligent damage by unidentified persons. Any missing or damaged components at the end of the project will be the responsibility of the Site Contractor. The site fencing quantity is limited to the extent shown and noted on the Site Logistics Plans and is to be included in the base bid. The drawings are diagrammatic therefore, it is the Site Contractor responsibility to visit the site to verify the locations and determine final quantity prior to ordering to ensure the proper amount of fencing is being provided to satisfy the extent shown on the Site Logistics Plan SL-1. The Site Contractor shall also provide the necessary labor to relocate the fencing as required to maintain protection of

the public and to follow flow work. The fence shall remain on site until such time the final cleaning and/or final landscaping/seeding, restoration work will be done or as directed by CM.

A) Repairs to the project site fence due to damage by other Prime Contractors (or their subcontractors/suppliers/vendors) shall be back-charged to the responsible party. NO MODIFICATIONS TO THE SITE FENCE SHALL BE PERMITTED WITHOUT AUTHORIZATION OF THE CONSTRUCTION MANAGER'S PROJECT SUPERINTENDENT IN WRITING.

B) The debris fence installation along the waters edge will be removed when work is shut down for the winter from December 2021 through March 2022. The debris fence will be reinstalled in March of 2022 and removed as per the construction schedule.

4.9 Work Outside of Site Fence

Any contract work that must be performed outside the limits of the site project fence must be carefully coordinated ahead of time with The Construction Manager and ECHDC. If work includes any further obstruction of traffic or pedestrians, work must be performed as directed and reviewed by ECHDC and/or The Construction Manager. If the work requires off-hours or overtime accommodating ECHDC constraints, premium time costs will be reimbursed. The Contractor shall provide all flag men and barricades necessary for the safe access and egress around the site relating to their work. Any street closure or traffic permits required for the performance of work outside the limits of the site fence will be the responsibility of the Contractor.

4.10 Site Spoils and Debris

All demolished materials (i.e. concrete, UG piping, storm/sanitary structures, foundations, asphalt paving, rock, debris, demo material, equipment, etc.) shall be immediately trucked off site and legally disposed of. No stock piling of materials will be allowed on site. Unless otherwise noted on the contract documents, all existing excess topsoil and subgrade removed during excavation(s) activity is to be removed off site. If the specifications require the reuse of existing excavated soils/subgrades, the storage of unused soils shall be coordinated with the Owner prior to the Contractor stockpiling the materials.

5.0 CONSTRUCTION SCHEDULE/PHASING (See Special Provisions **Exhibit A**)

5.1 Schedule Responsibilities (see also 3.1B)

Overall milestone construction and phasing schedule(s) have been provided by The Construction Manager to indicate general activity duration and sequence of work. Prior to award of contract, it is imperative that each Prime Contractor reviews these schedule(s) and provide feedback with regard to activity duration and sequence of work within ten (10) working days of the Notice to Proceed. Each Prime Contractor is to provide a detailed project schedule outlining all phases of the work that clearly identifies sequence of work, duration to complete each major work area, critical starting and ending dates. It is the responsibility of the Prime Contractor to indicate any scheduling problems before contract award. There will be no extensions of time to this schedule. **PLEASE NOTE: THE END DATES FOR EACH PHASE ARE DEFINED FOR OWNER OCCUPANCY. EACH CONTRACTOR IS RESPONSIBLE TO HAVE ALL WORK COMPLETE AND 100% CODE COMPLIANT FOR OCCUPANCY BY THESE DATES. THERE WILL BE NO EXCEPTIONS.**

Due to the extreme weather and location of the project site, the work for the Outer Harbor project is scheduled with a planned shutdown for onsite construction

activities from December through March. Work is planned to be substantially complete with the exception of final spring plantings and punchlist by December 2022.

ALL Prime Contractors and their Subcontractors shall provide within their base bid the cost to facilitate proper winter weather protection and foul weather protection (i.e.: temporary enclosures with plastic over scaffolding for work during rainy days, etc.) required to meet the completion dates defined in the project milestone schedule. Each Prime Contractor is responsible for its own winter and foul weather protection needs. In the event that work is cancelled due to weather conditions, to maintain project schedule it is required that contractors work Saturday as a makeup day to maintain project schedule.

If it becomes apparent that any single activity completion date may not be met, the responsible Contractors shall take some or all of the following actions at no cost to the Owner:

A) Increase construction manpower in such quantities as will eliminate the backlog of work and put the Project back on schedule.

B) Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing as will substantially eliminate the backlog of work and put the Project back on schedule. Additional costs for supervision by the Construction Manager, Architect or Owner for overtime or shiftwork is the Contractor's responsibility.

C) Reschedule activities to put the Project back on schedule. If a Contractor fails to take any of the above actions within twenty-four (24) hours after receiving written notice, the Construction Manager will take appropriate action involving contractual commitments and performance bonds. Owner retains the right to back charge any Contractor (as determined by the Architect/Engineer and Construction Manager) for any and all costs resulting from scheduling delays. This includes delays to the start or finish dates of other Contractors.

5.2 Expediting

Each Contractor shall be responsible for the cost of expediting all fabrication and delivery of its materials. Should, in the opinion of The Construction Manager, it become necessary in order to maintain job progress for The Construction Manager to supplement the Contractor's expediting efforts, then all cost incurred by the Construction Manager, Owner and/or Architect/Engineer shall be back charged to the Contractor as The Construction Manager may elect. If necessary, the Contractor is required to pay fees associated with site visits by the Construction Manager or the Architect/Engineer to manufacturing facilities producing materials for the project.

5.3 Continuous Operations / Out of Sequence Work

Work will be coordinated in an attempt to allow continuous installation by Contractors. This will not always be possible and some comeback and/or out of sequence work will be necessary to complete the construction on the part of the Contractors. Out of sequence work (including re-mobilizations), ordered by The Construction Manager or the Owner, which may be required to meet the job schedule or occupancy requirements or allow the Owner to use the facilities, shall be included in the base bid prices.

Any Prime Contractor who installs work out of sequence shall protect their work from the activities of other Contractors.

5.4 Project Coordination

Coordinate construction activities included under various Sections of the Specifications to assure efficient and orderly installation of each part of the Work.

Coordinate construction operations included under different Sections of the specifications that are dependent upon each other for proper installation, connection, and operation. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results. Where availability of space is limited, coordinate the installation of different components to assure maximum accessibility for required maintenance, service and repair. Make adequate provisions to accommodate items scheduled for later installation. Verify that anchorage, blocking, joining and other detailing are provided as required. Do not obstruct spaces required by Code in front of construction, access doors, or equipment. Coordinate all related questions regarding this issue through the Construction Manager

Existing facilities inside/outside Project Area will continue to be in operation during the construction period. The Contractor shall schedule and arrange the Work to provide minimum inconvenience the public and NYS Parks personnel. Keep all areas adjacent to and leading from the work areas clean and free of debris at all times. Where necessary, prepare memoranda for distribution to the CM outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings. Prepare similar memoranda for the separate Contractors where coordination of their work is required.

Administrative procedures:

Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to the following:

a. Preparation of schedules;
b. Installation and removal of temporary facilities;
c. Delivery and processing of submittals;
d. Installation and removal of mock-ups;
e. Pre-installation conferences;
e. Progress meetings;
f. Preparation and delivery of progress payments
g. Project Closeout activities;
g. Start up and adjustments of systems
h. Etc.

6.0 JOBSITE RULES

6.1 Work Hours

A. Restorations and New Construction:

In general the project will be open from 7:00 am to 5:00 pm for New Construction. **However, any work that will directly affect or provide disruption to Owner's Activities will be need to be coordinated with the Owner. Coordinate all aspects of this type of work with the Construction Manager as required.**

All trades will maintain the same work hours unless authorized by Turner Construction Company. If a Contractor or the Construction Manager feels overtime

hours are necessary to meet the contractual schedule commitment of the Contractor, the Contractor shall work such overtime hours, additional shifts, weekends and/or Holidays. The Contractor must notify the Turner Superintendent a minimum of seventy two (72) hours prior to normal quitting time so that arrangements can be made to supply supplemental supervision personnel. The Contractor requiring same shall cover the cost of the above.

B. NOTE: Prior to commencing work, ALL Contractors are to be in NYDOL Prevailing Wage compliance for both overtime work and/or working 10 Hour days. Refer to **Exhibit H and Exhibit I** for "Form 1655 Dispensation Hours (OT) Application" and "Form 1654 Registration for (4) 10 Hour Day Shifts".

6.2 Project Staff

All Contractors shall provide qualified and experienced Project staff including Project Manager, Coordinator/Project Engineer, Quality Assurance/Quality Control Coordinator, Environmental Health and Safety Officer, and Superintendents. Failure to maintain a superintendent on the Project site at all times work is in progress shall be considered a material breach of the Contract, entitling the Owner to seek equitable reimbursement by the Contractor, for durations until the Superintendent is on the Project site full time.

The onsite supervision must have the authority to take immediate corrective measures. All communication given to or produced by the Project staff shall be binding as if given to or produced by the Contractor. The Project staff shall be in attendance at the Project site not less than eight hours per day, five days per week, or anytime contract work is underway the Contractor or any other entity shall not employ members of the Project staff on any other project during their specified term at the Project site.

The Prime Contractors' proposed Project Manager and Field Superintendent for the project are to be **non-manual working** and to have five years' experience in the proposed position. Each successful bidder shall submit resumes to the Construction Manager for the proposed project manager and field superintendent for the project. This information will be reviewed with the Owner, Architect and Construction Manager for approval. Should the Project Managers and/or Superintendents prove unqualified for the position at any point in the project, the Construction Manager shall issue a letter stating that the person is to be removed from involvement in the project. Action must be made within seven working days of receipt of such letter. Each Prime Contractor is to maintain a competent person on site at all times when work is being performed. That person is to be responsible for the Contractor's operations. The name of this person must be provided to the CM.

Each Prime Contractor shall furnish employees and all subcontractors' employees with photo identification badges (2.125"w x 3.35"h). Provide clear PVC holders with clips or lanyards. Employees shall be required to wear badges at all times while on site.

Each Foreman should keep a supply of generic "visitor" badges for new or temporary employees until permanent badges can be printed/distributed. At a minimum, badges shall contain current photo, full employee name and company name. **See Exhibit D** for the mandatory format and colors for badges.

6.3 Jobsite Meetings

Bi-Weekly Job Progress Meetings: Meetings will be held at a predetermined day and time bi-weekly at the jobsite. Any and all coordination such as schedule related issues, submittals, material/equipment delivery dates, pricing and any open issues will be

discussed at these meetings. The Project Manager of each Contractor must attend these meetings and have the authority to make financial, schedule, manpower, or other job related decisions during these meetings. Supplementing the Project Manager duties with either the Superintendent and/or Foreman is unacceptable. Failure to assign and maintain a Project Manager on the Project shall be considered a material breach of the Contract, entitling the Owner to seek equitable reimbursement by the Contractor.

Each Project Manager will provide a written, two-week look ahead schedule for review and coordination at the meeting. The schedule will show all activities individually, with start/end dates, show which activities critical path based on the overall schedule, and durations will be shown in days.

Contractors failing to attend and abide by the content of these meetings may be held responsible for any delays and/or expenses incurred due to coordination difficulties in their trades.

Daily Field Huddles: The Foreman's of each Contractor are to attend a "Daily Huddle" for all major work areas. The huddle will be held at a predetermined time and place each day at the jobsite with all Prime Contractors and subcontractors to discuss logistics, schedule and work activities in the field. The huddles are to last approximately 15 minutes each day. The foreman of each Prime Contractor and major subcontractors are required to attend these meetings regardless of the size of his crew on the project at that time and shall be empowered to make decisions on behalf of their company.

6.4 Communication

A) Mobile Phone - Each Contractor shall be available to the Owner, Architect and Construction Manager 24 hours a day/ 7 days a week via an emergency service contact if personal phone numbers and contact are not distributed. All site Superintendents, and Foremen must have a working cellular phone equipped with email, text messaging and voicemail for the duration of the project and during normal working hours to communicate with the Construction Manager. This includes Contractors that have separate crews working simultaneously at different locations. The Foreman of each these crews must also have a mobile phone as noted above. If the Contractor does not provide the job phone to its Project, Superintendent, or Job Foreman as required, the Construction Manager will furnish a phone to the Contractor's Project, Superintendent, or Job Foreman and the cost of the phone plus a fee of $1,000.00 per phone will be deducted from the Contractor's pay application. Mobile cell service/internet hook-up and usage costs are the responsibility of the Contractor.

B) Tablets/IPads- All site Superintendents and Foremen must have at a minimum a working 64GB+ Tablet or iPad equipped with working cellular data for the duration of the project to communicate with the CM and access contract documents. At a minimum, the device must have access to e-mail, Procore, Drobox, and a PDF application that can sync with the shared contract documents (applications such as PDF Expert or Bluebeam can be purchased from either Android or Apple iTunes stores). If the Contractor does not provide the device to its Project Superintendent and Job Foreman as required, the Construction Manager will furnish job iPad(s) to the Contractor's Superintendent and/or Job Foreman and the cost of the iPad and service plus a fee of $1,000.00 per device will be deducted from the Contractor's pay application. Mobile cell service/internet hook-up and usage costs are the responsibility of the Contractor.

C) Each Contractor will be responsible for their own phone, fax, and internet services at their trailer location and is responsible to provide and coordinate the temporary telephone/data service to their onsite project trailers. All hook-up and usage costs are the responsibility of the Contractor requiring the service.

A) Bulletins, RFI's, submittals etc. will be handled electronically via electronic document control system "Procore" website. Each Contractor will get an electronic mailbox on the site to post/submit information, ask RFI's etc. and to retrieve responses. The box is to be checked daily for updated information. The Construction Manager will provide one (1) hour training for use of this system if required.

6.5 Daily Construction Reports

By 9:00 AM the following day, all Contractors will submit to The Construction Manager jobsite office, daily manpower counts, a detailed description of work performed and specific locations of each work activity **on Daily Report Form**. **PLEASE NOTE: CREW LEADS MAY HAVE TO STAY PAST 3:30PM TO COMPLETE THIS PAPERWORK.** Manpower shall be broken down by job classification (foreman, journeyman or apprentice) trade, and EEO classification. In addition, the Contractor shall include on his form the above information for all of his sub-contractors. Contractors will identify which labor is associated with which sub-contractors. The report shall also note all deliveries, equipment on site, inspection results, visitors and any safety incidents that may have occurred. This document shall not be used as a method of notification for delays. Separate correspondence is required for such notifications, in accordance with the contract documents. Late submission of DCRs is cause for temporary holds on Monthly payments.

6.6 Signage

Signs, logos, etc. will be permitted on the Contractor's own equipment but not on the site fence, shanties, or buildings unless otherwise approved by the Construction Manager. Each Prime Contractor shall post required notices and construction signage information as required by all governing agencies.

6.7 Jobsite Conduct

A. The Project sites are situated on public property. Each Contractor's management should review with their employees that it is imperative that their conduct be socially acceptable at all times. Vulgar or abusive language, sexually suggestive comments or gestures are strictly prohibited and will result in removal from the jobsite and/or criminal prosecution.

B. **Smoking and Tobacco use up to and including the use of electronic cigarette devices, smokeless (vapor) cigarettes and smokeless/chewing tobacco is absolutely prohibited on all the project site property including areas within construction fencing and parking areas. Any employee in violation of this law will be given a warning. Upon second offense the employee will be removed from the site immediately.** If employees smoke on adjacent public property, it is expected that any garbage or debris will be properly disposed of.

C. Alcohol consumption is absolutely prohibited on all project property including areas within construction fencing and parking areas. Workers observed drinking alcoholic beverages on or off site, during work hours, including lunch breaks, will be permanently removed from the site.

D. Firearms are strictly prohibited. Contractors shall verify that employees and vehicles are free from any and all firearms.

E. Face coverings are required for all unvaccinated workers in accordance with NYS.

6.8 Clothing

Proper attire is required on-site. Full-length pants, shirts with sleeves and hard sole work boots are required. No shorts, tank tops or tennis/running shoes are allowed.

6.9 Lunch Areas

Contractors and workers will contain their breaks and lunch periods to the areas designated by The Construction Manager or any public eating area outside the Project Site. All Contractors must provide, maintain and empty (1) 50-gallon container (with liners) within their break/lunch area for the placement of trash. The areas used for construction lunches are to be kept clean and orderly daily by all Contractors. Once finished flooring has been installed in a particular area, no food or beverages will be permitted in that area.

6.10 Disruptive Work

Due to construction adjacent to existing recreation areas, noise and dust control is essential. All noisy or disruptive work that may affect the adjacent property and facilities must be scheduled two weeks in advance through The Construction Manager. Work that interferes with the normal operations of facilities must be performed off-hours at the Contractor's expense, or the Contractor must provide alternate means for the work to continue.

Do not leave vehicles and/or equipment idling around unit vent and/or building openings. All exhaust discharges must be routed away from existing fresh air intake louvers. All equipment that will impact these areas shall be equipped with exhaust scrubbers to limit fumes.

6.11 Shutdowns/Notices/Permits

Plan the Work to minimize shutdown time of any service. Contractors are required to give all required notices to the proper authorities related to the work in their charge. To the maximum extent practicable, shutdowns shall be scheduled for periods when least need for that utility is anticipated. Provide within the Contract Sum an amount sufficient to cover all required overtime in connection with utility shutdown.

For all shutdowns affecting any operations of the owner, a Shutdown Request Form must be completed by the Contractor and approved by The Construction Manager and the ECHDC one (1) full week prior to the desired shutdown date.

- If less notice is provided, the Owner may refuse interruption of utility service.
- Resulting delay in performance of the Work will be a responsibility of the Prime Contractor.
- Do not proceed with the interruption of utility services without the approval of the Owner.

The Contractor is responsible to do due diligence to determine what systems are affected by the shutdown and identify these systems on the request form. Failure to receive proper approval will result in denial of the shutdown request.

Contractors are required to strictly comply with all governing laws, rules, regulations, and inspection requirements, both as to labor and materials, and pay all fees in connection therewith, and shall bear all loss from neglect.

When the existing buildings are occupied and fire alarm and safety system work is in progress, the **Electrical Contractor** shall continuously maintain the existing building's fire alarm and detection system and exit and emergency lighting system or provisions must be made by the EC to provide equivalent safety. EC must immediately notify the CM of any non-operating systems. EC must notify CM 48 hours in advance prior to shut down of fire alarm, phone, clock, bell, or P.A. systems.

6.12 Construction Vehicles

All construction vehicles must be cleaned prior to leaving the site. Any Contractor failing to clean vehicles will be responsible for cleaning the street **immediately upon notification by The Construction Manager.** Dust control and mud control is the responsibility of the Contractor creating same, and they must take appropriate steps to control such per The Construction Manager or other local authorities. Wheel washing equipment will be provided by the sitework contractor per the site logistics plan.

6.13 Excavation/Earthwork

Any Contractor whose work includes excavation shall notify the Construction Manager and "Dig Safely NY" at (800) 962-7962 or "811" at least one week prior to start of work. Dust control and mud control is the responsibility of the Contractor creating same, and they must take appropriate steps to control such per The Construction Manager or other local authorities.

The Contractor is warned that there are utility, power, fiber, tele/data and cable lines, etc. located below grade. **The Sitework Contractor** will be providing a third party utility marking company to mark out and identify the underground utilities using GPR prior to excavation. **The Sitework Contractor's** third party utility marking company will produce and submit an as-built survey to the Owner and other Contractors with their findings for their use and record. Contractor is responsible to maintain line markings for the duration of their work. Contractor is also responsible to coordinate all excavations in accordance to the provided as-built drawings. Any lines that have been struck, cut or damaged due to the failure of the Contractor to mark out the lines will be the responsible of the Contractor to fix, repair and/or replace at no cost to the Owner so that the services are restored to the original operating conditions.

Provide temporary shoring and bracing as required for excavation work. All shoring and bracing shall comply with safety regulations of authorities having jurisdiction.

Include all safety fencing and barricades as required to perform excavation and earthwork activities per OSHA requirements. A traffic plate over any excavation the CM feels impedes job movement or safety is also included. Refer to site logistics plans SL-1 for additional information.

6.14 Damages

All Contractors are responsible for any damage, which may occur to the property of the owner or adjacent private or public properties which in any way results from the acts or neglect of his employees.

In Addition, repair and make good, at the expense of the Contractor, all damages thereto including damage to existing utilities and paving arising from operations under the Contract. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

6.15 Testing, Inspections and Permits

A.) The Owner shall hire a certified, independent testing agency to complete all concrete, soils and steel testing and inspection described in the Contract Documents. The Owner shall also hire a certified, independent Project Monitor for asbestos and lead abatement testing and monitoring. If such testing and inspections performed reveal failure of the subcontractor's work to comply with requirements established by their contract documents, the subcontractor shall bear all costs made necessary by such failure, including but not limited to repeat testing and compensation to other subcontractors, The Construction Manager, Owner, A/E or other expense which may result.

All sub-subcontractors requiring testing and/or inspection by the testing agency shall notify the testing agency and Contractor of such need. The sub-contractor shall notify the testing agency 24 hours in advance of such testing and inspection being required. Delays and/or losses caused by failure of the sub-contractor to properly notify the testing agency for tests and inspections shall be borne by the subcontractor. The subcontractor shall not permit Work to be covered, concealed, or put into use until such Work has been inspected and accepted.

Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

B.) The Contractor is responsible for compliance to all applicable local, state, and federal regulations regarding codes, restrictions, and requirements.

C.) Except for testing and inspections performed by a testing Engineer in the employ of the Architect and/or Owner, the subcontractor shall be responsible for the execution of all tests, testing and inspections required by the specifications and by all governmental authorities having jurisdiction, and shall pay the costs of all such tests, testing and inspection. The subcontractors shall submit certified results of the tests and inspections to The Construction Manager for the Architect's approval. The frequency of the tests shall be such as not to delay the work of following trades.

D.) Contractors will obtain and pay for all permits or inspections required for the performance of their work, which are not otherwise provided by the Owner. Originals of all permits are to be furnished to the Construction Manager prior to commencement of the Work

E.) Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered to The Construction Manager. No requisition for payment will be accepted or reviewed until all formal test results/reports are brought current.

F.) The Owner will hire an independent, 3rd party Project Monitor for asbestos and lead abatement air monitoring. Extreme caution should be taken around this agencies air sampling devices. Any failed test results resulting from samples overloaded with dust/debris will be charged to the responsible party.

G.) See also "Testing Certifications and Special Inspections sections in the Project Specifications for additional information and requirements.

6.16 Quality Control

A.) In addition to the requirements of the specifications, the following shall also apply: It is in the best interest of both The Construction Manager and the Contractor to provide top quality workmanship and materials in accordance with the contract drawings and specifications. The Contractor agrees to actively participate in The Construction Manager's / Architects Quality Control Program and to correct deficient work immediately upon its discovery at no additional cost to The Construction Manager, Architect or the Owner. The project team will be employing the use of **electronic document controls** (i.e. Procore or similar electronic program) to complete inspections and checklists, and an issues log. The issues log will end up becoming the final punch list.

B.) Each Prime Contractor shall **utilize the designated electronic software DAILY** to check for open QA/QC items and update the status. Only the Owner, Architect or CM may close out an open item. Procore or similar electronic program is a no cost software that can be accessed with computer, iPhone, iPad, Tablet or Android device. A one (1) hour training will be provided to the Contractors by the Construction Manager.

C.) The Contractors recognize that contract documents, RFIs and submittals are available electronically from the Construction Manager Procore website and should be referenced frequently for coordination purposes. Note that these documents do not supersede official correspondence transmitted to the Prime Contractor's PM.

D.) The Contractor, at the Owner's, Architect's or CM's direction, may be required to provide mockups prior to the start of any work that is essential to the external or internal appearance or function of the building. This will be provided at no additional charge whether listed in the specification or not.

E.) Protect construction for quality control service activities until accepted through the Substantial Completion process.

F.) Each Prime Contractor will review and sign-off above ceiling checklists prior to the installation of ceiling grid and/or hard ceilings or any other type of finished closures.

G.) Contractors warrant that all materials and equipment furnished under this Agreement will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Architect or The Construction Manager, Subcontractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

H.) Where material is specified to be furnished by others or furnished and delivered only, the subcontractor installing the material shall be responsible for scheduling the delivery, receiving, unloading, storing, handling, relocating, hoisting, distributing, layout out and installing. Upon receipt and acceptance by the Subcontractor installing the material, risk of loss and damages shall be borne by that subcontractor.

I.) The Contractor shall allow sufficient time to inspect and accept the work of the previous Contractor and/or subcontractor. Should any discrepancies be discovered, The Construction Manager shall be notified sufficiently in advance so that corrective

action can be taken without affecting the progress of any subcontractor. If notice is not given, it shall be assumed that Subcontractor accepts all existing work.

6.17 Manufacturer's Field Services -

A.) When directed by the Architect or the Construction Manager, require the manufacturer or supplier (regardless of their location) to have qualified personnel to provide on-site observations and recommendations at no additional cost to the Owner. Representative shall submit written report to The Construction Manager listing observations and recommendations. The Manufacturer shall validate the quality of workmanship and materials when required by manufacturer warranty. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

B.) Provide attachment and connection devices and methods necessary for securing Work as required by the manufacturer, even if they are not illustrated on the Contract Documents.

6.18 Continuing Performance

Pending final resolution of a claim, unless otherwise agreed to in writing, the Contractor shall proceed diligently with performance of the contract and payments shall continue to be made in accordance with the contract documents.

6.19 Owner Related Issues

In case of phased and/or partial occupancy, the warranty period called for by the contract documents shall not commence regardless of Owner acceptance and/or occupancy for until the Architect issues either a partial substantial completion or final substantial certificate. Any costs associated with providing extended warranties to meet this requirement shall be included in the base bid

The Owner shall, in conjunction with The Construction Manager, have the right to place and install equipment during progress of the work and the Contractor agrees that such placing and installation of equipment shall not evidence completion of the work or portions of it, nor signify the Owner's acceptance of the work or portions thereof.

Contractors are advised that the Owner may, at his discretion, employ other Contractors or employees to perform work on this project. In such an event, all trades working under this contract shall cooperate in order that the work of all parties can be completed in reasonable order.

The Owner's equipment suppliers shall be provided with reasonable use of power and light (normal working hours) necessary for the installation of their work without additional cost to the Owner or The Construction Manager.

7.0 TEMPORARY FACILITIES AND UTILITIES

7.1 Jobsite Hoisting

There will be no exterior jobsite hoists. Each contactor is responsible for your own hoisting. **Use of crane or hoisting equipment over any building or area occupied by visitors, staff, or the general public is prohibited.** Use of Owner owned equipment and elevators to transport or hoist materials are also prohibited.

7.2 Trash Removal:

The **General Contractor** shall provide and maintain all dumpster(s) for the use and the use of all Prime Contractors and subcontractors for the duration of the project. Abatement/Haz mat dumpsters will be provided separately and designated for abatement work. Sitework contractor will be responsible for the removal and disposal of all site spoils (clearing and grubbing of trees, removal of excavated spoils) and these will not be placed in dumpsters. (see Milestone schedule). All charges associated with dumpster services are included in base bid up to and including; any transportation fees, fuel charges, sitting fees, tonnage charges, and disposal fees, etc. Provide dumpsters as follows:

Dumpsters shall be removed within 4-hours of being full and will be hauled off site to a legal dumpsite. Dumpsters shall be placed per the Site Logistics Plan. For logistical purposes, the dumpsters can be relocated per the Construction Manager's direction should it be deemed necessary. Additional dumpsters may be needed as the job progresses. The General Trades Contractor shall coordinate the need with the Construction Manager. Note any overloading charges will be the responsibility of the General Trades Contractor and is included in the base bid.

The General Trades Contractor shall also provide and maintain a designated abatement dumpster and shall haul off and remove from the site all asbestos/lead containing materials, separate from the above allowances.

The General Trades Contractor shall also provide and maintain a wood dumpster ramp at each dumpster location (capable of supporting 500 lbs) to facilitate wheelbarrows and/or dumping carts into the dumpster. Provide with a slope not greater than 12:1. Both ramps shall be covered with a slip resistant material (metal lath, sanded paint, granular roofing membrane, etc…). Provide protection pads (i.e. plywood, etc) under each dumpster roll off wheels to protect existing asphalt and finished surfaces. Patching and repairing of indentations caused by the dumpster roll off wheel due to lack of protection is also included.

The Sitework shall provide and maintain field installed temporary asphalt transition ramps to allow truck and equipment traffic to drive up and over the existing curbing leading to any area around the jobsite to facilitate access to and from the construction areas as noted on Site Logistics Plan SL-1. Asphalt transition ramps shall be at a minimum 30' feet width by 3' feet deep with flared edges. Removal and restoration to existing conditions upon project completion is also included.

The General Trades Contractor shall provide and maintain 1/2 CY interior portable dumpster carts for the use of all Prime Contractors for the duration of the project. Wheels shall be in good working order, so surfaces and finishes are not damaged. The General Contractor shall maintain or replace any damaged carts for the life of the project. Provide dumpster cart quantities as follows:– four (4) dump carts

It is the responsibility of each Prime Contractor to dump and maintain the carts daily. Refer to Section 9.0 of Special Provisions for interior dump cart dumping requirements.

The General Trades Contractor shall provide temporary floor protection for the existing flooring finishes as noted on the Phasing Plan OP-1. It is the responsibility of the General Trades Contractor to maintain this protection for the duration of the project. Removal and disposal of the temporary protection upon completion of the project is also included.

7.3 Drinking Water

Drinking water and ice will be the responsibility of all Contractors to provide for their work forces.

7.4 Fire Extinguishers, Hot Work Requirements and Volatile Storage

General Contractor will provide fire extingushers for general use in on the project site. Fire Extinguishers shall be mounted to portable stands with signage. General trades contractor will conduct all required inspections and maintenance for general use fire extinguishers. Each Prime Contractor and subcontractor must supply and maintain a fire extinguisher in all temporary rooms (including jobsite trailers), at flammable material storage areas, and at all locations where welding, cutting or burning work occurs. All Contractors shall follow all applicable regulatory hot and safe work procedures when performing welding, cutting, torching, grinding, brazing, or tacking, including protecting personnel and the adjacent work areas from fire hazards. Store paints, varnishes, volatile oils, and similar combustible materials in properly labeled storage containers and in storage areas as required by law. Store all gasoline and other volatile flammable liquids in properly labeled storage containers and in storage area as required by law. ABSOLUTLEY NO GASOLINE OR COMBUSTIBLES SHALL BE STORED IN THE BUILDING(S).

7.5 Temporary Water

Use of Owner's water supply (faucets, hose bibs, etc…) is permitted as long as the service is not being abused. Abuse will be the sole discretion of The Owner and the Construction Manager. Each Contractor requiring use of temporary water will be responsible for their own hoses and shutoffs from the point of hose bib or temporary water service.

Each Contractor shall also be responsible and pay for extending temporary water supply as required to complete their work. Shut- off valves must be installed and marked above the ceiling inside the existing building in case of emergency. Coordinate with The Construction Manager for locations. Incidental use of the existing building's water supplies will be accepted. When the temporary service is no longer required, the Contractor will remove all temporary work and patch any affected finishes. Each Contractor shall pay for extensions of piping that may be required beyond that described above. All temporary plumbing work shall conform to all federal, state and local requirements and codes.

Any damages to finish work due to negligence or careless use of water by any Contractor will be repaired by the responsible Contractor.

7.6 Temporary Heating, Cooling, Ventilation and Dehumidification

UNDER NO CIRCUMSTANCES SHALL THE NEW EQUIPMENT BE USED FOR TEMPORARY HEATING or COOLING PURPOSES!

During the Heating Seasons:

The Mechanical Trades Contractor will be responsible to provide and maintain temporary heat for the Green Room and Storage Room once temperatures fall below 50 degrees Fahrenheit. The temporary heating system must be capable of sustaining temperatures between 50-70 degrees. General Contractor shall also provide a digital thermostat to monitor and control the temperatures. The Mechanical Trades Contractor will provide temporary pipe extension for natural gas supply hookup from the existing building line to the temporary heating equipment (refer to Mechanical Trade Contract scope of work).

General Trades Contractor to coordinate natural gas requirements with the Plumbing Contractor prior to installation to ensure proper fitments and operability of the system.

During the Cooling Seasons:
The General Trades Contractor will be responsible to provide adequate ventilation and circulation for proper installation of materials and finishes. Temporary dehumidification equipment shall be in place once the installation of the finishes/materials are scheduled to begin. Dehumidification systems shall be designed in accordance to the SF load requirements of each area requiring dehumidification and shall be capable of maintaining a maximum relative humidity level of 50%RH in order to ensure the finishes are being installed in accordance to the manufacturer's recommendations. Manufacturer's recommendations shall be considered minimum requirements to be exceeded.

7.7 Temporary Power and Lighting

General Note: Unless otherwise noted, ALL Contractors shall provide their own temporary power and/or generators for power tools, saws, and any other equipment requiring electric up to and including jobsite lighting. All Contractors shall also provide temporary lighting as required to complete their work.

Provide temporary LED lighting and power for the duration of the project for all work enclosed work areas including below the stage, the green room and the storage room buildings. Temporary LED lighting provided must meet OSHA standards at a minimum and is to be removed in its entirety upon completion of an area and prior to project completion. Temporary lights to be spaced out equally and supported securely to structures.

Electrical contractor will provide temporary power to the Construction Manager's trailer as indicated on the site logistics plan, including heat trace on water and waste piping. Each contractor is responsible for providing power to their own trailers.

1The Electrical Contractor shall provide and maintain all temporary power and lighting required for the use of ALL trades in order to maintain workflow within the new addition. Temporary power at a minimum shall consist of a temporary sub panel mounted to a self-supporting stand from the nearest main distribution panel with individual (20-30 amp) circuit breakers to accommodate a minimum of (8) quad outlets w/GFI's for the duration of the project.

7.8 Temporary Toilets

A.) The General Trades Contractor will provide the temporary chemical toilets for use by all Contractors at the project site as indicated on the schedule below. Toilets shall remain on site for the duration of the project. Section 1926.51 of OHSA shall be the basis for the minimum quantity of toilets required, but not less than as stated below. All facilities will meet local practice and OSHA requirements.

Temporary Toilet Schedule: Provide 5 Temporary Toilets. One temporary toilet will be designated as Female Only and a lock with (10) spare keys will be provided to the construction manager.

Refer to Site Logistics plan SL-1for location. Coordinate final with the CM.

B.) Temporary toilets must be free from all graffiti, cleaned and maintained, as needed, **twice a week minimum**, and will be supplied with the necessary toilet paper, hand sanitizer and paper towel supplies.

C.) General trades contractor shall include an allowance of $3,000 for the construction of a temporary hot water handwashing sink. Assembly shall consist of electric hot water heater, sink, faucet and connections to cold/hot water.

D.) The General Trades Contractor shall also be responsible to provide the following work associated with portable temporary toilets:

1. The portable temporary toilets shall be placed as directed by the Construction Manager's Project Superintendent.
2. Each portable temporary toilet shall be relocated as necessary and as directed by the Construction Manager's Project Superintendent.
3. Temporary toilets will be inspected daily to ensure all units are graffiti free. Any graffiti discovered will be brought to the immediate attention of the CM.
4. Temporary toilets shall be properly anchored so that they will not blow over.

The appropriate number of temporary toilets shall be designated for the sole use of all Female workers on site.

7.9 Temporary Offices

The General Trades Contractor shall provide the requirements for the Construction Manager's Field Office; See "Office Requisition" portion of the **General Trades** contract scope of work.

Contractors are permitted to have one (1) temporary office space for use during construction and may be placed in the existing parking lot in designated "staging" areas as indicated on the Site Logistics Plan SL-1. All costs associated with temporary offices including, but not limited to, partitions, electrical service, telephone service, temporary heat, etc. will be by the Contractor. Location of temporary offices must be reviewed and approved by the Owner and the Construction Manager. Reference the Site logistics plan for locations. Offices must be removed or relocated whenever they impede the normal progress of work at no cost to The Construction Manager or the Owner. All shanties installed by a Contractor must be constructed of fire retardant materials. Non-combustible paint is not acceptable. Installation and utility costs of a Contractor's jobsite trailer are the sole responsibility of that Contractor. If electrical power is provided by the jobsite temporary service or the owner's primary service, the Contractor shall have a meter installed and be responsible for the utility cost.

7.10 Site Dewatering

Each Contractor is to make provisions for their own dewatering so as not to impede job progress including that of other Contractors. Any water being discharged into a storm sewer must be compliant with the SWPPP. In addition, the General Trade Contractor will have the discharge water tested for turbidity to create a job record. Include all filtering as required to discharge water to the appropriate cleanliness.

Dewatering during Abatement – If during abatement, water is encountered within the containment zones, dewatering will be provided by the General Trades Contractor. Provide all necessary filters and removals as required in accordance to all state, local and jurisdictional code rules. All discharge water removed under abatement shall be tested in accordance to all state, local and jurisdictional code rules.

The General Trades Contractor shall provide all dewatering as required to maintain clear access and egress to and within all areas of the foundation work below grade for the duration of the project.

7.11 Snow/Ice Removal

All Prime Contractors, for their portion of the work, shall remove all snow and ice as may be required for the protection and execution of your work. Off hour work for removals shall be included at no charge.

The Sitework Contractor shall provide all snow and ice removals required to clear the areas necessary to complete their work within the jobsite fence areas and around the construction trailers. During active construction the Sitework contractor is responsible for snow removal for parking areas and designated employee access routes, including shoveling and salting pathways. The Sitwork Contractor shall also provide all snow and ice removals as required to clear the construction entry door(s)/gate(s), dumpsters and ramps to facilitate the trash removals. See Site Logistics Plan SL-1 for locations.

Note – construction managers trailer will remain occupied throughout the winter months and snow removal, including removal of snow for the access route and shoveling pathways to the office trailer and salting walkways will be required for the entire winter.

7.12 Temporary Interior/Exterior Partitions/Enclosures

Unless otherwise noted, protection shall be at a minimum 3-5/8"steel stud framing at 24" O.C. insulated, with ½" exterior grade plywood fastened with screws. Protection shall be installed in a manner to provide a water tight seal at each building envelope exposure (i.e.: temp caulking at all seams, etc.) until the new work is installed. All temporary interior partitions/doors (unless otherwise noted) shall be furnished, installed, maintained and removed by the General Contractor. Refer to the General Trades Contract Scope of Work for further details.

The General Trades Contractor shall remove and dispose of the temporary protection for the doors, unit vent penetrations and mechanical systems. Include modification/removal, reinstallation of temporary enclosures as necessary to complete the work of this Contract. Include all cost to remove temporary partitions, enclosures and/or doors. Repair of all finishes damaged during the installation of and removal of temporary partitions and doors is also included. This shall include but is not limited to wall patching, ceramic tile replacement, painting and ceiling restoration, etc.

All Contractors shall Include modification/removal, and reinstallation of temporary enclosures (originally installed by the General Trades Contractor) as required to install the work of their contracts. Buildings must remain weather tight at all times to protect interior finishes and must be secure at the end of each workday to prevent theft/vandalism.

7.13 Ladders/Rough Carpentry

Each Contractor will be responsible for furnishing, erecting, maintaining and removing, temporary scaffolding, ladders and stairways to access and install their own work as required. OSHA regulations to apply for number and size required. Location of the temporary scaffold stairs shall be reviewed and approved by the Construction Manager.

7.14 Benchmarks and Building Control Lines

The Sitework Contractor shall procure services of a registered professional land surveyor to perform the field layout work for establishing primary site lines and levels at all exterior areas. If any of the control points are moved or lost, control points shall be re-established by the General Trades Contractor at no additional cost to the Owner. Contract work shall properly relate to lines and levels and detail dimensions shown or established by the contract documents. See also Specification Section 017300 for additional requirements.

All layouts are the responsibility of each Contractor. Contractors shall exercise proper precaution to verify the dimensions shown on drawings prior to laying out work. All discrepancies, inaccuracies or errors which are found, are to be reported to The Architect and Construction Manager prior to proceeding with the work. The Contractor shall be held responsible for any error resulting from failure to exercise such precautions.

The Contractor will be responsible for any and all extensions of lines and grades necessary for their work. Contractors are cautioned that temperature corrections during all surveying and layouts must be used. Contractors are also expected to clear, move and clean site areas as necessary to perform their own layout.

7.15 Temporary Shoring and Bracing

Provide temporary shoring and bracing as required for execution of the work. All shoring and bracing shall comply with safety regulations of authorities having jurisdiction and must be designed by a Professional Engineer licensed in the State of NY.

7.16 Temporary Signage

Each Contractor is required to post and notify the public prior to any work beginning. This includes all types of safety signage throughout the duration of the project.

By no later than October 1, 2021 the General Trades Contractor shall provide and maintain the following signage for the duration of the project. Signs must be made of metal with grommets for mounting and shall be turned over to the Construction Manager upon project completion:

A.) Furnish and install (10) 24”x18” **“NO TRESPASSING Construction Area Violators Will Be Prosecuted”** Include labor and material to fasten signage to temporary and/or existing fencing at locations as designated by The Construction Manager

B.) Furnish and install (3) **“All Contractors/Visitors Must Register with Turner Construction”** signs in location designated by The Construction Manager. Signs are to have white, reflective backgrounds with blue lettering. (2’x2’ w/2½” letters). Include labor and material to fasten signage to temporary and/or existing fencing at locations as designated by The Construction Manager.

C.) Furnish and Install (3) 2’x2’ w/2½” letters **“HARD HAT/SAFETY GLASSES REQUIRED”** Include labor and material to fasten signage to temporary and/or existing fencing at locations as designated by The Construction Manager.

D.) Furnish and Install (10) 2’x2’ w/2½” letters **“NO SMOKING ON PROPERTY”** signs in location designated by The Construction Manager. Signs are to be red with white lettering.

E.) Furnish (1) 3’x3’ “Gate 1” and (1) 3’x3’ “Gate 2” Sign. Sign to have 1’ Letters Include labor and material to fasten signage to temporary and/or existing fencing at locations as designated by The Construction Manager.

F.) Furnish (2) 2'x2' w/2½" letters **"EMERGENCY MUSTER POINT"** Include labor and material to fasten signage to temporary and/or existing fencing at locations as designated by The Construction Manager.

G.) Furnish and Install ALL Storm Water Prevention Plan (SWPP) signage as required per the contract documents and specifications.

7.17 Removal and Reconditioning

Temporary facilities, barricades, utilities, and other construction of temporary nature shall be removed from the project site as soon as the progress of the Work will permit in the opinion of the Construction Manager. Legally dispose of all debris resulting from removal and recondition operations.

8.0 GENERAL PROTECTION AND SAFETY

8.1 Site Safety Plan

The Contractor Safety programs along with any additions and/or modifications that may be necessary over the life of the project, should assist in helping to keep accidents at a minimum during the construction. This program is to be incorporated into the Contractor's own site specific safety program referenced in section 3.2 of these Special Provisions. Contractors must realize that accident prevention is mandatory, and beneficial to all. The responsibility of every individual on this project is a safe job site.

The Owner expects the full cooperation of all Contractors, regardless of tier, in monitoring, supervision, and enforcing the project safety and fire prevention program, including project specific requirements.

A) The safety of the Contractor and subcontractors, and their representatives, agents, employees and invitees, while on the Work site, or of any other person who enters upon the Work site with the consent of Contractor, subcontractors or the representatives, agents, employees or invitees of any of them for reasons relating to the Contract, shall be the sole responsibility of Contractor. Contractor shall at all times maintain good order among its employees and shall not employ, for purposes of the Contract, any person unfit or not skilled in the Work assigned.

B) Contractor shall, at all times during the performance of the Contract, take all measures and precautions to (i) protect the property of the Owner and others, and (ii) prevent injury, illness or death to any person. Such measures and precaution shall include, but shall not be limited to, all safeguards and warnings necessary (i) to protect all persons against any condition, including exposure to health hazard, on the Work site which could be dangerous and (ii) to prevent accidents of any kind whenever the Work is being performed, particularly where the Work is being performed in proximity to any moving or operating machinery, equipment or facilities, whether such machinery, equipment or facilities are the property of or are being operated by, Contractor, its subcontractors, Owner, or other persons.

C) Contractor shall promptly comply and shall at all times during the performance of the Contract take all measures and precautions necessary to ensure that subcontractors and their representatives, agents, employees and invitees shall promptly comply with any and all of Owner's requirements, if any, to initiate corrective action for deficiencies regarding (i) the prevention of accidents or fires or (ii) the elimination of accident hazards, fire hazards or unsafe practices.

D) Contractors shall comply, and shall at all times during the performance of the Contract take all measures and precautions necessary to ensure that subcontractors and their representatives, agents, employees and invitees shall comply with all federal, state and local safety, health and environmental laws, rules, regulations, ordinances, orders, decrees, decisions, restrictions and permits and licenses including, but not limited to, the Occupational Safety and Health Act, 29 U.S.C. § 651 et. seq.; as they have been or will be amended from time to time, and the regulations implementing such statutes; any similar state and local laws and ordinances concerning the protection of human health and the environment and the regulations implementing such statutes.

E) Contractor shall comply, and shall at all times during the performance of the Contract take all measures and precautions necessary to ensure that subcontractors and their representative, agents employees and invitees shall comply, with such regulations, policies and procedures as Owner may from time to time establish.

F) Contractor shall not introduce, and shall at all times during the performance of the Contract take all measures and precautions necessary to ensure that subcontractors and their representatives, agents, employees and invitees shall not introduce, onto the Work site any Hazardous Substance with Owner's prior written approval. "Hazardous Substance(s)" means (i) any substance, material, chemical or waste which is or shall be listed or defined as hazardous, toxic or dangerous under any Applicable Environmental Law, or (ii) any petroleum products, or (iii) any substance, material, chemical or waste which is or may become, directly or indirectly, by chemical reactions or otherwise, hazardous, toxic or dangerous to life, health, property or the environment by reason of toxicity, flammability, explosiveness, corrosively or any other reasons.

"Applicable Environmental Law" means any and all laws concerning the protection of human health and the environment which include, but shall not be limited to, the Comprehensives Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601, et seq.; the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901, et seq.; the Federal Water Pollution Control Act, 33 U.S.C. §§ et seq.; the Clean Air Act, 42 U.S.C. §§ 7401 et seq.; the Hazardous Materials Transportation Act, 49 U.S.C §§ 1471 et seq.; the Toxic Substances Control Act, 15 U.S.C. §§ 2601 through 2629; and the Safe Drinking Water Act, 42 U.S.C. §§ 300f through 300j; as they have been or will be amended from time to time, and the regulations implementing such statues; and any similar state and local laws and ordinances concerning the protection of human health and the environment and the regulates implementing such statutes.

G) Zero Tolerance Program- Bias-Motivated Event / Workplace Violence/Graffiti Protocol Statement on Harassment: The Owner expects that each Prime Contractor will promote a work environment at the Project that is free from harassment of any kind. Each Prime Contractor must have ZEROTOLERANCE for harassment, including harassment on the basis of race, sex, gender, gender identity, gender expression, transgender status, sexual orientation, pregnancy, childbirth and other pregnancy-related conditions, color, national origin, ancestry, age, religious creed, citizenship, marital status (including registered domestic partners), parental status, physical disability, mental disability, medical condition, genetic information,

military or veteran status (including protected veteran status), or any other characteristic or status protected by law.

Each Prime Contract agrees to be bound by this Statement on Harassment and any violation or suspected violation of such policy by the Prime Contractor or any of its officers, agents, servants, employees, subcontractors or suppliers shall be considered as Prime Contractor's failure to perform its obligations under the terms and conditions of this Agreement. Prime Contractor shall actively promote a harassment-free work environment among its officers, agents, servants, employees, subcontractors, and suppliers.

Training/Stand Downs/ Postings:
Each Prime Contractor shall mandate and track that each worker on the jobsite has been through a 10 minute Inclusive and Respectful Workplaces video before entering the job site. A video will be provided by the CM at notice of award.

Each Prime Contractor shall participate in two (2) stand downs that promote an Inclusive and Respectful workplace coordinated with CM.

Each Prime Contractor shall post zero tolerance posters at all huddle areas and project trailers.

Temporary Toilets:
The Prime Contractor responsible for portable toilets shall inspect prior to delivery to the site to ensure that each unit is:
1. Clean and in "like new" condition
2. Free from any drawings, stickers or graffiti of any type
3. Free from any etched markings
A facility that does not meet the standards listed above will not be acceptable. Any cost associated with the removal and replacement of a facility that was delivered in an unsatisfactory condition will be borne by this contractor. Prime Contractor must post anti-graffiti posters at each portable toilet area.
Graffiti:
Graffiti is often found in less frequently traveled locations such as machine rooms, stairwells, closets, site fences, etc. Prime Contractor must conduct daily inspections of the project to ensure that these areas are free of graffiti.
Prior to working in renovated spaces, inspect and document existing project conditions and notify the Construction Manager of any existing graffiti prior to starting work. The entire project site is to be inspected including stairwells, mechanical rooms (including inside and outside air handling units), electrical closets and existing building toilets planned to be used by workers during construction.

Bias-Motivated Event / Workplace Violence/Graffiti Protocol
The following protocols pertain to bias-motivated incidents in the workplace directed at an individual or a group based on perceived or actual membership in a protected class, including (but not limited to) race, religion, gender, gender identity, sexual orientation, class, ethnicity, age, and/or disability.
Certain bias-motivated events rise to the level of a hate crime, a criminal offense. Examples include destruction, damage or vandalism of property, intimidation, graffiti or symbol(s) depicting hate (e.g., a noose, confederate flag, swastika), issuance of derogatory leaflets, threats and/or acts of violence.

Any individual who witnesses a bias-motivated event or potential hate crime, MUST NOT ignore it:

1. If the incident involves immediate danger or violence CALL 911

2. If the incident targets a specific employee, group of employees or other individuals, ensure their safety and well-being.

3. Secure the area. DO NOT remove evidence or disturb the potential crime scene; take photos only. All such photos must be secured, not shared, or published in any way, outside of the investigation. Limit foot traffic to authorized members of management only; no visitors.

4. Immediately inform the Construction Manager and provide information for an incident report. The Construction Manager will notify the Client and notify the other Prime Contractors and coordinate a job site stand down. A job site stand down will be conducted within 24 hours of an incident and it is mandatory participation for each worker, Project Site Leadership staff and Principals of each Prime. Each Prime Contractor will be responsible for notifying their sub-primes and ensuring simliar participation.

5. Each Prime Contractor will be required to participate in a Bias Motivated Event (BME) call with the Construction Manager within 2 hours of the event.
During Bias-Motivated Event Call participants determine next steps, including:
a. Whether or not to notify the police, if necessary, with the input and approval of the Owner.
b. How to address the media, if necessary, but with the intput and approval of the Owner.
c. Individuals assigned to conduct the investigation
d. Appropriate response based on the nature of the event, severity, and recurrence (e.g. stand down, project shutdown, subcontractor consequences, training & education)

6. If BME call determines that a project shut down is required then Each Prime Contractor will send all of their workers home following a stand down.
Prior to any workers returning to work the following work day, each worker shall receive additional Diversity, Equity and Inclusion training coordinated with the CM.

7. If BME call determines a site investigation is needed. The Foreman for each Prime Contractor will remain on site and fully cooperate with planning of the investigation including providing the names of all employees that have been on site within the time frame that the incident most likely to have occurred. At their discretion, the Owner and the Construction Manager may observe or participate in the investigation conducted by the Prime Contractor.

8. Each Prime Contractor will be responsible for implementing and documenting an anti-harassment, zero tolerance tool box talk program, coordinated with the Construction Manager, following the incident promoting and mandating zero tolerance.

8.2 <u>Safety Program</u>

The Owner requires Contractors to be responsible for maintaining a safe job. This will be insured by the following means:

A. All persons on the project, including workers, delivery drivers, visitors, inspectors, employees of any subcontractor and/or supplier, shall be required to wear ANSI Z87.1 approved safety glasses with permanently attached side shields. Persons with prescription glasses shall wear ANSI Z87.1 approved goggles to cover their existing glasses. Each of the above mentioned parties must also wear an OSHA approved hard hat 100% of the time. Violators will be removed from the site. Other safety protection shall be as dictated by the work. All employees shall wear a hard hat, safety glasses, **level 4 cut resistant gloves(minimum), shirts with sleeves(4" minimum), long pants and work boots at all times.** Other safety protection shall be as dictated by the work. Each Contractor shall keep spares of each in their site trailer or gang box for new employees and replacement. No shorts, tank tops or tennis shoes shall be permitted.

B. **All workers are required to wear ANSI Class 2 high visibility safety vests** for increased awareness/visibility at all times while working on site. Each Contractor shall keep spares in their site trailer or gang box for new employees and replacement.

C. Prior to commencement of work, each **Prime Contractor** shall attend a Site Specific Safety Kick Off meeting. An officer of the company, project manager and project crew lead shall attend the meeting. Prior to any tiered subcontractors commencing work, a safety kickoff meeting shall be held with each sub and attended by an officer of their company, the project manager and the project foreperson

D. **Each Prime Contractor shall conduct a site specific safety orientation for all of their workers and subcontractor workers prior to the worker beginning work on site. The Prime Contractor shall keep a log of all workers and their date of orientation. The Prime Contractor shall supply a project specific sticker or tag to visibly identify that each worker has been orientated to the project site. The orientation shall be developed by the Contractor's safety director or principal of the company and include an overview of all items within this document, the crisis plan and evacuation plan for the project as well as any other pertinent safety information.**

E. Each **Primes** Safety Coordinator will conduct Bi-weekly site safety inspections by the **Prime Contractor** health and safety director or an officer of the company with a written report. Each **Prime Contractor** will have a representative review open items and resolution at each biweekly Project Manager's meeting. Also, contractors shall advise of the forthcoming operations that could create new hazards. There will be a 24-hour limitation imposed on correction of safety violations (immediately on critical hazard).

F. Each **Prime Contractor** shall conduct a quarterly critical safe behavior coaching event. The **Prime Contractor**'s health and safety director/consultant shall be accompanied by 2 to 4 employees and will observe an activity for a period of 10-15 minutes to observe the number of activities that were either safe or at-risk. At the end of the observation period, the observers stop the crew for a feedback or "coaching moment". Observations shall be documented and shared with the other **Prime Contractor**s at the next project meeting.

G. The Owner, Construction Manager and the A/E are to be notified immediately of any safety incident on site. Contractors shall provide accident reports to The Construction Manager no later than (24 hours) after an accident occurs. **Each Prime Contractor shall be required to perform a Root Cause Analysis conducted by their health and safety director/consultant, project manager, superintendent, foremen and a principal of the company following each incident and/or near miss to help identify the true cause of the event, examine lessons learned and implement continuous improvement and program evolution.**

H. The **General Contractor** shall provide, install and check weekly a project safety suggestion box prominently displayed on the project. Any suggestions shared shall be discussed with action items with all of the **Prime Contractor**s during the bi-weekly project meetings. The **General Contractor** shall close the loop with the workers to inform them on how suggestions were or were not implemented.

I. Each Contractor shall have at least one (1) Red Cross CPR certified first aid & CPR person and competent person on the Project at all times. The name of this person and date of certification shall be submitted to The Construction Manager's Project Superintendent at the start of his work and any change shall be noted on the weekly Tool Box Talk Minutes.

J. All **Prime Contractor**s are required to participate in safety stand downs as requested by the Owner and after each recordable incident (a minimum of 2 stand downs will be held). This will include stopping all work on the project and gathering all individuals to a central location to discuss important safety items on the project for a short duration (15-30mins). The safety director from each **Prime Contractor** will be responsible to collaborate together and come up with the presentation. Send presentation to construction manager 5 days ahead of stand down. Include time in bid.

K. Job Hazard Analysis. JHA's shall be completed by each **Prime Contractor** and reviewed with their onsite workforce a minimum of two weeks prior to the start of each new activity. **Prime Contractor** shall provide a record copy of the JHA with sign in sheet.

L. Each **Prime Contractor** is required to utilize pre-task plans PTP's for all work being performed. Contractors will be required to meet with all of their workers in the morning to discuss the day's activities, hazards and controls. Contractors will be required to create a form to include the tasks, hazards, controls and the signatures of the crew members. These forms shall be provided for project record each day by 9am. Should the plan differ from the Pre-Task meeting held in the morning, a new PTP will be required. Each Contractor's health and safety director/consultant is required to review all PTP's from their company's crews at least once per week. This is to be noted in the safety report & DCR.

M. All **Prime Contractors** are to implement a Stretch and Flex program on this project. The stretch and flex shall be facilitated and led by each Prime Contractor's superintendent or designee at a central location, every morning prior to the start of work. All sub-tier contractors are required to participate in the program. All employees are required to participate up to their physical level of comfort.

N. The **General Contractor** shall include an allowance of $100/month to host a total of (9) monthly safety lunch for (5) randomly selected trade workers, taken from the entire project workforce, to discuss project safety conditions and opportunities for improvement. Each **Prime Contractor** shall make their employees available to participate when selected. The meetings will commence July 2021 and will be managed by the **General Contractor's** health and safety director/consultant or a principal of the Company. The **General Contractor** shall close the loop with the workers to inform them on how suggestions were are were not implemented.

O. **Nothing Hits the Ground**:

Fabrication:
All material fabrication shall be performed at a workstation between 30 and 39 inches off the floor. Workstations shall be mobile and include a fire/debris stop directly behind all chop saws. Rubbish containers shall be mobile and located directly adjacent to the workstation. The subcontractor is to furnish all mobile rubbish containers for their work.

Housekeeping:
All rubbish shall be disposed of as it is generated and be immediately placed in mobile rubbish container. Cordless power tools are required unless the subcontractor can demonstrate a hardship or need to use tools with power cords. The subcontractor is required to elevate all power cords in order to minimize tripping hazards on walking/working surfaces. Debris is not allowed to be consolidated on the floor.

Material Handling and Storage:
Materials may not be stored within 10 feet of the building perimeter or within 6' of interior shafts or stairwells. All material laydown areas must be coordinated through ECHDC and the CM. Material must be stored to promote mobility of material. Pipes, conduits, metal fabrications and steel framing are to be stored on rolling racks or similar means of conveyance. Bulk material must be palletized to allow for easy mobility using a pallet jack. "Just in Time" delivery is required to minimize clutter. Nothing should be stored on a floor that cannot be installed within one week. Heavy material such as glass and drywall must be loaded so as not to overload the structure. The **Prime Contractor** is required to do a floor loading analysis for submission to the design team for review. Contractor shall be required to store all materials on carts with castors to promote mobility and efficiency. Each Contractor shall have mobile work benches designed for fabrication/cutting in the power zone (height between the knees and shoulders) and garbage bins should be positioned with each work bench to eliminate accumulated debris on the floor. Each scissor lift should have a waste bin to collect miscellaneous debris to reduce housekeeping concerns. Dump carts should be readily available in all areas and dumped at the end of each shift. All debris to be placed directly into garbage bins.

P. **Ladder Policy**:

1. Prior to beginning work, the Contractor or subcontractor shall evaluate all tasks that require individuals to work at elevated heights. It is the expectation that these tasks will be performed using methods other than a ladder where feasible. Use of lifts and portable scaffold devices shall be the preferred method to perform this type of work. Ladder use on this project will be allowed only when it has been determined that it is unfeasible to use all other

options to complete the task. If it is determined that a ladder is the only means of performing the job at elevated height. Ladder usage must be specifically noted on each crew's pretask plan.

2. If a ladder is to be used, it must be a platform/podium type ladder or a "leansafe" ladder with a green top.
3. No aluminum or job built ladders are to be used on the project.
4. Workers must maintain 3 points of contact while ascending/descending a ladder. If this cannot be done, worker must tie off at any height.
5. When working at a height greater than six (6) feet, 100% fall protection is required. A retractable lanyard must be used.

Q. **Access to Roofs:**

Ladders shall not be permitted. Contractor shall utilize portable lifts or provide and maintain a stair scaffold system complete with the bottom entry point protected by an 8' lockable enclosure for the duration of the project. Reference the General Trades Contract Summary of Work and Site Logistics plans for placement.

R. In accordance with OSHA regulations, each contractor will hold weekly "Tool Box" meetings with jobsite personnel to discuss safety. Minutes of each (handwritten) of these meetings shall be turned in weekly with the HAZMAT log to the Construction Manager Safety Coordinator.

S. **There is a 6'-0" positive fall protection rule for all work on this project. For all roofing work, a safety monitor is not permitted, a full perimeter safety system consisting of a top rail, mid rail and toe board is required at all roofing elevations.** The use of guard rail, safety harness with a personal protection device, or safety net **whenever <u>ANYONE</u>** is working over 6'-0" is required except as follows:

1. During scaffold erection and dismantling the designated competent person overseeing the operation shall determine the feasibility of positive fall protection. If it is deemed that positive is infeasible, the competent person shall put a fall protection plan in writing which meets the Federal OHSA requirements found in Subpart L section 1926.451(g) and provide copies to The Construction Manager for the project record prior to commencing the operation.

2. The 6'-0" fall policy does not apply to moving up and down ladders. However, when working from ladders, and an individual's work requires him/her to lean out over the side rails of the ladder, positive fall protection utilization is mandatory.

3. Steel erectors and metal deck installers are required to utilize 100% positive fall protection at all times.

T. Contractors are to responsible to ensure that all scissor lifts, mobile elevated work platforms, and aerial/boom lifts provided on site shall be equipped with manufacturer approved guards and shrouds for lift controls. All aerial/boom lifts shall also be provided with anti-crush technology.

U. The use of restraint lanyards is required at all times within a scissor lift.

V. Personal Fall Arrest System is required at all times when working in an aerial/boom lift.

W. All electrically operated tools and equipment must be properly grounded with the exception of approved insulated types.

X. Contractors are responsible to remove and replace in original positions barricades, railings, covers, etc., in accordance with subpart M, OSHA 1926,500. The unguarded opening(s) shall be manned until the barricade is replaced. During discontinuous or intermittent work operation, safety protection is to be replaced immediately. If not promptly replaced, replacement will be by others at the removing Contractor's expense.

Y. Only low velocity powder actuated tools can be used. All personnel must be certified when using powder activated tools and laser devices. All use of these tools must be approved by the Contractors Safety Officer prior to their usage, as well as, posting all proper signage.

Z. All compressed gas cylinders must be properly handled. They must always be in the upright position and properly secured when stored. Cylinders are to be separated by a minimum of 20 feet or a manufactured cart with a CERTIFIED AND TESTED 30 minute barrier. All oxygen and acetylene cylinders in use should be secured on a special carrier with a fire extinguisher.

AA. All Contractors and delivery drivers employed on the job site are required to wear a hard hat and eye protection as a condition of employment. There are no exceptions to this rule. Contractors will provide workers with all necessary personal protective equipment and tools and enforce the use of same.

BB. Any worker that is part of the demolition that is not certified in asbestos removal is required to take and provide certification of OSHA Asbestos Awareness Training (2 hour course).

CC. The Contractor and sub-contractor is expected to have a scheduled maintenance program for all tools and equipment.

DD. All shanties and trailers must be supplied with a current 20# ABC fire extinguisher, an OSHA approved first aid kit and a copy of the OSHA Construction Standards. A prominent sign is required at the extinguisher's location. If gang boxes are used instead of a shanty, the gang box shall contain the above.

EE. Take all necessary precautions to avoid fires. Provide fire watches when welding or burning operations are in progress. Fire watch must remain at the location of the work for a period of 60 minutes after work is completed.

FF. Alcoholic beverages or illegal drugs are **not** permitted on this Project.

GG. Media devices with earphones are not permitted on this Project. Loud radio playing is a potential hazard, disrupting to building occupants and is not permitted.

HH. Use of cell phone while operating any equipment is strictly prohibited.

II. No Contractor shall permit their employees to use another Contractor's scaffold without written permission from the owner of the scaffold. All scaffolds shall be checked daily and before each use for safety compliance. No scaffold shall be left at any time in an unsafe condition and shall be removed immediately if not to be used again.

JJ. All extension cords, cables and hoses shall be maintained at least 6 feet 6 inches above the working floor. Where this is impossible, these items shall be inspected daily and repaired immediately or tagged and removed from use until repaired.

KK. No material shall be stored within 6 feet of a floor opening of the building, 10 feet of the perimeter, or 15 feet from the edge of the roof. For assistance with storage locations, contact the Project Superintendent.

LL. All equipment, materials and debris shall be secured at all times, or removed immediately to grade level until the building is enclosed, to prevent wind blown objects.

MM. In accordance with the provisions of the HAZARD COMMUNICATION STANDARD 29 CFR-1926, Material and Safety Data Sheets for any chemical/substance alone with any additional information, safety data or supplemental material safety data sheets available now or in the future are required to be submitted to The Construction Manager prior to material deliveries to the site.

Failure to comply with the agreement may result in The Owner or Construction Manager receiving a citation from the Occupational Safety and Health Administration (OSHA), for violation of the Hazard Communication Standard. The Contractor shall be responsible for all costs to The Owner or Construction Manager for such citations issued in connection with the Contractor's material.

The Contractor shall be responsible for, but not limited to, the following conditions as it relates to the Hazards Communications Act:

1. Set up and conduct a program for its employees at each jobsite.
2. Maintain an updated chemical inventory sheet and SDS's, which must be coordinated and shared with The Owner's EH&S Committee and all other subcontractors at the jobsite. These forms must be a searchable .pdf format. Contractors shall turn these in with copies of their Tool Box Talks.
3. Each Contractor is responsible for maintaining an updated file for this jobsite for all hazards that may be encountered on the job.
4. Each Contractor is responsible for labeling and identifying materials (per OSHA requirements) used by him and sharing this information with all other Contractors and subcontractors at the jobsite.
5. Training and documentation of training in hazard communications is the responsibility of each Contractor.

6. All documentation of respiratory "Fit Test", medical records, etc., shall be submitted prior to any work that shall be performed requiring such protection.

8.3 Protection of Utilities/Facilities

Prior to beginning any work, the Contractor shall carefully survey the existing work and examine the site for pre-existing damage. The Contractor shall document via photographs, videos, etc., any existing adjacent facilities that may be potentially affected by the work. The General Trades Contractor will provide a third party utility marking service. Contractor is to coordinate with the utility markings service prior to commencing work. Refer to Special Provisions Section 6.13 for details.

During the progress of work, Contractors shall protect any newly installed or existing utilities and shall be responsible for the repair or replacement of same if damaged by work performed under his contract or incidental thereto. Contractor shall work expediently and continuously to repair damaged utilities at no additional cost to the Owner. If a shutdown is required, the Contractor must schedule same with The Construction Manager well in advance of the needed date, so as to minimize any disruption of normal operations.

All Contractors are cautioned that since the Project is located in existing occupied site and buildings, all precautions, protection, and care must be exercised to protect existing structures and finishes in accordance with good safety practices that are appropriate for work.

All existing and new landscape areas that require construction vehicle or equipment traffic shall have protection laid down to protect the lawn and minimize damage caused by the vehicle/equipment. Any damage caused to the landscape area shall be repaired by a landscape Contractor at the responsible Contractor's expense.

Any shoring or bracing (including removal of same) required for the completion of Contract scope is the responsibility of the Contractor needing same.

All Contractors are required to have a "competent" person on site during the performance of their work as defined by OSHA.

Contractors are not allowed to use the buildings restrooms at any time. Temporary toilets will be provided at each building for Contractor use.

8.4 Dust Protection

Each Contractor is responsible for dust control. The methods used must be reviewed and approved by The Construction Manager prior to the start of any dust-producing activities. The existing site property line is along the residential neighborhood. The Contractor is responsible to provide and maintain dust control methods along the neighboring fence/property lines (see SL-1) to mitigate (i.e. construction scrim attached to existing fencing, etc.) any dust and/or debris that can potentially migrate to the neighboring houses. When truck traffic conditions

produce dust, the streets must be sprinkled with water and/or swept to minimize the generation of dust. All truck wheels must be inspected, and any loose materials must be removed prior to leaving the site. The Contractors shall keep all public roads free of stone, dirt and debris.

During interior demolition, all Contractors shall install, at minimum, plastic sheeting, ventilation air and negative air machines for dust control to complete their work.

8.5 Air pollution and Odor Control

Each Contractor shall employ measures to prevent creation of air pollution and odors. On interior work and work adjacent to occupied areas, all passageways and vent systems will be sealed to prevent dust, air pollution, and odors from traveling into occupied areas. Measures shall be taken by each Contractor to ensure proper separation, by use of taped fire retardant visqueen tenting, or other separator. Each Contractor has responsibility to ensure that the integrity of the separation is maintained throughout the period of the work. In the event any Contractor must remove a barrier, it is their responsibility that the barrier is reconstructed at the end of each work period.

If the omission of construction related odors is found to be offensive by public users in the adjacent space work will be stopped immediately. Continuance of the odor causing work will be permitted during non-occupied times. Any additional cost associated shall be borne by the Contractor producing the odor.

No gasoline/diesel powered engines or lifts are permitted inside the building.

8.6 Protection of the Public

In addition to the general requirements of the contract, it is the Contractor's responsibility to barricade or otherwise separate the work area from public access and/or exposure. Maintain barricades and signs in a clean and neat, graffiti free condition. Particular attention must be given to the isolation and/or protection of pedestrian and vehicular traffic at the perimeter of the Project Site. Any work that must be performed outside of the site fence must be accompanied by the appropriate protection (by the Contractor).

The Contractor shall provide and maintain in accordance to OSHA guidelines, a covered protected pedestrian walkway system at all accessible building entrances that are impacted by and/or in direct line with overhead work activities that pose a safety risk to the public (i.e.: roofing, hoisting, etc.)

8.7 Protection of Finished Work

All Contractors are wholly responsible for the protection of finished work, both their own and that of others, as may be required to perform their work.

All finished surfaces; including sills, jambs, and soffits of all openings used as passageways or through which materials are handled, shall be protected if any possible damage may result from the work by other trades.

All finished surfaces, including factory-finished surfaces, shall be cleaned upon delivery of the building to the Owner. The Contractor shall, without extra compensation, refinish all damaged surfaces. Final cleaning of MEP equipment shall be by the respective MEP Contractor providing the equipment.

Roof surfaces shall not be subjected to construction traffic nor shall they be used for the storage of materials. Where activity must take place in order to carry out the Contract requirements, adequate protection, subject to the approval by The Construction Manager, shall be provided at the Contractor's expense.

Each Contractor is responsible for any damage, which may occur to the property of any other Contractor connected with the work, or to adjacent private or public properties, or to any portion of the structure which in any way results from the acts of neglect of his/her employees.

Prior to material being stored on finished floor surfaces, the Contractor must obtain approval from Construction Manager. If required, a protective paper is to be installed. All traffic over these areas should use rubber tires.

8.8 Cutting and Patching

Reference Project Manual Specification 017300 – Cutting and Patching

All patching shall be done by tradesmen who are skilled in the required work. All patchwork will be done to the highest quality standards. The Contractor shall include the cost of all cutting and patching required in connection with performance of his work. Include supports, protection from elements, protection of surroundings, and immediate clean up.

If necessary, for the Contractor to remove a minimal amount of spray on fireproofing or fire stopping material after initial installation it will be his responsibility to replace or pay for the necessary patching.

All Contractors affected by temporary utilities/openings shall include necessary comeback to infill, patch, fireproofing, etc.

Submit a written notice, requesting approval to proceed, to the Construction Manager at least 48 hours in advance of executing any cutting or alteration which affects the following:

A. Work of the Owner and/or any separate Contractor

B. Structural value or integrity of any element of the Project

C. Integrity or effectiveness of weather –exposed or moisture-resistant elements or building systems

If the Contractor provides inadequate notice, or if the proposed cutting and/or patching will compromise the Owners operations, the Owner has the right to refuse the cutting and patching as proposed without a delay claim to the contract.

The Contractor shall not damage or endanger any portion of the work of other Contractors or property of the Owner. The Contractor shall not alter the Owner's or other Contractor's work without written consent of the Owner or other Contractor. All such requests shall be made through the Construction Manager. Said consent shall not be unreasonably withheld.

Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio. Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. If possible retain the original installer or fabricator to cut and patch exposed Work or, if it is not possible to engage the original installer or fabricator, engages another recognized experienced and specialized firm.

If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect, consult with the Owner's representative prior to placement.

If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding. Protect existing construction during cutting and patching to prevent damage. Until provisions have been made to bypass them, take all precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated.

Where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required to minimum disturbance of adjacent surface. Temporarily cover openings when not in use. To avoid marring existing finished surfaces, best practices should be used to protect finishes (i.e. mask areas off with masking tape) and cut or drill from the exposed or finished side into concealed surfaces.

Where removal of walls or partitions extends one finished area into another: Patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance; Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.

Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch, after the patched area has received primer and second coat; Patch, repair, or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

The Contractor will follow all applicable regulatory hot and safe work procedures when performing welding, cutting, torching, grinding, brazing, or tacking, including protecting personnel and the adjacent work area from fire hazards. Store paints, varnishes, volatile oils, and similar combustible materials in properly labeled storage containers and in storage area as required by law. Storage of

gasoline and other volatile flammable liquids shall be in properly labeled storage containers and in storage area as required by law.

8.9 Perimeter Protection

It is the responsibility of each Contractor(s) to provide any perimeter fall protection as required by OSHA within the building footprint.

The Sitework Contractor shall provide and maintain temporary perimeter site fencing, gates and barricades as indicated on the Site Logistics Plan (SL-1) and Section 4.8 of the Special Provisions. The General Trades Contractor shall also provide and maintain perimeter barricades, fencing, etc. around the full perimeter of the excavated areas, trenches, etc. as required by OSHA for the full duration of the work. Protection shall be installed 100% prior to completing the excavations and maintained until the areas are ready to be backfilled and permanently closed. Contractor shall provide manpower to inspect and repair perimeter protection and barricades weekly to ensure the fencing, gates and barricades are fully secure and operational

As areas become completed, The General Trades Contractor shall remove the Perimeter fencing and warning systems from the jobsite to avoid interference with finishes. Removal of the perimeter protection system shall be conducted in such a manner that there is never a breach in protection to the public.

It is the responsibility of each Contractor(s) to provide a full perimeter fall protection as required by OSHA on the roof of each building when performing their work. This fall protection must be in place prior to commencing work.

8.10 Traffic Control

Provide traffic control barriers and flag persons throughout the construction period at any point in time that construction traffic obstructs normal traffic conditions. Provide flag persons at pedestrian crossings of construction equipment right of ways 100% of the time, when such equipment is operating. Provide and maintain adequate traffic control and flag person's services at all points where transporting of equipment and materials engaged on the Work regularly enters and exits from the job site. Provide numbers of flag persons necessary for vehicular and pedestrian traffic control. Provide temporary traffic control barriers to ensure safety of all persons and property in accordance with NYSDOT. Include stands for temporary traffic control signs. The above shall be provided by the sub-contractor requiring the same.

8.11 OSHA Silica Standards

All Contractors shall perform work in compliance with OSHA's Respirable Crystalline Silica Standard for Construction (29 CFR 1926.1153) as it relates to protection of the workforce, building occupants, and the public at all times.

9.0 CLEAN-UP

9.1 Cleaning, Trash Removal & Dumpsters

On site dumpster shall be provided per Section 7.2 of the Special Provisions.

<u>Each Contractor is responsible for DAILY CLEANUP</u>! If this is not performed to the Owner's satisfaction, the Owner/CM may, without notice, self-perform or subcontract this work and back charge the responsible Contractors accordingly.

Each Contractor will place all of his/her trash and debris in the 1/2 CY dumpsters carts and out to the 30 CY dumpsters provided by the General Trades Contractor. This removal will take place **<u>DAILY</u>**. Each Contractor will minimize packing and crating materials in the building to help eliminate fire hazards. In addition, all boxes and debris will be broken up by each respective Contractor to maximize the usable space within the container. Items that do not fit in dump carts shall be taken directly to the dumpster by the Contractor responsible to the item's trash.

Contractors shall keep all areas in which they are working broom clean at all times.
If the clean-up work is not accomplished within twenty–four (24) hours, The Construction Manager, with written notification, will have the work completed by a designated Contractor. The cost of the work will be back charged to the Contractor involved, as determined solely by the Construction Manager.

Contractors are to provide their own individual trash containers and liners for their respective break areas and dump as needed.

The Sitework Contractor shall clean out and maintain all manholes, drains, catch basins, and swales, etc. on site of any debris during the course of the project.

Contractors having a special/large delivery generating debris that will fill a one-yard dumpster or more will follow to dump same carts into the 30cy dumpster. Only lawful disposal of construction debris is allowed in containers; no paint, thinner, oil, contaminated rags, gasoline, diesel fuel, empty gas or fuel tanks, 55 gallons drums (empty or full), pressurized containers, asbestos, tires, batteries, PCB's or other hazardous material can be disposed of in the supplied dumpster. The Contractor generating such waste will properly dispose of these materials.

All Contractors are to remove all debris and rubbish from inside walls, partitions, pipe chases, above ceilings and other closed or remote spaces, prior to closing the space. The Contractor shall vacuum cavities clean and receive CM's sign-off prior to closing the space

During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Each Prime Contractor is responsible for the final cleaning of their work just prior to turnover to the Owner. This work shall include removal debris, marks, stains, fingerprints, dirt, paint, paper, etc., regardless of origin. The finished product shall be cleaned to the complete satisfaction of the Construction Manager, Architect and Owner before final approval is requested and granted. General construction cleaning will be by

the General Trades contractor and will be performed at the direction of the Construction Manager.

9.2 Trash Chutes

Not Used - Trash chutes will not be provided.

9.3 Roadway and Parking Lot Cleaning

The Sitework Contractor shall provide DAILY sweeping/cleaning of all adjacent roads/parking lots shall be performed to collect any loose debris (stone, dirt, mud, packaging, etc.) that has been tracked through and/or blown outside of the construction parking lots and staging areas. Cleaning shall also include passing of a magnet to pick up all loose screws, nails and fasteners, etc.

10.0 SUBMITTALS AND SHOP DRAWINGS

10.1 General Submittal Information

In addition to the information below, refer to Specification Section 01330 for additional submittal requirements.

A submittal log will be made available electronically online via the Procore web based document management program. All Contractors are required to submit any modifications to the submittal log to The Construction Manager within ten (10) working days from notice to proceed. Contractors are to supply date of submittal delivery, and include date required on jobsite (ROJ) and material lead-times.

All Contractors are required to make prompt submissions of all Shop Drawings and/or samples in such a sequence so that the material and/or equipment can be reviewed by the Architect/Engineer and returned as soon as possible so as not to delay job progress. No extension of Contract Time will be authorized because of Contractor's failure to comply with the approved submittal schedule or failure to transmit submittals to Architect sufficiently in advance of the Work to permit processing.

Delays caused by failure to submit Shop Drawings and computations in a timely manner are the responsibility of the Contractor. No additional time will be allowed the Contractor for delays caused by an excess number of re-submittals. Contractor is responsible for A/E and CM costs after (3) submission attempts.

All submittals must have a submittal coversheet and be accompanied with a letter of transmittal. Any deviation from the plans or specifications must be noted on the transmittal and on the item submitted for approval. Deviations from Contract Documents require clear indication (clouded or circled) on the submittal and specific written acceptance by the Architect of the noted deviation.

Where printed, Product Data includes information on several products, some of which are not required, mark (flag or circle) copies to indicate the applicable information.

All submittals are to be **sent electronically to Bergmann and/or Trowbridge and to the Construction Manager simultaneously via a searchable, printed in PDF format and uploaded to the web based document management program (Procore).** All submittals must be transmitted electronically All product literature and shop drawings will be in original, electronic formats (from manufacturer's websites, etc.). **All submittals over 10 pages are to be bookmarked by the Contractor prior to**

submission. Electronic submittals generated from faxed or scanned copies WILL NOT be accepted.

Physical Samples - **All physical samples are to be sent directly to Bergmann and/or Trowbridge. A photo of the sample submitted shall be taken and attached to a coversheet and shall be simultaneously sent electronically via web based document management program (Procore) for tracking purposes.**

As a minimum provide:

1. Product Data and Manufacturer's Instructions – submit copies as detailed in specification sections 013300
2. Samples - submit copies as detailed in specification section 013300.
3. Samples for Selection- submit copies as detailed in specification section 013300.
4. Samples for Verification- submit copies as detailed in specification section 013300.
5. Shop drawings – submit copies as detailed in specification section 013300.

Each Contractor is responsible for the reproduction, distribution and coordination of all submittal materials to other Contractors and their own subcontractors.

It is the Contractor's obligation, upon submitting a Shop Drawing or a sample, which involves a change in contract price, which is not covered by specific authorization, to include with their submission a request for a change with an estimate of the cost of the change. Approval of a drawing or sample is not to be interpreted as an agreement of a change in contract price or recognition of a claim for a change in contract price.

Do not permit submittals marked "Rejected, and/or "Revise and Resubmit" to be used at the job site, or elsewhere where Work is in progress.

Approval of a drawing or sample is not to be interpreted as an approval of a change in contract price or recognition of a claim for a change in contract price. It is the Contractor's obligation, upon submitting a Shop Drawing or a sample, which involves a change in contract price, which is not covered by specific authorization, to include with their submission a request for a change with an estimate of the cost of the change..

10.2 M/E/P Coordination Drawings

Provide all coordination drawings that are required per the contract documents and specifications. Refer to specification sections for additional information.

10.3 O&M and As-Built Drawings

In addition to the requirements of Specification Section 017700 and 017823, each Contractor is required to maintain an up to date set of as-built drawings and to provide one set of these to The Construction Manager at the completion of his work. These as-built drawings shall be available for inspection at all times by the Construction Manager. The as-builts will be progress inspected at 20%, 40%, 60% & 80% and Completion. If the as-built drawings are not kept up to date, The Construction Manager shall have the right to withhold payment until the as-built drawings are brought up to date. If the as-built drawings are not kept up to date, the Owner shall have the right to withhold payment until the drawings are brought up to date.

Coordinate construction changes, Change Order numbers, RFI numbers and similar identification. Give particular attention to information on concealed elements, which

would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

a. Dimensional changes to the Drawings;
b. Revisions to details shown on the Drawings;
c. Depths of foundations below the first floor;
d. Locations and depths of underground utilities;
e. Revisions to routing of piping and conduits;
f. Revisions to electrical circuitry;
g. Actual equipment locations;
h. Duct size and routing;
i. Locations of concealed internal utilities;
j. Changes made by Change Order;
k. Details not on original Contract Drawings;
l. Update of all room numbers on Drawings and in Specifications to reflect current Building number designations.

Mark record sets with "RED" erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.

Final as-builts shall be COLOR scanned into a PDF file and all electronic files turned over on a USB Jump Drive as well as the required hard copies. At a minimum as-built turn over shall consist of three (3) USB Jump Drive's and one (1) full size drawing set. Sheet size shall be 32"x48". The file labels shall be the sheet numbers of the drawings. Any posted sketches on the back of each pages shall be scanned and labeled the as the same sheet with the suffix "a".

11.0 PAYMENT PROCEDURES

11.1 Payment Program

Within (15) working days of Notice to Proceed, all Contractors are to submit a detailed breakdown (schedule of values) of his costs for approval to The Construction Manager. Breakdown shall to a level of detail to expedite the reviewing process. Construction Manager reserves the right to direct a larger breakdown. See Item 3.3 of the Special Provisions.

The schedule of values will be reviewed and adjusted if necessary. Once approved the schedule of value is to be used for the AIA request for payment application. Only the AIA pay application forms G732CMa and G703 will be recognized for billing purposes.

Billing for stored material will be subject to prior written approval by the Owner and The Construction Manager. Proof of insurance for items stored off site, copies of the Bill of Sale and copies of the invoices for the materials being billed are to be provided to the Construction Manager with the Application for Payment requesting payment for the stored materials NO EXCEPTIONS. The Construction Manager's visual inspection and photographs of materials is required. Reference the AIA 232.

A draft (pencil) copy of the Application for Payment shall be presented to The Construction Manager no later than the 20th day of the month for the period through the end of the month. The Construction Manager will acknowledge agreement with or will provide required changes. Contractor is to send four originals (finals) back to The

Construction Manager by the last working day of the month for processing. Failure of The Construction Manager to respond by the 25th day of the month will not constitute agreement. Payment application shall only include work completed to the end of the month.

Submit final Applications for Progress Payment, notarized with original signatures, containing all corrections as indicated by The Construction Manager, shall be presented to The Construction Manager no later than the 25th day of the month in quadruplicate. Progress payments and Final applications must be accompanied by Contractor Payment Affidavit, Partial Waiver of Liens, sub-contractor waivers and Certified Payroll for each application for payment from all subcontractors, vendors or suppliers for work through the previous billing period.

Applications shall be submitted by the Construction Manager to the Architect and Owner for final approval by the first (1st) working day of the month. Contractors shall receive payment no later than 45 days from receipt of final applications. All funds will be dispersed by Erie Canal Harbor Development directly to the Contractors.

All deposits and prepayments are the responsibility of each Contractor. Interim waivers of lien and certified payroll records are required for Prime Contractor, subcontractors, vendors, and suppliers with each monthly application for payment. Certified Payrolls are to be submitted directly to ECHDC.

11.2 Changes in the Work

In addition to the requirements of the General Conditions, regarding changes in the work, the following shall also apply.

If the Construction Manager and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, the Contractor must notify The Construction Manager in writing the nature of the dispute and must, if so directed, proceed to complete the change on a time and material basis. Time and material tickets must be submitted daily for a signature by an authorized Construction Manager Representative within 24 hours of performing the work. No overhead or profit will be paid on additional wages paid for overtime work or standby work (contract work). Signed T & M tickets must be submitted for invoicing within 30 days after work is completed. All invoices are to include an itemized breakdown for material and labor. Submit T & M invoices for extra work to The Construction Manager's Project Superintendent and Project Engineer simultaneously.

Changes to the work cannot be billed until the Architect issues a contract change order and has been executed by all parties.

Also see Specification Section 012600, Changes to the Contract for additional procedures and requirements.

11.3 Formula For Changes

Percentage Markup and Procedures Applicable to Work Added to or Omitted from the Original Agreement.

Lump Sum: Predetermined Lump Sum additions and/or deletions to the Agreement are to be based upon the estimated "Net Actual Cost", plus the following maximum percentages for Overhead and Profit. On proposals for decreases in the amount of the contract, the

overhead and profit will be added to the "Net Actual Cost", thereby increasing the credit that would be deducted from the price of this agreement:

Maximum % for Overhead & Profit

	Labor	Material	Sublet Work
Additions:	**15%**	**15%**	**5%**

Minimum % for Overhead & Profit

	Labor	Material	Sublet Work
Deductions:	**15%**	**15%**	**5%**

Time & Material: Additional Work to the Contract, authorized by The Construction Manager in advance to be performed on a Time & Material Basis, is to be based upon the "Net Actual Cost", plus the following percentages for Overhead & Profit:

Maximum % for Overhead & Profit

	Labor	Material	Sublet Work
Additions:	**15%**	**15%**	**5%**

Contractor's **5%** mark on Sublet Work shall be on the total of labor and material only and **excludes** the Subcontractor's mark up.

For each change, for Contractor, Subcontractor or Sub-subcontractor involved, the total aggregate sum mark up for all Contractors shall not exceed 30% of the total direct work costs.

General:

1. Submission of lump sum estimates and costs shall be itemized in a form satisfactory to The Construction Manager to permit ready analysis and evaluation. On Time & Material Work, daily reports to duplicate showing all field and shop labor expended and/or material delivered, shall be submitted to The Construction Manager's Job Staff. Invoices shall be submitted monthly.

2. No overhead & profit will be permitted on the premium time portion of overtime work. Percentages shall apply to net difference in quantities for adds and deducts in any one change

3. Percentages applied by sub-contractors for labor and material shall not exceed those of Contractors.

4. "Net Actual Cost" defined:
   a. Labor
      1. Wages of labor, including foreman and general foreman, engaged in this work and directly on Contractor's payroll.
      2. Engineering and drafting performed with The Construction Manager's prior approval.
      3. Fringe Benefits established by governing trade organizations.
      4. Federal Old Age Benefits, Federal and State Unemployment Taxes.
      5. Net actual premium paid for Public Liability, Workman's Compensation, Property Damage, and any other forms of insurance required by the Owner.

b. Material

1. Net cost of construction materials and supplies delivered to site, including applicable Sales and/or Use Taxes, transportation costs, trade and cash discounts. (Note: Sales Tax is not applicable to transportation costs).

2. Costs of a special nature, approved in advance by The Construction Manager, such as for riggers, labor transportation, equipment rentals, royalties, permits and other expenses of this nature.

5. Percentages shall include the following overhead costs:
   a. Supervision & Executive Expenses (both field and office supervision).
   b. Small tools; incidental scaffolding, blocking, shores; appliances; Contractor's trucks and driver, etc; and the expense of maintaining same.
   c. Administrative expenses – clerical, accounting, etc.; both at the Project and the Contractor's office.
   d. Project Managers, Engineering costs, Shop Drawings, Proposal Preparation Review, Expediting Costs, etc.
   e. Taxes required to be paid by the Contractor, but not included under the aforementioned "Net Actual Cost".
   f. Any other miscellaneous general conditions necessary to complete the Change Order.

6. Percentages shall include all profit.

7. Cost of Bonds, if applicable, are not included in the above percentages (i.e. no overhead and profit is allowed on bond cost). Bonds costs shall be identified as a separate line item on each change order. Proof of bond rates from the bonding company is required prior to payment for additional bond costs. Bond rates for changes are to be provided in a "percent" formula (i.e.: Bond Cost = 2.0%)

11.4 Access to Accounting Records

The Contractor shall check all materials, equipment and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under this Agreement and the system shall be satisfactory to the Owner. The Owner or its representative shall be afforded access to all the Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda and similar data relating to the contract, and the Contractor shall preserve all such records for a period of three years, or for such longer period as may be required by law, after the final payment.

11.5 Final Payment Procedure

The following requirements of the Contract Documents shall be fulfilled for Final Payment authorization:

A. Satisfactory completion of construction work and acceptance by The Construction Manager, Architect, and Owner.

B. Acceptance by The Construction Manager, Architect and Owner of written warranties and maintenance agreements.

C. Acceptance by the Construction Manager and Architect of Record Drawings and "As-builts."

D. Delivery to The Construction Manager of all satisfactory Waiver of Liens upon

Final Payment and Guarantee(s).

E. Delivery to The Construction Manager of a complete list of Sub-contractors and principal vendors with contact name, number and address. Include any applicable account numbers that shall be referenced at time of warranty request.

F. Delivery to The Construction Manager of a complete file of Operations, Training, and Maintenance Manuals.

G. Submission to The Construction Manager of an affidavit of all employees, vendors, and sub-contractors has been paid in full.

H. Submission (when applicable) to The Construction Manager of an affidavit for proof of payment that ALL union dues have been paid in full.

I. Delivery to The Construction Manager of Consent of Surety to reduce and/or release retention.

J. Relief to Owner of attic stock and "extra" materials.

K. Delivery to The Construction Manager of all meter readings for utility services.

L. Delivery to The Construction Manager proof that all taxes, fees, and similar obligations have been paid in full.

M. Acceptance by The Construction Manager, Architect and Owner that all construction equipment, material, etc. has been removed from project site.

N. Acceptance by The Construction Manager, Architect and Owner of final clean-up.

O. Submit Final Payment original of the Application for Payment to The Construction Manager along with AIA Documents: G706 "Contractor Affidavit of Payment of Debts and Claims, G706A "Contractor Affidavit of Release of Liens and G707 "Consent of Surety to Final Payment".

12.0 JOB CLOSE-OUT PROCEDURES

See also Project Closeout Section 017700 in the Project Manual

12.1 Punchlist

Upon substantial completion of a major work area and prior to the Owner taking possession of the space, the Architect will conduct a punch list inspection upon written notification by the Prime Contractors requesting such. The project team will be employing the use of electronic punch list system to generate and complete the punch list. All Contractors shall be required to utilize an online Work to Complete/Punch List program (i.e. Procore, etc.). After receiving a copy of this punch list, the Contractor shall complete corrective action on all items within (30) working days of issuance. When all punch list items have been completed, the contractor shall be required to log in to electronic punch list system to report when the issues have been completed and ready for inspection. The AE / CM will complete a final inspection for verification. Once the job and the area have been accepted by the AE, The Construction Manager and the Owner, final payment procedures will commence.

12.2 Contract Closeout

Before requesting inspection for certification of Substantial Completion, complete the following, and list exceptions in the request. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the Work claimed as substantially complete. Include

supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete. Advise the Construction Manager of pending insurance changeover requirements. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, lien releases, and similar documents. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases. Deliver tools, spare parts, extra stock, and similar items. Advise the Owner's personnel of changeover in security provision.

Complete start-up testing of systems, and instruction (training) of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed. Complete final clean up requirements, including touch-up painting as required.

12.3 Operation and Maintenance Data

The manual shall flag significant points to be observed or attended with the words "Attention:" and a brief description of the notice or action to be taken, separated from main text, in bold or italic type. Where operation poses hazard or risk to the operator, staff, patients, or the facility, the point shall be flagged with the word "Warning:" and a brief description of the hazard or action to be taken, separated from the main text, in bold or italic type. The procedures shall also clearly indicate the limits of work, which may be performed by other than manufacturers or installers' personnel during the warranty period without violating equipment warranties. Contractor shall submit the specified copies. See also Specification Section 017823 for further requirements.

All O&M manuals shall be provided in a ".pdf" format, bookmarked, with a hyperlinked table of contents on the first page. This requirement supersedes the specifications.

12.3 Warranties

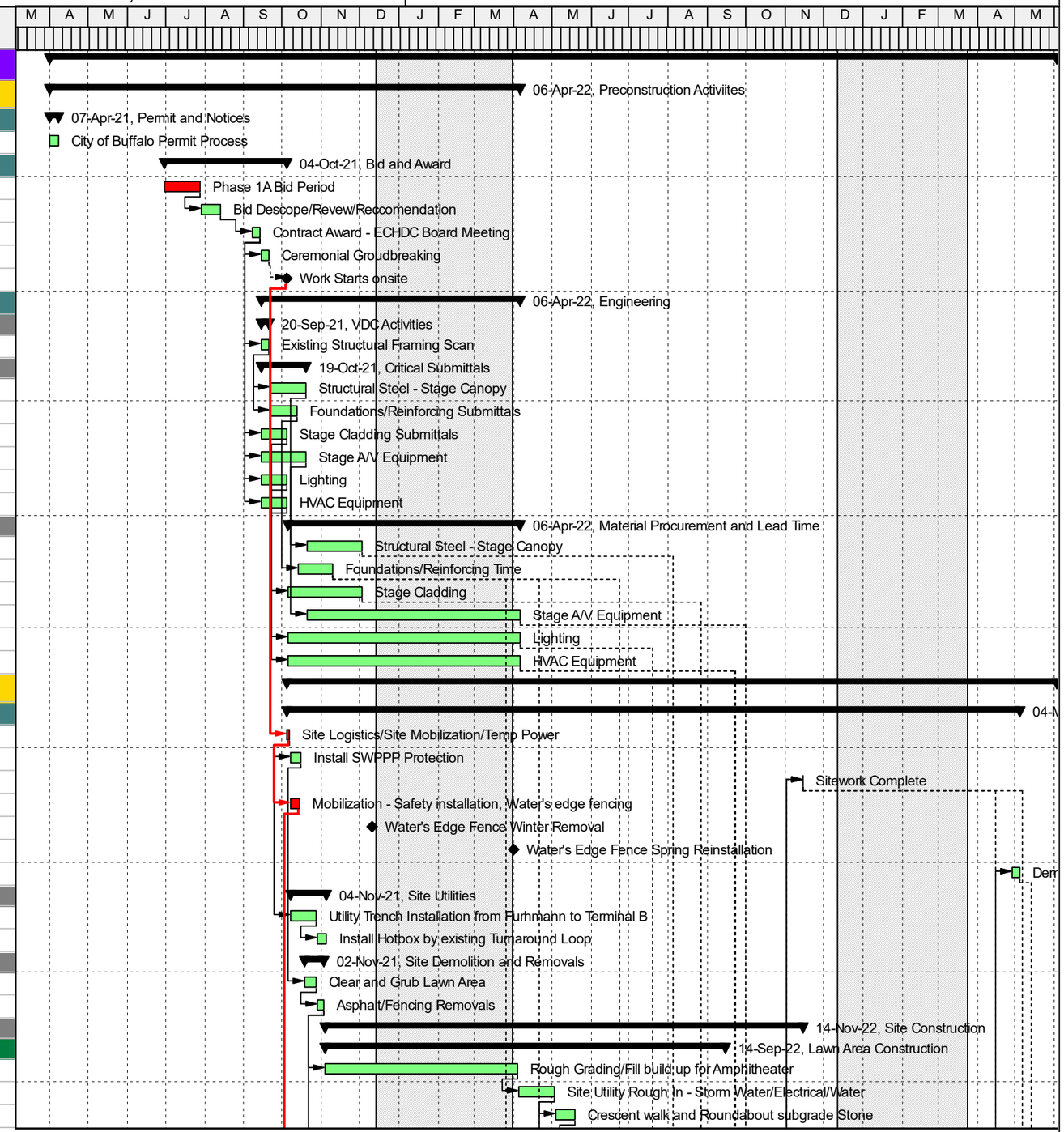
In addition to Section 017700, Warranties specified in the individual Specification Sections are in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents. In all cases, periods of warranties and guaranties shall not commence until the item being warranted or guaranteed is accepted and considered complete.

Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and/or subcontractors required to countersign special warranties with the Contractor

Each Contractor is required to provide the extended warranties for all equipment/materials that has been turned over and accepted by the Owner for use regardless of the phased completion of the project.

END OF SPECIAL PROVISIONS

Activity ID	Activity Name	Original Duration	Start	Finish
ECHDC Outer Harbor PH1		385	01-Apr-21	02-Jun-23
Preconstruction Activiites		179	01-Apr-21	06-Apr-22
Permit and Notices		5	01-Apr-21	07-Apr-21
A1000	City of Buffalo Permit Process	5	01-Apr-21	07-Apr-21
Bid and Award		66	30-Jun-21	04-Oct-21
A1010	Phase 1A Bid Period	20	30-Jun-21*	28-Jul-21
A1020	Bid Descope/Revew/Reccomendation	12	29-Jul-21	13-Aug-21
A1030	Contract Award - ECHDC Board Meeting	5	07-Sep-21	13-Sep-21
A1040	Ceremonial Groudbreaking	5	14-Sep-21	20-Sep-21
A1450	Work Starts onsite	0	04-Oct-21*	
Engineering		65	14-Sep-21	06-Apr-22
VDC Activities		5	14-Sep-21	20-Sep-21
A2140	Existing Structural Framing Scan	5	14-Sep-21	20-Sep-21
Critical Submittals		25	14-Sep-21	19-Oct-21
A1090	Structural Steel - Stage Canopy	20	21-Sep-21	19-Oct-21
A1100	Foundations/Reinforcing Submittals	15	21-Sep-21	12-Oct-21
A1110	Stage Cladding Submittals	15	14-Sep-21	04-Oct-21
A1120	Stage A/V Equipment	25	14-Sep-21	19-Oct-21
A1130	Lighting	15	14-Sep-21	04-Oct-21
A1140	HVAC Equipment	15	14-Sep-21	04-Oct-21
Material Procurement and Lead Time		50	05-Oct-21	06-Apr-22
A2080	Structural Steel - Stage Canopy	30	20-Oct-21	02-Dec-21
A2090	Foundations/Reinforcing Time	20	13-Oct-21	09-Nov-21
A2100	Stage Cladding	40	05-Oct-21	02-Dec-21
A2110	Stage A/V Equipment	40	20-Oct-21	06-Apr-22
A2120	Lighting	50	05-Oct-21	06-Apr-22
A2130	HVAC Equipment	50	05-Oct-21	06-Apr-22
Construction Activities		257	04-Oct-21	02-Jun-23
Site Construction - Terminal B		237	04-Oct-21	04-May-23
A1050	Site Logistics/Site Mobilization/Temp Power	3	04-Oct-21	06-Oct-21
A1060	Install SWPPP Protection	6	07-Oct-21	15-Oct-21
A1440	Sitework Complete	0	15-Nov-22	15-Nov-22
A1455	Mobilization - Safety installation, Water's edge	5	07-Oct-21	14-Oct-21
A1465	Water's Edge Fence Winter Removal	0		10-Dec-21*
A1475	Water's Edge Fence Spring Reinstallation	0	01-Apr-22*	
A1485	Demobilize Site - SWPPP Removal, Site Fence	5	28-Apr-23	04-May-23
Site Utilities		20	07-Oct-21	04-Nov-21
A1070	Utility Trench Installation from Furhmann to Ter	14	07-Oct-21	27-Oct-21
A1080	Install Hotbox by existing Turnaround Loop	6	28-Oct-21	04-Nov-21
Site Demolition and Removals		12	18-Oct-21	02-Nov-21
A1180	Clear and Grub Lawn Area	8	18-Oct-21	27-Oct-21
A1190	Asphalt/Fencing Removals	4	28-Oct-21	02-Nov-21
Site Construction		182	03-Nov-21	14-Nov-22
Lawn Area Construction		141	03-Nov-21	14-Sep-22
A1200	Rough Grading/Fill build up for Amphitheater	28	03-Nov-21	04-Apr-22
A1210	Site Utility Rough In - Storm Water/Electrical/W	20	05-Apr-22	03-May-22
A1370	Crescent walk and Roundabout subgrade Stor	12	04-May-22	19-May-22



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

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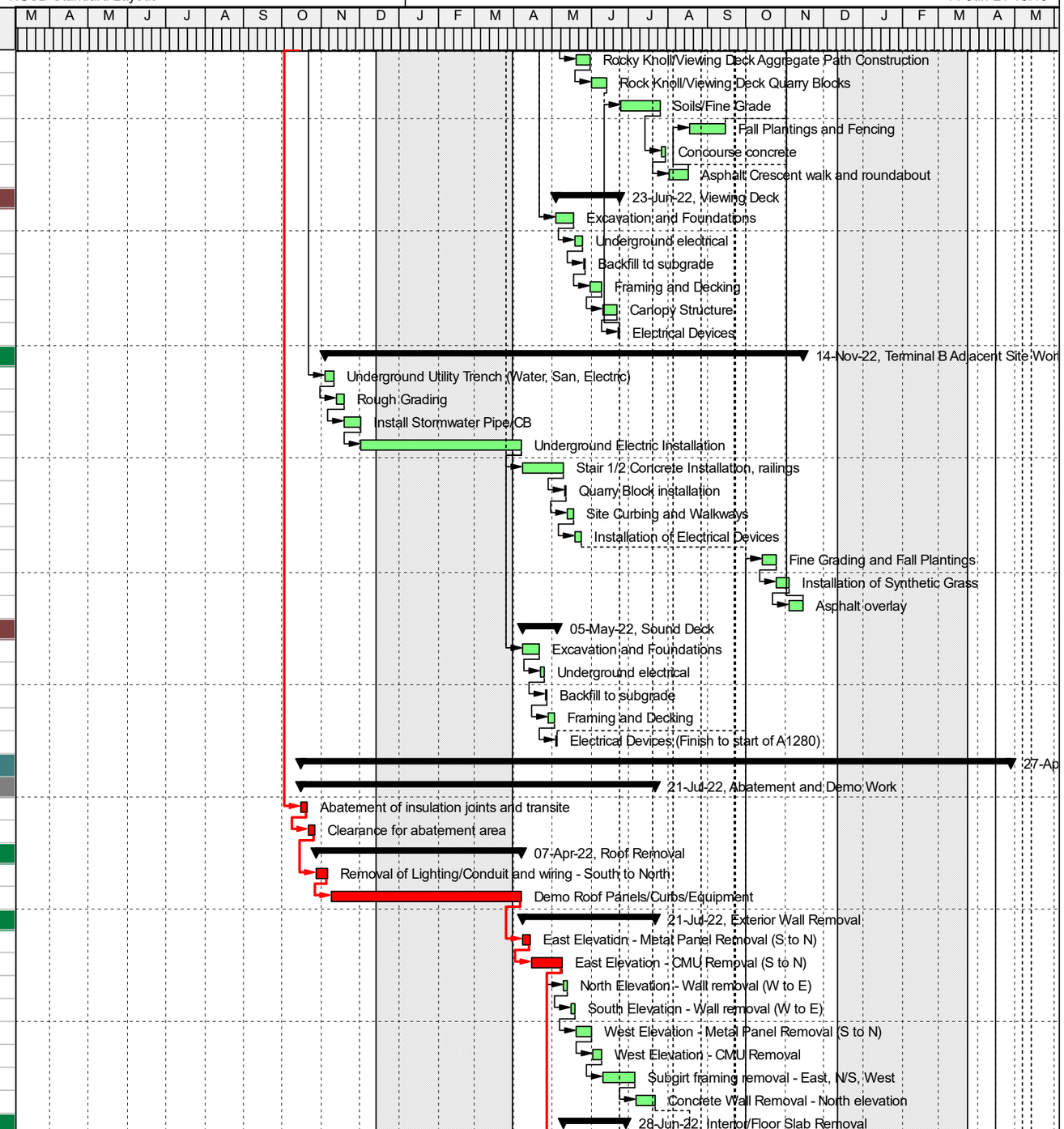
Activity ID	Activity Name	Original Duration	Start	Finish
A1380	Rocky Knoll/Viewing Deck Aggregate Path Con	7	20-May-22	31-May-22
A1390	Rock Knoll/Viewing Deck Quarry Blocks	9	01-Jun-22	13-Jun-22
A1400	Soils/Fine Grade	21	24-Jun-22	25-Jul-22
A1410	Fall Plantings and Fencing	20	17-Aug-22	14-Sep-22
A1420	Concourse concrete	4	26-Jul-22	29-Jul-22
A1430	Asphalt Crescent walk and roundabout	12	01-Aug-22	16-Aug-22
Viewing Deck		**36**	**04-May-22**	**23-Jun-22**
A1150	Excavation and Foundations	11	04-May-22	18-May-22
A1153	Underground electrical	5	19-May-22	25-May-22
A1155	Backfill to subgrade	2	26-May-22	27-May-22
A1160	Framing and Decking	8	31-May-22	09-Jun-22
A1170	Canopy Structure	8	10-Jun-22	21-Jun-22
A1360	Electrical Devices	2	22-Jun-22	23-Jun-22
Terminal B Adjacent Site Work		**182**	**03-Nov-21**	**14-Nov-22**
A1215	Underground Utility Trench (Water, San, Electric	6	03-Nov-21	10-Nov-21
A1220	Rough Grading	5	12-Nov-21	18-Nov-21
A1230	Install Stormwater Pipe/CB	8	19-Nov-21	01-Dec-21
A1235	Underground Electric Installation	12	02-Dec-21	07-Apr-22
A1240	Stair 1/2 Concrete Installation, railings	22	08-Apr-22	10-May-22
A1250	Quarry Block installation	2	11-May-22	12-May-22
A1260	Site Curbing and Walkways	4	13-May-22	18-May-22
A1270	Installation of Electrical Devices	4	19-May-22	24-May-22
A1280	Fine Grading and Fall Plantings	7	14-Oct-22	24-Oct-22
A1290	Installation of Synthetic Grass	8	25-Oct-22	03-Nov-22
A1300	Asphalt overlay	6	04-Nov-22	14-Nov-22
Sound Deck		**19**	**08-Apr-22**	**05-May-22**
A1310	Excavation and Foundations	9	08-Apr-22	21-Apr-22
A1320	Underground electrical	2	22-Apr-22	25-Apr-22
A1330	Backfill to subgrade	2	26-Apr-22	27-Apr-22
A1340	Framing and Decking	4	28-Apr-22	03-May-22
A1350	Electrical Devices (Finish to start of A1280)	2	04-May-22	05-May-22
Terminal B Work		**224**	**15-Oct-21**	**27-Apr-23**
Abatement and Demo Work		**116**	**15-Oct-21**	**21-Jul-22**
A1460	Abatement of insulation joints and transite	4	15-Oct-21	20-Oct-21
A1470	Clearance for abatement area	4	21-Oct-21	26-Oct-21
Roof Removal		**36**	**27-Oct-21**	**07-Apr-22**
A1480	Removal of Lighting/Conduit and wiring - Sout	8	27-Oct-21	05-Nov-21
A1490	Demo Roof Panels/Curbs/Equipment	28	08-Nov-21	07-Apr-22
Exterior Wall Removal		**72**	**08-Apr-22**	**21-Jul-22**
A1500	East Elevation - Metal Panel Removal (S to N)	5	08-Apr-22	14-Apr-22
A1510	East Elevation - CMU Removal (S to N)	16	15-Apr-22	09-May-22
A1540	North Elevation - Wall removal (W to E)	4	10-May-22	13-May-22
A1550	South Elevation - Wall removal (W to E)	4	16-May-22	19-May-22
A1560	West Elevation - Metal Panel Removal (S to N)	8	20-May-22	01-Jun-22
A1570	West Elevation - CMU Removal	6	02-Jun-22	09-Jun-22
A1590	Subgirt framing removal - East, N/S, West	17	10-Jun-22	05-Jul-22
A1600	Concrete Wall Removal - North elevation	12	06-Jul-22	21-Jul-22
Interior/Floor Slab Removal		**35**	**10-May-22**	**28-Jun-22**



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

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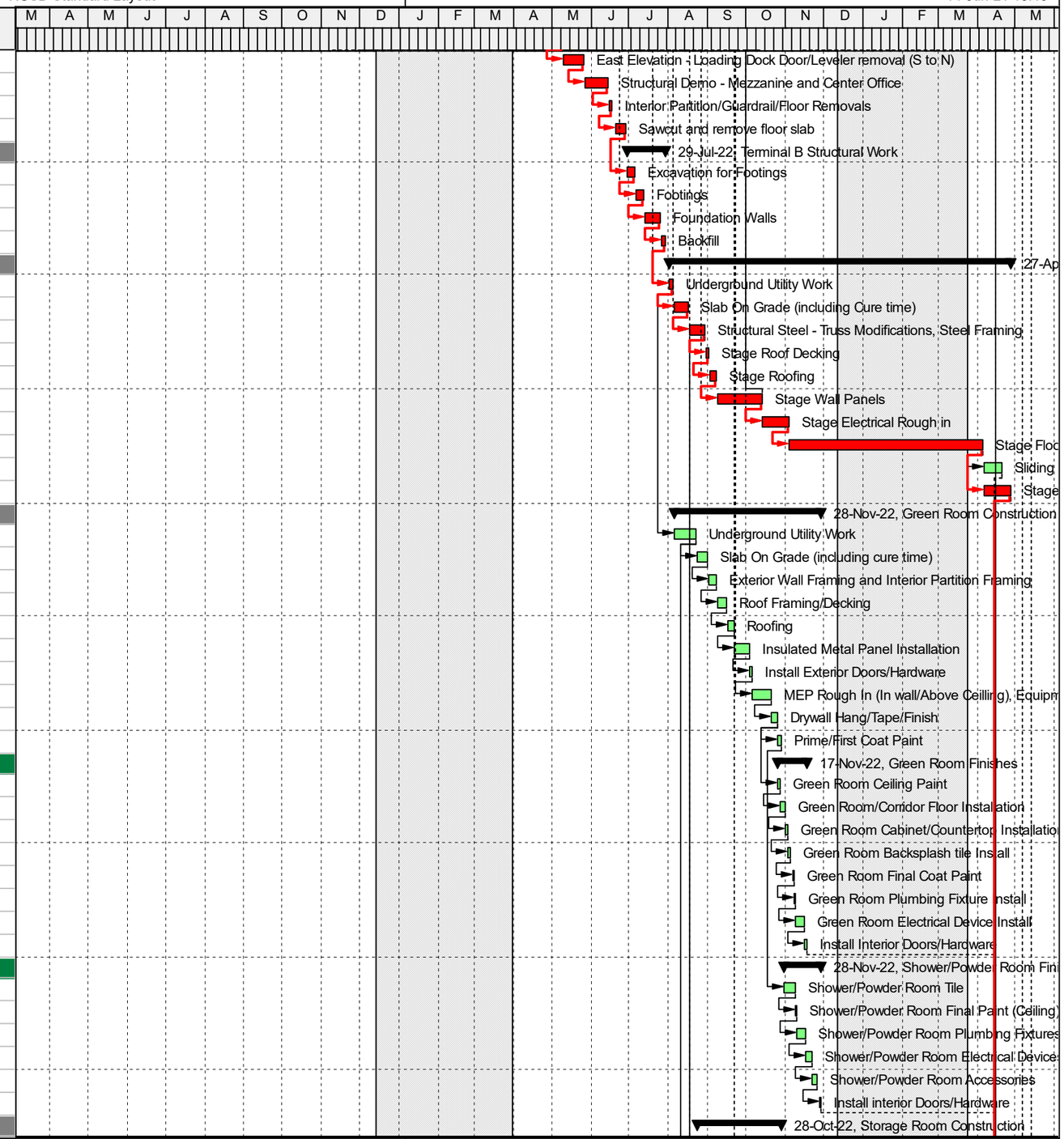
Activity ID	Activity Name	Original Duration	Start	Finish
A1520	East Elevation - Loading Dock Door/Leveler rer	13	10-May-22	26-May-22
A1525	Structural Demo - Mezzanine and Center Offic	12	27-May-22	14-Jun-22
A1530	Interior Partition/Guardrail/Floor Removals	3	15-Jun-22	17-Jun-22
A1580	Sawcut and remove floor slab	7	20-Jun-22	28-Jun-22
Terminal B Structural Work		**22**	**29-Jun-22**	**29-Jul-22**
A1610	Excavation for Footings	4	29-Jun-22	05-Jul-22
A1620	Footings	5	06-Jul-22	12-Jul-22
A1630	Foundation Walls	9	13-Jul-22	25-Jul-22
A1640	Backfill	4	26-Jul-22	29-Jul-22
Stage Construction		**102**	**01-Aug-22**	**27-Apr-23**
A1645	Underground Utility Work	4	01-Aug-22	04-Aug-22
A1650	Slab On Grade (including Cure time)	8	05-Aug-22	16-Aug-22
A1660	Structural Steel - Truss Modifications, Steel Fra	9	17-Aug-22	29-Aug-22
A1980	Stage Roof Decking	3	30-Aug-22	01-Sep-22
A1990	Stage Roofing	3	02-Sep-22	07-Sep-22
A2000	Stage Wall Panels	25	08-Sep-22	13-Oct-22
A2010	Stage Electrical Rough in	15	14-Oct-22	03-Nov-22
A2020	Stage Floor Construction	20	04-Nov-22	05-Apr-23
A2030	Sliding Partition Installation	10	06-Apr-23	20-Apr-23
A2180	Stage Final Electrical A/V Installation	15	06-Apr-23	27-Apr-23
Green Room Construction		**78**	**05-Aug-22**	**28-Nov-22**
A1670	Underground Utility Work	12	05-Aug-22	22-Aug-22
A1690	Slab On Grade (including cure time)	7	23-Aug-22	31-Aug-22
A1710	Exterior Wall Framing and Interior Partition Frar	4	01-Sep-22	07-Sep-22
A1720	Roof Framing/Decking	6	08-Sep-22	15-Sep-22
A1725	Roofing	4	16-Sep-22	21-Sep-22
A1730	Insulated Metal Panel Installation	8	22-Sep-22	03-Oct-22
A1735	Install Exterior Doors/Hardware	2	04-Oct-22	05-Oct-22
A1740	MEP Rough In (In wall/Above Ceilling), Equipm	10	06-Oct-22	20-Oct-22
A1750	Drywall Hang/Tape/Finish	3	21-Oct-22	25-Oct-22
A1760	Prime/First Coat Paint	3	26-Oct-22	28-Oct-22
Green Room Finishes		**16**	**26-Oct-22**	**17-Nov-22**
A1810	Green Room Ceiling Paint	2	26-Oct-22	27-Oct-22
A1820	Green Room/Corridor Floor Installation	2	28-Oct-22	31-Oct-22
A1830	Green Room Cabinet/Countertop Installation	2	01-Nov-22	02-Nov-22
A1840	Green Room Backsplash tile Install	2	03-Nov-22	04-Nov-22
A1845	Green Room Final Coat Paint	1	07-Nov-22	07-Nov-22
A1850	Green Room Plumbing Fixture Install	1	08-Nov-22	08-Nov-22
A1860	Green Room Electrical Device Install	4	09-Nov-22	15-Nov-22
A1870	Install Interior Doors/Hardware	2	16-Nov-22	17-Nov-22
Shower/Powder Room Finishes		**19**	**31-Oct-22**	**28-Nov-22**
A1770	Shower/Powder Room Tile	7	31-Oct-22	08-Nov-22
A1775	Shower/Powder Room Final Paint (Ceiling)	1	09-Nov-22	09-Nov-22
A1780	Shower/Powder Room Plumbing Fixtures	4	10-Nov-22	16-Nov-22
A1790	Shower/Powder Room Electrical Devices	3	17-Nov-22	21-Nov-22
A1800	Shower/Powder Room Accessories	3	22-Nov-22	25-Nov-22
A1880	Install interior Doors/Hardware	1	28-Nov-22	28-Nov-22
Storage Room Construction		**47**	**23-Aug-22**	**28-Oct-22**



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

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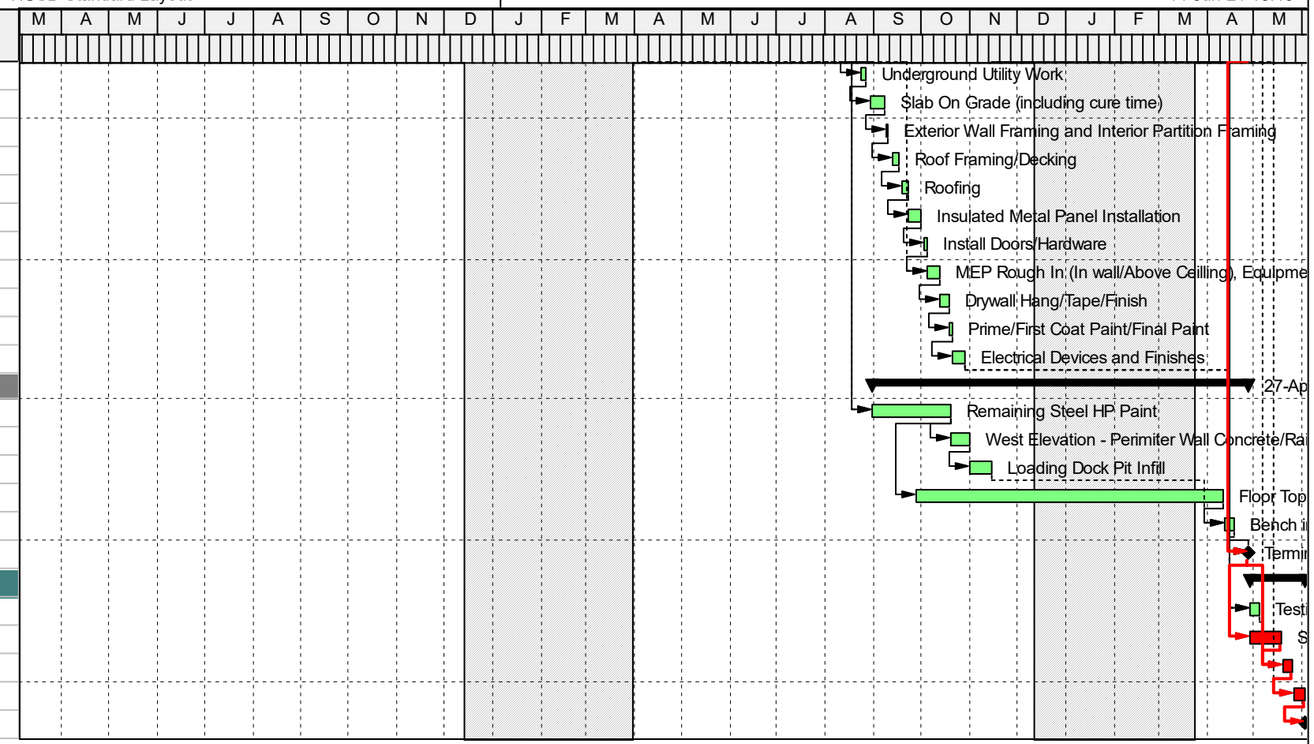
Activity ID	Activity Name	Original Duration	Start	Finish
A1680	Underground Utility Work	4	23-Aug-22	26-Aug-22
A1700	Slab On Grade (including cure time)	7	29-Aug-22	07-Sep-22
A1890	Exterior Wall Framing and Interior Partition Frar	2	08-Sep-22	09-Sep-22
A1900	Roof Framing/Decking	5	12-Sep-22	16-Sep-22
A1910	Roofing	4	19-Sep-22	22-Sep-22
A1920	Insulated Metal Panel Installation	6	23-Sep-22	30-Sep-22
A1930	Install Doors/Hardware	2	03-Oct-22	04-Oct-22
A1940	MEP Rough In (In wall/Above Ceilling), Equipm	5	05-Oct-22	12-Oct-22
A1950	Drywall Hang/Tape/Finish	4	13-Oct-22	18-Oct-22
A1960	Prime/First Coat Paint/Final Paint	2	19-Oct-22	20-Oct-22
A1970	Electrical Devices and Finishes	6	02-Jun-23	28-Oct-22
General Terminal B Work		81	30-Aug-22	27-Apr-23
A2035	Remaining Steel HP Paint	35	30-Aug-22	19-Oct-22
A2040	West Elevation - Perimiter Wall Concrete/Railin	8	20-Oct-22	31-Oct-22
A2050	Loading Dock Pit Infill	9	01-Nov-22	14-Nov-22
A2060	Floor Topping Slab and Floor Finish	50	28-Sep-22	11-Apr-23
A2070	Bench installation	4	12-Apr-23	18-Apr-23
A2150	Terminal B construction Substantial Completior	0		27-Apr-23
Closeout Activities		25	28-Apr-23	02-Jun-23
A2155	Testing/Balancing/Commissioning	5	28-Apr-23	04-May-23
A2157	Spring Plantings/Final Sitework	15	28-Apr-23	18-May-23
A2160	Punchlist	5	19-May-23	25-May-23
A2170	Code Inspecitons/CO	5	26-May-23	02-Jun-23
A2190	Project Complete	0		02-Jun-23



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

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ECHDC Outer Harbor Phase 1A

Date: 6/14 Rev No: 0

- Site Logistics Plan-

Date: 6/14/21

Author: TCCo

- SL-1 -

Erie Canal Harbor Development
Phase 1A
Buffalo Outer Harbor

Turner 5/28//21

EXHIBIT C - SPECIFICATION MATRIX

BID PACKAGE BREAKDOWN

BP / Spec Number	Bid Package/ Spec Description	Comments / **Bid Analyst**
1	**BP-1 - Site Construction**	**All**
	DIV 00 & 01: Bidding, Contract, & General Requirements	Shared
24119	SELECTIVE DEMOLITION	Shared
33000	CAST-IN-PLACE CONCRETE	Shared
316213	STEEL PILES	Exclusive
321723	PAVEMENT MARKINGS	Exclusive
323113	CHAIN LINK FENCING AND GATES	Shared
323300	SITE FURNISHINGS	Shared
330500	COMMON WORK RESULTS FOR UTILITIES	Shared
17419	EXCAVATED SOIL AND CONSTRUCTION WASTE MANAGEMENT AND DISP	Shared
44100	DRY LAID STONE	Exclusive
101400	SIGNAGE	Shared
221113	FACILITY WATER DISTRIBUTION PIPING	Shared
221118	DOMESTIC WATER PIPING SPECIALTIES	Shared
224713	DRINKING FOUNTAINS	Shared
311000	SITE CLEARING	Exclusive
312000	EARTH MOVING	Exclusive
312513	EROSION AND SEDIMENT CONTROL	Exclusive
321216	ASPHALT PAVING	Exclusive
321313	CONCRETE PAVING	Exclusive
321315	PERVIOUS CONCRETE PAVING	Exclusive
321543	POLYMER BASED DECOMPOSED GRANITE PAVING	Exclusive
321816	SYNTHETIC GRASS SURFACING SYSTEM	Exclusive
323113	FENCES AND GATES	Exclusive
329113	SOIL PREPARATION	Exclusive
329200	TURF AND GRASSES	Exclusive
329300	PLANTS	Exclusive
333913	MANHOLES AND DRAINAGE STRUCTURES	Exclusive
334104	CORRUGATED POLYETHYLENE STORM DRAIN PIPE	Exclusive
334105	PLASTIC STORM DRAINAGE PIPE	Exclusive
2	**BP-2 - General Trades**	**All**
	DIV 00 & 01: Bidding, Contract, & General Requirements	Shared
24119	SELECTIVE DEMOLITION	Shared
28213	ASBESTOS ABATEMENT	Exclusive
28214	PROTECTION OF WORKER – LEAD BASED PAINT	Exclusive
31000	CONCRETE FORMING AND ACCESSORIES	Exclusive
32000	CONCRETE REINFORCING	Exclusive
33000	CAST-IN-PLACE CONCRETE	Shared
33543	POLISHED CONCRETE FINISHING	Exclusive
51200	STRUCTURAL STEEL FRAMING	Exclusive
53100	STEEL DECKING	Exclusive
54000	COLD-FORMED METAL FRAMING	Exclusive
55000	METAL FABRICATIONS	Exclusive
55119	METAL GRATING STAIRS	Exclusive
55213	PIPE AND TUBE RAILINGS	Exclusive
55316	PLANK GRATINGS	Exclusive
57000	DECORATIVE METAL	Exclusive
57300	DECORATIVE METAL RAILINGS	Exclusive

61000	ROUGH CARPENTRY	Exclusive
61533	WOOD PATIO DECKING	Exclusive
61600	SHEATHING	Exclusive
64116	PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS	Exclusive
72100	THERMAL INSULATION	Exclusive
72600	VAPOR RETARDERS	Exclusive
74113	FORMED METAL PANELS	Exclusive
74213	INSULATED METAL WALL PANELS	Exclusive
75323	ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING	Exclusive
76200	SHEET METAL FLASHING AND TRIM	Exclusive
77100	ROOF SPECIALTIES	Exclusive
77200	ROOF ACCESSORIES	Exclusive
77253	SNOW GUARDS	Shared
79200	JOINT SEALANTS	Exclusive
79219	ACOUSTICAL JOINT SEALANTS	Exclusive
79513	PARKING DECK EXPANSION JOINT COVER ASSEMBLIES	Exclusive
81113	HOLLOW METAL DOORS AND FRAMES	Exclusive
81416	FLUSH WOOD DOORS	Exclusive
83113	ACCESS DOORS AND FRAMES	Shared
83323	OVERHEAD COILING DOORS	Exclusive
87100	DOOR HARDWARE	Exclusive
88300	MIRRORS	Exclusive
92216	NON-STRUCTURAL METAL FRAMING	Exclusive
92900	GYPSUM BOARD	Exclusive
93013	CERAMIC TILING	Exclusive
95113	ACOUSTICAL PANEL CEILINGS	Exclusive
96513	RESILIENT BASE AND ACCESSORIES	Exclusive
97720	FIBERGLASS REINFORCED WALL PANELS	Exclusive
99113	EXTERIOR PAINTING	Exclusive
99123	INTERIOR PAINTING	Exclusive
102800	TOILET, BATH, AND LAUNDRY ACCESSORIES	Exclusive
104413	FIRE PROTECTION CABINETS	Exclusive
104416	FIRE EXTINGUISHERS	Exclusive
111200	DOCK CONTROL EQUIPMENT	Exclusive
111313	DOCK BUMPERS	Exclusive
113013	RESIDENTIAL APPLIANCES	Exclusive
122200	CURTAINS AND DRAPES	Exclusive
123661	SOLID SURFACING COUNTERTOPS	Exclusive
284621	ADDRESSABLE FIRE ALARMS SYSTEMS	Exclusive
315000	EXCAVATION SUPPORT AND PROTECTION	Exclusive
323113	CHAIN LINK FENCING AND GATES	Shared
323300	SITE FURNISHINGS	Shared
17419	EXCAVATED SOIL AND CONSTRUCTION WASTE MANAGEMENT AND DISP	Shared
31100	CONCRETE FORMWORK	Exclusive
32100	STEEL CONCRETE REINFORCMENT	Exclusive
33001	CAST-IN-PLACE CONCRETE	Exclusive
51201	STRUCTURAL STEEL	Exclusive
55001	METAL FABRICATIONS	Exclusive
61001	ROUGH CARPENTRY	Exclusive
61500	WOOD DECKING	Exclusive
101400	SIGNAGE	Shared
3	**BP-3 - Mechanical Trades**	**All**

	DIV 00 & 01: Bidding, Contract, & General Requirements	Shared
24119	SELECTIVE DEMOLITION	Shared
77253	SNOW GUARDS	Shared
83113	ACCESS DOORS AND FRAMES	Shared
220500	COMMON WORK RESULTS FOR PLUMBING	Exclusive
220517	SLEEVES AND SEALS FOR PLUMBING PIPING	Exclusive
220519	METERS AND GAGES FOR PLUMBING PIPING	Exclusive
220523	GENERAL DUTY VALVES FOR PLUMBING PIPING	Exclusive
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	Exclusive
220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT	Exclusive
220700	PLUMBING INSULATION	Exclusive
221112	FACILITY WATER DISTRIBUTION PIPING	Exclusive
221116	DOMESTIC WATER PIPING	Exclusive
221119	DOMESTIC WATER PIPING SPECIALTIES	Exclusive
221313	FACILITY SANITARY SEWER	Exclusive
221316	SANITARY WASTE AND VENT PIPING	Exclusive
221319	SANITARY WASTE PIPING SPECIALTIES	Exclusive
221413	FACILITY STORM DRAINAGE PIPING	Exclusive
221423	STORM DRAINAGE PIPING SPECIALTIES	Exclusive
223400	ELECTRIC DOMESTIC-WATER HEATERS	Exclusive
224000	PLUMBING FIXTURES	Exclusive
224700	WATER COOLERS	Exclusive
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	Exclusive
230548	VIBRATION CONTROLS FOR HVAC	Exclusive
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	Exclusive
230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC	Exclusive
230713	DUCT INSULATION	Exclusive
233113	METAL DUCTS	Exclusive
233300	AIR DUCT ACCESSORIES	Exclusive
233713	AIR DIFFUSERS	Exclusive
233713	REGISTERS AND GRILLES	Exclusive
237219	FIXED PLATE AIR-TO-AIR ENERGY RECOVERY UNITS	Exclusive
238126	SPLIT-SYSTEM AIR-CONDITIONERS	Exclusive
238239	PROPELLER UNIT HEATERS	Exclusive
238323	RADIANT-HEATING ELECTRIC PANELS	Exclusive
330500	COMMON WORK RESULTS FOR UTILITIES	Shared
4	**BP-4 - Electrical**	**All**
	DIV 00 & 01: Bidding, Contract, & General Requirements	Shared
24119	SELECTIVE DEMOLITION	Shared
77253	SNOW GUARDS	Shared
83113	ACCESS DOORS AND FRAMES	Shared
260100	BASIC ELECTRICAL MATERIALS AND METHODS	Exclusive
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	Exclusive
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	Exclusive
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	Exclusive
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS	Exclusive
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLI	Exclusive
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS	Exclusive
260923	LIGHTING CONTROL DEVICES	Exclusive
262213	LOW-VOLTAGE DISTRIBUTION TRANSFORMERS	Exclusive
262416	PANELBOARDS	Exclusive
262726	WIRING DEVICES	Exclusive

262733	POWER DISTRIBUTION UNITS	Exclusive
264113	LIGHTNING PROTECTION FOR STRUCTURES	Exclusive
265119	LED INTERIOR LIGHTING	Exclusive
265213	EMERGENCY AND EXIT LIGHTING	Exclusive
265556	SPECIAL LIGHTING AND CONTROL SYSTEMS	Exclusive
265619	LED EXTERIOR LIGHTING	Exclusive
267650	PERFORMANCE SOUND SYSTEMS	Exclusive
271100	COMMUNICATIONS EQUIPMENT ROOM FITTINGS	Exclusive
271116	COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES	Exclusive
271313	COMMUNICATIONS COPPER BACKBONE CABLING	Exclusive
271323	COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING	Exclusive
271513	COMMUNICATIONS COPPER HORIZONTAL CABLING	Exclusive
271523	COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING	Exclusive
330500	COMMON WORK RESULTS FOR UTILITIES	Shared
221113	FACILITY WATER DISTRIBUTION PIPING	Shared
221118	DOMESTIC WATER PIPING SPECIALTIES	Shared
224713	DRINKING FOUNTAINS	Shared
260518	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	Exclusive
260523	CONTROL-VOLTAGE ELECTRICAL POWER CABLES	Exclusive
260525	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	Exclusive
260543	UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS	Exclusive
260552	IDENTIFICATION FOR ELECTRICAL SYSTEMS	Exclusive
260922	LIGHTING CONTROL DEVICES	Exclusive
260943	ADDRESSABLE LUMINAIRE LIGHTING CONTROLS	Exclusive
262725	WIRING DEVICES	Exclusive
265613	LIGHTING POLES AND STANDARDS	Exclusive
265618	LED EXTERIOR LIGHTING	Exclusive

SECTION 011200 - MULTIPLE CONTRACT SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.

C. Related Requirements:

1. Section 011000 "Summary" for the Work covered by the Contract Documents, restrictions on use of Project site, coordination with occupants, and work restrictions.
2. Section 013100 "Project Management and Coordination" for general coordination requirements.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.4 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
2. Trenches and other excavation for the work of each contract shall be the work of each contract for its own work.
3. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of the General Construction Contract.

4. Furnishing of access panels for the work of each contract shall be the work of each contract for its own work. Installation of access panels shall be the work of the General Construction Contract.
5. Equipment pads for the work of each contract shall be the work of the General Construction Contract.
6. Roof-mounted equipment curbs for the work of each contract shall be the work of the General Construction Contract.
7. Painting for the work of each contract shall be the work of each contract for its own work.
8. Cutting and Patching: Each contract shall perform its own cutting; patching shall be under the General Construction Contract.
9. Through-penetration firestopping for the work of each contract shall be provided by each contract for its own work.
10. Contractors' Startup Construction Schedule: Within five <> working days after startup horizontal bar-chart-type construction schedule submittal has been received from Construction Manager, submit a matching startup horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.

B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the work.

1. The Construction Manager shall coordinate substitutions.

C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Section 015000 "Temporary Facilities and Controls," each contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own field office, complete with necessary furniture, utilities, and telephone service.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. Staging and scaffolding for its own construction activities.
7. General hoisting facilities for its own construction activities, up to 2 tons (2000 kg).
8. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
9. Progress cleaning of work areas affected by its operations on a daily basis.
10. Secure lockup of its own tools, materials, and equipment.
11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

D. Temporary Heating, Cooling, and Ventilation: The HVAC Contract is responsible for temporary heating, cooling, and ventilation, including utility-use charges, temporary meters, and temporary connections.

E. Use Charges: Comply with the following:

1. Sewer Service: Include the cost for sewer service use by all parties engaged in construction activities at Project site in the General Construction Contract.
2. Water Service: Include the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site in the Plumbing Contract.
3. Electric Power Service: Include the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site in the Electrical Contract.

1.5 GENERAL CONSTRUCTION CONTRACT

A. Work of the General Construction Contract includes, but is not limited to, the following:

1. Remaining work not identified as work under other contracts.
2. Selective demolition.
3. Foundations, including footings, foundation walls, and piles.
4. Slabs-on-grade, including earthwork, subdrainage systems, and insulation.
5. Below-grade building construction, including excavation, backfill, and insulation and waterproofing/dampproofing.
6. Superstructure, including floor and roof construction.
7. Exterior closure, including walls, parapets, doors, windows.
8. Roofing, including roof insulation, coverings, flashings roof specialties and roof accessories.
9. Interior construction, including partitions, doors, and fittings.
10. Fire-protection specialties.
11. Stairs, including railings and finishes.
12. Interior floor and ceiling finishes.
13. Miscellaneous items, including concrete equipment bases.
14. Equipment, including the following:

    a. Stage equipment.
    b. Residential appliances.

15. Furnishings, including casework and seating.

B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:

1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract HVAC Contract Electrical Contract and Site Work Contract.
2. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
3. Temporary enclosure for building exterior, except as indicated.
4. Excavation support and protection, unless required solely for the Work of another contract.
5. Special or unusual hoisting requirements for construction activities, including hoisting loads in excess of 2 tons (2000 kg), hoisting material or equipment into spaces below grade, and hoisting requirements outside building enclosure.
6. Project identification and temporary signs.

7. General waste disposal facilities.
8. Pest control.
9. Temporary stairs.
10. Temporary fire-protection facilities.
11. Barricades, warning signs, and lights.
12. Covered walkways.
13. Security enclosure and lockup.
14. Environmental protection.
15. Maintenance and restoration of Owner's existing facilities used as temporary facilities.

C. Refer to Section 011200.2 “Scope of Work – General Trades Contract PH1A-102” for additional scope of work information.

1.6 MECHANICAL TRADES

A. Work of the Mechanical Trades Contract includes, but is not limited to, the following:

1. HVAC systems and equipment.
2. HVAC instrumentation and controls.
3. HVAC testing, adjusting, and balancing.
4. Building automation system.
5. Mechanical connections to equipment furnished by the General Construction Contract, Mechanical Trades Contract, and Electrical Contract.
6. Plumbing fixtures.
7. Domestic water distribution.
8. Sanitary waste.
9. Stormwater drainage.
10. Plumbing connections to equipment furnished by the General Construction Contract and Mechanical Trades Contract.

B. Temporary facilities and controls in the Plumbing Contract include, but are not limited to, the following:

1. Piped sewerage and drainage.
2. Piped gas service.
3. Piped water service.

C. Refer to Section 011200.3 “Scope of Work – Mechanical Trades Contract PH1A-103” for additional scope of work information.

1.7 ELECTRICAL CONTRACT

A. Work of the Electrical Contract includes, but is not limited to, the following:

1. Electrical service and distribution.
2. Exterior and interior lighting.
3. Communication and security.
4. Special electrical systems, including the following:

a. Uninterruptible power supply systems.
b. Lightning protection systems.
c. Audio Visual Equipment

5. Electrical connections to equipment furnished by the General Construction Contract Plumbing Contract HVAC Contract Electrical Contract and Site Work Contract.

B. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:

1. Electric power service and distribution.
2. Lighting, including site lighting.
3. Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction Contract Plumbing Contract Electrical Contract and Site Work Contract.

C. Refer to Section 011200.4 “Scope of Work – Electrical Contract PH1A-104” for additional scope of work information.

1.8 SITE WORK CONTRACT

A. Work of the General Construction Contract includes, but is not limited to, the following:

1. Site preparation, including clearing, building demolition and relocations, and earthwork.
2. Site improvements, including roadways, parking lots, pedestrian paving, site development furnishings and equipment, and landscaping.
3. Tunnels for site utilities.
4. Site water supply and distribution.
5. Site sanitary sewerage.
6. Site storm drainage.
7. Site fuel distribution.
8. Site special plumbing systems.
9. Site electrical distribution.
10. Site lighting and light poles.
11. Site communications and security.
12. Foundations, including footings, foundation walls, and piles for site structures and light poles.
13. Superstructure, including floor and roof construction for site structures.
14. Site stairs, including railings and finishes.

B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:

1. Sediment and erosion control.
2. Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
3. Stormwater control.
4. Temporary roads and paved areas.
5. Dewatering facilities and drains.

6. Excavation support and protection, unless required solely for the Work of another contract.
7. Special or unusual hoisting requirements for construction activities, including hoisting loads in excess of 2 tons (2000 kg), hoisting material or equipment into spaces below grade, and hoisting requirements outside building enclosure.
8. Site enclosure fence.
9. Security enclosure and lockup.
10. Environmental protection.

C. Refer to Section 011200.1 “Scope of Work – Site Contract PH1A-101” for additional scope of work information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 011200.1 SITEWORK CONTRACT PH1A-01
SCOPE OF WORK

1. **Scope of Work:**

The Work of this Agreement shall include, but not be limited to, all labor, materials, tools, equipment, plant, supplies, shop drawings, layout, transportation, supervision, contributions, insurance compliance with all agencies (Town, County, State and Federal as may be required), and shall cover all other items necessary for the performance of the **SITEWORK Contract** as shown detailed and/or implied by the following documents and as defined herein. This requisition is intended to supplement the Contract Specifications and drawings and must be used in coordination with these documents to fully understand the Scope of Work. Requirements given in one area thus are applicable to all. This requisition does not generally repeat scope requirements given in the Contract Documents but clarifies and coordinates the work. Work in the Documents repeated here is for specific coordination purposes.

If a direct conflict exists between this requisition and direction on the documents, this requisition shall govern.

The Scope of the SITEWORK Contract – PH1A-01 includes, but is not limited to, providing the following:

The scope of your work is generally defined as all work included in specification sections as indicated in the specification matrix Exhibit C, and as here in:

a. Contract Documents Bid Set
b. Exhibit A – Milestone Schedule
c. Exhibit B – Site Logistics Plans (SL-1)
d. Exhibit C – Specification Matrix
e. Special Provisions - 011100

A. General

1. Include all documents and related costs of permits, including tapping fees, to execute your work.
2. This work shall include all scope of work items in other drawings defined as; but not limited to "SC", "SW" and/or "Site Contractor", Contractor is advised that you must review ALL drawings to fully understand the scope of work required by this contract.
3. Note: The work of this contract will occur over multiple phases, spanning a period two years that will a winter shutdown from December through March, starting in September of 2021 ending in May 2023. Refer to Milestone Schedule (Exhibit A) for substantial completion dates.

1. Verify existing conditions before starting the Work. Notify the Construction Manager immediately if any discrepancies are discovered. Contractor to tour and survey the site to assess existing conditions prior to submitting their proposal. Any conflict in drawings or omissions shall be brought to The Construction Manager's attention immediately. Contractor to schedule site visits with The Construction Manager at least 48 hours in advance.
4. The Sitework Contractor and all subcontractors tiers associated with this bid package are required to provide multiple mobilizations, with multiple crews at multiple locations working simultaneously to meet the project milestone schedule is included in this contract. Double shifts and Weekend work including Saturday and Sunday (if required) is included in this contract.

5. All Sitework Trade-related testing and inspection requirements as specified in the Contract Documents and/or required by local municipalities will be the responsibility of the Sitework contractor.
6. **Sitework Contractor to provide safety program noted on section 8.2 of special provisions.**
7. Provide all hoisting and/or rigging required to complete the work of this package. Provide all unloading, hoisting, scaffolding, planking, man-lifts etc. for safe access, material handling and storage to complete the scope of this work. Include dunnage and temporary protection of materials stockpiled on site to prevent damage from other trades, dirt/mud and moisture infiltration. Barricade as necessary. Include moving these items as required for completing your work.
8. Field measuring will be required. Where field measuring is not possible due to meeting schedule or product interface, NOTIFY CM IMMEDIATELY. Field fabrication shall be included at no additional cost to the contract.
9. The drawings are diagrammatic and may not be complete in every detail. They reflect the intent of the Architect/Engineer to provide for a complete working system in compliance with all codes as shown by the documents. This contractor shall include any other equipment or devices necessary to provide a complete functioning system
10. The sitework contractor shall coordinate with the electrical contractor for all power, requirements, installation and wiring of all electrical components supplied under this contract (IE Hotbox for water service).
11. Provide temporary water service to the construction trailer from the existing water service available at Terminal B.
12. **Provide all surveying, line, grade, and layout necessary to complete the work of this contract.**
13. Provide services of a land surveyor to verify existing conditions and lay out their work prior to commencing with foundation work, site work and earthwork. **Sitework Contractor** shall provide formal notice of any existing conditions that could impact new construction including, but not limited to vertical and horizontal alignment of existing structures. Provide (2) exterior benchmarks in locations determined by the **CM**. Provide (1) internal benchmark (after formed slab work) for use by all contractors, coordinate location with **CM.**

B. **SITE WORK (Included in Sitework Contract PH1A-01)**

1. Provide secured staging areas and truck access road with gate to the extent shown on SL-1. Provide infill with clean stone all areas of cracked and degraded paving to allow for truck traffic routes and contractor office trailer installation. Maintain area for the duration of the project. Restoration of the area to the original site conditions is also included.
2. This Contractor is responsible to provide, maintain and remove all temporary fencing, gates, utilities, staging area, etc. complete as shown on Site Logistic Plan SL-1 and as described in special provisions section 4.8.
3. Provide (1) 6’ x 6’ temporary concrete wash out facilities which shall consist of at a minimum: 10 mil plastic lining extending over straw bales and lining bottom of washout facility. Provide hard wood stakes minimum 2 per bales with plastic lining stapled to the wood stakes with Geotech fabric under the entire washout facility. Refer to Site Logistics Plan SL-1. This must be inspected daily and maintained to ensure there are no holes or tears for the duration of the project. All residual concrete needs to be cleaned after each washout. Remove from site upon completion and demobilization. Concrete spoils are not to be placed in onsite dumpsters.

4. This contract will be required to have a spill control and containment kit onsite at all times. At a minimum, the spill kit should contain an absorbent such as kitty litter or sawdust, acid neutralizing agent, brooms, dust pans, mops, gloves, goggles, plastic and metal trash container. Contractor is responsible to clean any and all spills associated with their work. If they fail to do so, this contract is responsible to patch, repair, and/or replace areas that have been damaged due to any spills and/or associated equipment leakages.

5. Provide, maintain and remove erosion and sediment control of the site per the contract documents and the project Stormwater Pollution Prevention Plan (SWPPP) including but not limited to; silt fence, check dams, temporary sediment traps, water filter bags, inlet protection, construction entrances, erosion control blankets, and any required discharge permits. SWPPP requirements are generally as identified on drawing C100, though the New York State Department of Environmental Conservation (NYSDEC) blue book shall be the minimum requirements. The contractor will be required to submit a current NYSDEC blue book to Turner for reference during SWPPP activities. Maintain working area in compliance with the SWPPP plan at all times. All installations to be confirmed and coordinated with TCCo, and may need to be relocated to adjust for project progress. This contract will be required to sign the Contractor Certification form included in the SWPPP. The employee listed on the form will be required to complete the NYSDEC Endorsed 4-hour erosion and sediment control training and be onsite during all ground disturbing activities and maintenance of SWPPP plan. This contract cannot disturb more than 5 acres of stabilized land at anyone time during the performance of the work and must comply with all rules, laws, regulations, etc. as it pertains to SWPPP. A five acre waiver is not provided for this project. Provide a mailbox and post at the construction entrance on Furhmann Blvd with "SWPPP" written on both sides using 3" letters, coordinate with TCCo Superintendent for location.

6. Provide public and on site road and parking lot cleaning for the duration of the project. The Site Work Contractor will provide general maintenance of the site and adjacent public drives and shall clean all debris at the end of each day at a minimum.

7. All open excavations (including the utility trench) are to be protected with orange construction fence (at a minimum) when un-attended. This includes breaks during the work day. Refer to Special Provisions for additional information.

8. Provide a hydrovac truck to clean and maintain all trench drains, catch basins, drain inlets, sediment basins, piping, etc. throughout the duration of this contract. In addition contractor to provide a final clean as directed by the Construction Manager. Contractor to submit a final report identifying that all pipes are free and clear prior to turnover to the Owner. Minimum of 10 locations directed by CM.

9. In addition to providing temporary site fencing per the Site Logistics Plans SL-1 provide additional fencing as required to protect existing site features (i.e. shrubs, trees, score board, light poles, etc.) that have been identified on the contract documents.

10. Include all demolition work as specifically defined in the contract documents. Provide all site preparation including but not limited to, clearing, grubbing, topsoil striping, and rough grading. Provide all site demolition and clearing, etc. as indicated on the documents. Removal of all site features, vegetation, stumps, roots, trees, shrubs and landscaping as noted on the contract documents. Removal of unforeseen foundation wall, piers, concrete slabs exposed during excavation to complete this work is also included in this contract.

11. Provide all general site finish notes.

12. All earthwork required for the performance of the work of this contract complete as shown and specified including layout, compaction, proof rolling, dust/erosion control,

dewatering, cut, fill for over-excavation, excess off-site spoil removal, and protection of existing utilities/landscaping/structures.

13. Provide all imported fill as required to achieve grading and site preparation called for on the contract documents. Final grading and seeding to all disturbed areas including staging/access roads, new pavement locations, and all site disturbances is also included.

14. Include fill for loading dock leveler infills. Install by this contract geotextile fabric, drainage stone, 6" smooth stone. Powder Coated metal plate and grating by **General Trades Contractor**.

15. Provide all asphalt paving for roads, walkways and asphalt overlay paving. Include all stabilized crushed aggregate installations. Provide all temporary protection needed for existing items to remain (i.e. trees, sanitary structures, fire hydrants, light poles, utility lines, pavement, sidewalks, lawn areas, etc.).

16. Provide all landscaping, plantings, topsoil, lawns, grasses, seeding work complete in all disturbed areas as shown on the contract documents and specifications including but not limited to: all fertilizers, mulch, seed, tackifier, lime, and the specified maintenance thereof. Finish landscaping will be performed in phases coordinated with Turner construction as the locations become available or to take advantage of favorable planting weather conditions. This work will require multiple mobilizations in coordination with other contractors. This coordination and the multiple mobilizations required to allow access for other trades to perform their work is included in the base bid for this contract. Achieve full grass growth at all lawn areas. Include watering and maintenance as required to achieve full growth. Provide a minimum of two mowing's prior to acceptance.

17. Furnish and install all trees per site planting plan. All trees to be approved by Landscape Designer. Landscape designer to be provided opportunity to select trees at local nursery and have the opportunity to approve or reject any specimens at their discretion. Any trees installed by the contractor that have not been reviewed in advance by the landscape designer, and subsequently rejected will be replaced at no cost to the project.

18. Provide all exterior concrete paving, sidewalks, steps, ramps, curbs, curb cuts, etc. up to and including all form work, concrete, rebar, mesh, sub-base etc. Coordinate in the field to avoid any areas of standing water. Contractor is to provide proper form work to ensure that the concrete paving depth is meeting the project specifications. **General Trades contractor** will be responsible for Stair 1, Stair 2, Sound Stage Foundation and if alternate is selected the viewing platform foundation only. Balance of site concrete is by the Sitework Contractor.

19. Provide all quarry blocks including all subgrade and leveling course for complete installation. Provide quarry block stairs. Pricing for Alternate 2 – wood benches on quarry blocks to be by this contract. Reference Specification section 012300 and L201A/L504A etc.

20. Provide joints sealant where any two dissimilar materials touch and as required to complete finishes for this work. Sealant between your work and the intersections of work of others is also included.

21. Provide all expansion joint materials and sealants for concrete paving and sidewalks complete. <u>Note: Contractor is responsible to provide sealants that are compatible with all expansion joint materials to maintain manufacturer's warranty.</u> Contractor will be responsible for the replacement of concrete paving that has failed due to installation of non-compatible materials. Submit product data for the complete joint system confirming compatibility to the Architect for approval prior to commencing work.

22. Provide all bollards and bike racks as indicated on the concrete documents.

23. Protect all foundations, footers, concrete, asphalt paving, etc. that are to remain per the Contract documents. Any damages by this Contractor to existing and surrounding structures affected will be this Contractor's responsibility to repair/replace.

24. Provide all new fencing outside of the building footprint, gates, and accessories up to and including footers, post, etc. per the contract complete. Fencing inside the building footprint by the General Trades Contractor. This includes all chain link and establishment fencing for plantings. Include Barrier gates

25. Provide all asphalt cutting, repairs, patching, installation of new asphalt, binder, wear and finish asphalts courses, up to and including all tack coating, tackifiers, hot coal tar sealers, sealants, etc. as required for a complete installation per the contract documents and specifications. Cleaning between binder and top courses is also included.

26. Provide all parking signs and asphalt striping and markings that are affected by the renovations and/or as described on the contract documents.

27. All finish painted equipment is to be field touched up if scratched, marred or dented prior to Architect/Owner acceptance. This contractor owns protection of their work and correction of any damage that occurs to it for not protecting properly.

28. Provide allowance of forty (40) operator hours including (40) equipment hours (ex. Kubota 080 or similar) and forty (40) laborer hours to be used at the discretion of the Construction Manager only for unforeseen conditions during site demolition. Allowance shall be tracked on a Time and Material ticket, and hours include all overhead and profit. Unused portion of allowance will be credited back to the Owner via a deduct change order.

29. In addition to the contractual requirements, Contractor to provide an additional 300 cubic yards of undercutting and removals, placement of soil stabilization fabric (SSF) and providing and compacting to 95% density imported granular backfill material as identified in Specification Section. Provide a credit in the form of a deduct change order for labor and material not used during the project.

C. Site and Electrical Utilities

1. Provide excavation for underground electrical work as shown on the contract documents. Include all restoration at locations of underground electric. This includes backfill, pipe bedding materials, ductbank concrete conduit encasement (including reinforcing bar), rough grading, road paving, curbs, sidewalk saw cut removal and replacement, backfill and compaction, placement of topsoil, fine grading and seeding. This includes all excavations for site lighting poles. The Electrical Contractor will be responsible to furnish and install all materials including conduit, duct bank spacers, wire, handholes, vendor receptacles, site lighting pole bases, etc.

2. All site utilities performed by this contract to be installed, locations marked and capped and terminated 5' outside the exterior foundation wall. Termination points to be surveyed and identified on a drawing turned over to Turner Construction for coordination with the succeeding contractor to continue the installation. Survey to be transmitted in .pdf and cad format.

3. Provide all new site storm piping and drainage as indicated on the documents including but not limited to all excavation, backfill, piping, structures, catch basins, man holes required for complete installation of the storm system. All underdrain to be tied into nearest catch basin unless specifically shown different on the contract drawings. Include all concrete flow channels poured inside storm manholes per the details.

4. Provide new sanitary force main system as indicated on the documents including but not limited to; all excavation, backfill, piping, structures, man holes, pumps, core drilling into

existing MH and sealing of new pipe installation, clean-outs, etc. required for complete installation of the sanitary system. Include complete installation of duplex submersible pump station, including all electrical connections, floats, locking hatch, control panel box and electrical conduit to pull box outside of manhole. Electrical Contractor to provide power and is responsible for connection to panel box only. All other connections, programming, testing and setup are by this contract. Include all coordination and fees with public utilities.

5. Provide the new water main complete, including but not limited to all excavation, backfill, piping, valves, connections, thrust blocks, hydrants, mechanical joints, etc. required for complete installation of the water system. Include all coordination and fees with public utilities. Provide all backflow preventer, hot box, thrust blocks, bedding sand/stone required for all waterline work indicated. Include all backflow certifications and provide copies of the reports to the CM.
6. Provide new fire service complete, including all excavation, compaction, backfill, sidewalk removal and replacement, thrust blocks tap into existing 16" water main, tapping fees and post indicator valve. Include coordination and tapping fees with public utilities.
7. Provide new gas line connection and installation. Cap off gas line for future use and clearly identify onsite and on as built information location and depth of gas line installation.
8. Include modifying rim elevations (storm, sanitary, or electrical) as necessary to accommodate grading in blacktop or lawn areas. This includes rework of existing rim collars and/or replacement of rim collars with new to maintain proper elevations. It is the contractor's responsibility to maintain surface drainage.
9. The Site Work contractor is responsible to verify all new and existing inverts and tie-in points prior to ordering any structures or placing pipe. Site Work Contractor to verify depths of existing know utilities crossing new utilities prior to starting any work. Provide early mobilization and excavation as required to verify.
10. General protection of surrounding finishes and existing cabling, wiring, data lines, etc. shall be provided and maintained throughout the duration of this work.
11. Where additional underground utilities are required within grass/soil areas, at a minimum the contractor is to provide the following: Encased conduits 3" clear all sides with sand bedding, a minimum of 36" below finish grade, the trench is to be backfilled with No. 2 R.O.C., at 6" lifts to subgrade, and topped to match surrounding conditions. At areas where the trench intersects seeded areas, contractor is to provide a minimum of 12" of topsoil to match existing grade.
12. All interior and exterior caulking, joints sealants and accessories required for the work of this contract shall be included.
13. Provide all back feeding of existing systems in the event that the noted electrical work disrupts services that are scheduled to remain. This work shall be completed on overtime and expedited to be complete immediately upon recognition.
14. **General Contractor to bring Stormwater, Sewer and Water Supply Site utilities 5 feet to building envelope. Final connection made by Mechanical Trades Contractor. All excavation and backfill outside of building footprint (to edge of foundation wall) responsibility of this Contract.**
15. Provide a $5,000 miscellaneous excavation and landscaping allowance for unforeseen conditions associated with the site work. Allowance shall be tracked on a Time and Material ticket and includes all overhead and profit. Unused portion of allowance will be credited back to the Owner via a deduct change order.

3. **The Scope of The Sitework Contract Specifically Excludes the following**:

1. General building permit – by Owner
2. Environmental and Materials Testing – By Owner
3. Electrical Materials for site electrical work – By Electrical Contract

4. **The Scope of the Sitework Contract Includes, but is Not Necessarily Limited to, the Following Understandings and Stipulations**:

A. Schedule:

1. In order to maintain project milestone schedule, all long lead submittals, up to and including any product data, and shop drawings are required to be submitted to the Architect (15) working days from notice to proceed for an expedited review by the Architect.
2. ALL submittals and shop drawings, with the exception of those to be determined as "long lead" must be received within (45) calendar days of notice to proceed.
3. Submittal Schedule is due within (10) working days from Notice to Proceed. Submittals shall be sent directly to the Architect with a copy to The Construction Manager. All costs to recapture lost time due to late submittals will be the responsibility of that Contractor
4. This contract is required to have multiple crews working at different locations/buildings simultaneously. Double shifts and Weekend work including Saturday and Sunday (if required) is also included. Weather delays will not be considered unless the Contractor has provided sufficient manpower, as determined by the Construction Manager/Architect, and worked every available daylight hour, including weekends.

5. Additional Provisions:

2. Prior to the start of any work, the Contractor shall coordinate a meeting with The Construction Manager to review their project scope. The Contractor will have in attendance their Project Manager, Site Foreman and Estimator/Purchaser.
3. This contractor is cautioned that scope of work to be provided under this contract is also detailed in the Special Provisions.
4. Restoration to any existing finishes, inside and outside, for damage caused by the work of this Contractor. This includes, but is not limited to, ceilings, soffits, GWB, wall tile, trim, paint, brick, lawn, landscaping etc.
5. Contractor to provide a third party utility marking company (i.e. "GPRS" Ground Penetrating Radar Services) to mark out and identify the underground utilities prior to excavation. Contractor shall also produce and submit an as-built survey to the Owner with their findings for record. Contractor is also responsible to maintain line markings for the duration of their work. Any lines that have been struck, cut or damaged due to the failure of the Contractor to mark out the lines will be the responsible of the Contractor to fix, repair and/or replace so that the services are restored to the original operating conditions. See Special Provisions
6. This Contractor shall survey all new underground utilities installed as part of this contract a minimum of every 10 lineal feet. Include additional survey points at all manholes, catch basins, electrical pull boxes, fiber pull boxes, tracer wire vaults, valves, caps, etc. Survey data shall be submitted to Turner in a .CSV file format and include any benchmarks used, vertical datum, horizontal datum, and other pertinent information required.

7. If any part of work depends upon the work of another contractor for proper execution and results, notify The Construction Manager in writing of any conditions that conflict with the furnishing and installation of the Work. Failure to do so shall constitute an acceptance of the other Contractor's work by this Contractor.

END OF SITEWORK CONTRACT
CONTRACT PH1A-01

SECTION 011200.1 GENERAL TRADES CONTRACT PH1A-02
SCOPE OF WORK

1. **Scope of Work:**

The Work of this Agreement shall include, but not be limited to, all labor, materials, tools, equipment, plant, supplies, shop drawings, layout, transportation, supervision, contributions, insurance compliance with all agencies (Town, County, State and Federal as may be required), and shall cover all other items necessary for the performance of the **General Trades Contract** as shown detailed and/or implied by the following documents and as defined herein. This requisition is intended to supplement the Contract Specifications and drawings and must be used in coordination with these documents to fully understand the Scope of Work. Requirements given in one area thus are applicable to all. This requisition does not generally repeat scope requirements given in the Contract Documents, but clarifies and coordinates the work. Work in the Documents repeated here is for specific coordination purposes.

If a direct conflict exists between this requisition and direction on the documents, this requisition shall govern.

The Scope of the General Trades Contract – PH1A-02 includes, but is not limited to, providing the following:

The scope of your work is generally defined as all work included in specification sections as indicated in the specification matrix Exhibit C, and as here in:

a. Contract Documents Bid Set
b. Exhibit A – Milestone Schedule
c. Exhibit B – Site Logistics Plans (SL-1)
d. Exhibit C – Specification Matrix
e. Special Provisions - 011100

A. General

1. Include all documents and related costs of permits, including tapping fees, to execute your work.
2. This work shall include all scope of work items in other drawings defined as; but not limited to "GC", "GT" and/or "General Contractor", "General Trades", "Asbestos Abatement Contractor", "Abatement Contractor", "Hazardous Materials Contractor", "Hazardous Waste Contractor". Contractor is advised that you must review ALL drawings to fully understand the scope of work required by this contract.
3. Note: The work of this contract will occur over multiple mobilizations, spanning a period two years that will include 2 summers, starting in September of 2021 ending in May, 2023. Refer to Milestone Schedule (Exhibit A) for substantial completion dates.
4. Verify existing conditions before starting the Work. Notify the Construction Manager immediately if any discrepancies are discovered. Contractor to tour and survey the site to assess existing conditions prior to submitting their proposal. Any conflict in drawings or omissions shall be brought to The Construction Manager's attention immediately. Contractor to schedule site visits with The Construction Manager at least 48 hours in advance.
5. The General Trades Contractor and all subcontractors' tiers associated with this bid package are required to provide multiple mobilizations, with multiple crews at multiple locations working

simultaneously to meet the project milestone schedule is included in this contract. Double shifts and Weekend work including Saturday and Sunday (if required) is included in this contract.

6. All General Trade-related testing and inspection requirements as specified in the Contract Documents and/or required by local municipalities will be the responsibility of the General Trade's contractor.

7. **General Contractor to provide safety program noted on section 8.2 of special provisions.**

8. Provide all unloading, hoisting, scaffolding, planking, man-lifts etc. for safe access, material handling and storage to complete the scope of this work. Include dunnage and temporary protection of materials stockpiled on site to prevent damage from other trades, dirt/mud and moisture infiltration. Barricade as necessary. Include moving these items as required for completing your work.

9. Field measuring will be required. Where field measuring is not possible due to meeting schedule or product interface, NOTIFY CM IMMEDIATELY. Field fabrication shall be included at no additional cost to the contract.

10. The drawings are diagrammatic and may not be complete in every detail. They reflect the intent of the Architect/Engineer to provide for a complete working system in compliance with all codes as shown by the documents. This contractor shall include any other equipment or devices necessary to provide a complete functioning system

11. Daily cleanup of own work to dumpsters is included.

12. The General Trades contractor shall coordinate with the electrical contractor for all power, requirements, installation and wiring of all electrical components supplied under this contract.

13. Provide the Final Building cleaning of **ALL WORK associated with Terminal B** (interior and exterior) prior to Owner occupancy (refer to Milestone Schedule and Phasing plans). At a minimum final cleaning shall consist of all dusting (including high dusting), wiping down and cleaning all new and/or existing finished surfaces, wet mop and vacuum all sealed concrete floors, clean flooring and carpet, clean interior and exterior of all glass, including door lites, sidelites and transoms, vacuuming all casework drawers and shelving units, cleaning all toilet fixtures, urinals, mirrors, wiping down all walls and metal liner panels, cleaning all doors inside and out. Dusting all MEP, FP equipment. Cleaning out of floor drains within the building interior is also included. All final cleaning shall be figured as 2nd shift or weekend work. Contractor shall coordinate with the Construction Manager for approval to proceed with final cleaning prior to commencing work.

14. At all areas where temporary doors are required, contractor is to provide door sweeps at both bottom of the door and vertical latch side of each door. Contractor is also to include 26"x37" (or larger) tacky walk off mats at each door entrance/egress and at all areas where construction work transition into finished occupied spaces. Maintenance and replacement of the mats as needed is also included for the life of the project.

15. Provide and maintain protection of all new flooring in enclosed finish spaces up to and including polished concrete areas as noted on the contract documents immediately upon completion of installation. Protection at a minimum shall be commercial grade "Ram Board Plus" with all seams duct taped together edge to edge continuously and shall extend wall to wall. Removal and disposal of all flooring protection is also included.

16. Provide services of a land surveyor to verify existing conditions and lay out their work prior to commencing with building foundation work. **General Contractor** shall provide formal notice of any existing conditions that could impact new construction including, but not limited to vertical and horizontal alignment of existing structures. Provide (1) internal benchmark (after formed slab work) for use by all contractors, coordinate location with **CM.**

17. Provide an initial wall layout for PC during underslab plumbing installation for use prior to construction of floor slab. This includes providing layout and marking of wall locations for plumbing drainage piping in the stone subbase.

B. FIELD OFFICE REQUISITION

1. The General Trades Contractor shall provide Project Field Office contents and services for principal use by Turner Construction. Unless otherwise noted below, the Project Field Office services and contents are to be completely set up no later than September 15, 2021 and will remain onsite through June 2023. The associated contents within the Field Office will remain the property of the General Trades Contractor throughout the duration of the project and shall be insured by the General Trades Contractor throughout the duration of the project for all perils and risks.
2. For the project duration the General Trades Contractor will provide each of the items listed below:

C. ELECTRONICS

1. All items listed below are to be provided, installed, maintained, and will become the property of Erie Canal Harbor Development at the completion of this project. Items shall be turned over to a location to be determined :No later than September 15, 2021; the General Trades Contractor shall provide and turn over to the Construction Manager all computer related items listed below for immediate use.
2. Provide (2) New 256GB iPad Mini 5, "Space Gray" with A12 chip with 64 bit, retina display, 8MP camera, WiFi+Cellular model, with Verizon 4GLTE (or newer) connectivity and Apple Care Plus extended warranty. For each iPad, include the following: Unlimited cellular data only plan on a full retail, month to month contract through Verizon Wireless from September 1, 2021 through May 31st, 2023, with Verizon Total Mobile Protection Plan. Note: General Trade Contractor is to "purchase" (not lease) the iPad.
3. Provide (1) Verizon Inseego MiFi M2100 5G UW with Verizon "Unlimited Plus" data plan through Verizon Wireless from September 1, 2021 through May 31st, 2023,
4. Provide (1) Toshiba 50LF621U21 50-inch Smart 4K UHD with Dolby Vision
5. Provide (1) Brother MFC-J6945DW printer. Include (1) 15' Printer USB Cable, (2) Complete sets of Printer ink, (1) Case of 8 ½ x 11" Paper and (1) Case of 11x17 Paper
6. Provide (1) 25' HDMI cable
7. Provide (2) Otterbox utility series latch II for iPad Mini 5
8. Provide (1): Apple TV 4th Generation (or newer) – Digital Multimedia Receiver w/remote
9. Provide (1) $50 iTunes Gift Card required for application downloads (i.e. Bluebeam Apple.
10. Provide (5) SanDisk64GB USB 3.0 Flash Drive.

D. **FURNITURE/SUPPLIES:**

1. *Unless otherwise noted,* all items listed below are to be provided and turned over to the Owner at the completion of this project: No later than (15) days after Notice to Proceed; the General Trades Contractor shall provide the following furniture/supplies for the Construction Manager's use:

2. Provide rental of (1) 50'x12' office trailer for the duration of the construction period until substantial completion. Trailer shall be in new or like new condition, equal to Willscot office trailer https://www.willscot.com/mobile-offices/office-trailers/50-x-12-Office-Trailer including optional restroom and central A/C. Include all skirting with 2" Polyiso insulatoin, exterior stairs and toilet room wastewater storage tank. Include weekly pumping of storage tank, Provide monthly filter changes for HVAC unit. Temporary electrical service to be by the Electrical Contractor. Temporary water service by the Sitework Contractor. Include insulation and heat trace for water/drain lines. Include weekly cleaning of the construction trailer including replacement of paper towels, toilet paper, hand soap, etc.
3. Provide water cooler rental for the duration of the project with weekly service to replace any empty water jugs. Water cooler shall have hot and cold water.
4. Include an office supplies allowance in the amount of $750 for CM use. Any unused allowance will be credited back to the Owner.
5. Provide (3) new Poly scoop with large, deep blade shovels, (3) new 24" wide commercial grade indoor/outdoor push brooms, and (3) new angle brooms. All equipment shall be turned over to the Owner for the Construction Managers use.
6. Furnish (2) 6' and (2) 8' Folding Tables and (10) Folding Chairs with padded seats.
7. Furnish (2) High Back Mesh Chairs Work Pro Quantum 9000 Mesh.
8. High visibility, Class II, mesh safety vest, lime green or yellow in the following quantities: (2) X-Large, (2) Large, (2) Medium for visitors use.
9. Furnish (1) Klein Tools Voltage Tester.
10. Furnish (1) Commercial Electric Outlet Tester
11. Provide (24) Hexarmor safety glasses MX300 with CBR65 Tint
12. Provide (12) Magid D-ROC GPD486 (4) size 8, (4) size 9, (4) size 11
13. Furnish (6) Cases of 10 reams (8.5" x 11") and (2) Cases of 5 reams (11" x 17") 20# weight paper
14. Provide (3) 48 x 96" Whiteboards.
15. Furnish two (2) Sets of colored dry markers with erasers.
16. Furnish (1) 20-Volt Max XR Lithium-Ion Cordless Brushless Hammer Drill and Impact Driver Combo Kit (2-Tool) with (2) Batteries, Charger and Bag. Model #DCK296M2.
17. Furnish (1) set reciprocating saw blades.
18. Furnish (1) drill bit and driver bit set to include masonry and metal drill bits.
19. Furnish (1) Laser distance meter Bosch model GLM165-40
20. Furnish (1) BernzOmatic Torch kit
21. Furnish (1) 50LB bag of rock salt
22. Furnish (1) Pack of "AA" batteries (24 count), (1) Pack of "AAA" batteries (24 count), and (1) Pack of 9 Volt batteries (2 count).
23. Furnish (1) roll of fire rated Poly
24. Furnish (1) case of P-Tak poly tape(Abatement tape)
25. Furnish two (2) 8oz Shoreline Marine Signal Horns

26. Furnish (3) cans of orange and (3) cans of pink marking paint and compatible marking stick and a 12" diameter measurement wheel.
27. Furnish (5) Master pad locks with 4' chains. Include (15) keys.
28. Provide (2) 6'x4' Dry Erase Markerboards
29. Furnish (1) Heavy-duty stapler by GBC Bates model #224XHD with 1,000 staples to fit.
30. Furnish (3) drawer file cabinets, Cabinets to be 28" or less.
31. No later than 15 days after contract award; The General Trades Contractor shall provide and maintain a fully stocked First Aid Cabinet Model 14129 by Cintas. Monthly service includes refills as necessary for the full duration of this contract. **Contact Cintas account representative John Poente, at 617-512-3672 or 1-855-859-1363 for complete details.**

E. Demolition

1. Include all selective demolition work as specifically defined in the contract documents, including but not limited to Architectural AD101A through AD301A and Structural Series Drawings (SD101A, SD201A, SD202A) and specifications up to and including removal of interior and exterior walls (or portions of). Include all removals of exterior wall metal panels, CMU Backup, intermediate support steel, roof decking and existing remaining roof membrane and insulation. ceilings, soffits, ceiling systems, finished flooring, wall base, doors/frames, and interior finishes required to accommodate the new work. Remove overhead doors and dock leveling equipment.
2. All interior demolition and disposal, except MEP equipment and systems, as required to complete all proposed work, for example, but not limited to, doors, ceilings, walls, wall systems, millwork, flooring, base, tile work, casework, lockers, specialties, toilet accessories and partitions, etc. Coordinate ceiling demo with MEP Contractors. Include all shoring and temporary support of ceilings during partition demolition.
3. Provide all saw cutting, and/or hand excavation necessary for full concrete slab removal per the limits shown on drawings AD101A. All additional saw cutting and slab removals required by the MEP trades outside of the limits shown on drawings AD101A will be by the MEP Trades contractor.
4. Include all shoring and temporary support of ceilings and mezzanine framing areas during partition demolition. DO NOT proceed with any load bearing wall demolition until a shoring plan is designed by a professional engineer in the State of New York and approved by the Architect.
5. Demolition of all flooring and mastic as noted on the contract documents.
6. Demolition of the existing gypsum board and/or plaster soffits as required per the contract documents.
7. This Contractor is warned that they are also responsible for the demolition and disposal of all miscellaneous items to be demolished in work areas that may not be noted on drawings.

F. Abatement

1. Post buildings (10) business days prior to beginning any abatement. In addition, this contractor will hold information sessions with ECHDC (5) days prior to the start of the

work where the asbestos and lead abatement procedures and safety regulations specific to this project will be reviewed.

2. The Owner will retain an air monitoring and environmental testing agency to provide monitoring and testing as required per specifications. This contractor is responsible to coordinate directly with the testing agent and the Construction Manager for all testing and to provide 48-hour notice before testing is required. This contractor will be responsible for all charges for any un-notified or last-minute cancellations of the testing agent.
3. The General Contractor will provide ALL asbestos and lead abatement/demolition work as specifically defined in the contract documents and specifications. Reference all abatement notes on AD Series drawings. All abatement work is to be performed by a licensed abatement subcontractor in accordance with all state, local and jurisdictional code rules. It will be this contractors responsilbity to provide all water an power connections to the temporary provisions included by the sitework and electrical contractors.
4. During abatement, water may be encountered within the existing trenches. Dewatering of water found in the trench areas is also included in this contract. Provide necessary filters and removals as required in accordance with all state, local and jurisdictional code rules.
5. Provide an OSHA approved demolition plan to the Construction Manager (10) days prior to starting any work. Contractor will hold a pre-abatement coordination meeting with the Owner and Construction Manager (5) days prior to the start of work where the asbestos and lead abatement will occur. Procedures/safety regulations specific to this project will be also be reviewed. Confirm shut down of mechanical, plumbing and electrical systems in areas that are to be abated with the CM and respective Contractors prior to starting any work. Obtain written sign-off from trades that all equipment being removed under abatement has been disconnected. Turnover copy of signed consent to CM prior to starting any work.
6. Hire an independent testing agency for personnel sampling as specified.
7. This Contactor shall be responsible for the protection, health and welfare of their employees and their subcontractors with regards to working on this project. This Contractor shall be required to perform any additional ACM/PCB abatement not shown on the abatement drawings necessary to complete this work.
8. The presence of lead paint has not been identified; however this Contactor shall be responsible for the protection, health and welfare of their employees and their subcontractors with regards to working on this project. This Contractor shall be required to perform any additional lead abatement not shown on the abatement drawings necessary to complete this work.
9. Provide the Final Asbestos, lead and PCB cleaning of all work completed by this contractor (interior and exterior) by a qualified contractor. At a minimum final cleaning shall consist of all dusting (including high dusting), wiping down and cleaning all finished surfaces, wet mop and vacuum all floors, vacuuming all casework drawers and shelving units, cleaning all toilet fixtures, urinals, mirrors, wiping down all walls and metal liner panels, cleaning all overhead doors inside and out. Dusting all MEP devices and grilles.
10. Additional testing costs for sample failures will be the responsibility of this Contract (This includes dust overloaded samples).
11. All asbestos waste bags must be removed from the site each day and the Construction Manager must be notified of transport and storage on a daily basis. Provide copies of all required certifications. Waste manifest chain of custody slips will be signed by the contractor and a copy will be provided to the CM for record.

12. In addition to the general dumpsters (see Special Provisions), this contract shall provide separate dumpster(s) for the removal/disposal of any asbestos, PCB or lead containing materials. Refer the site logistics plan; dumpster shall be located on the site for ease of trash removal. Coordinate final location with the Construction Manager's Superintendent.

G. Metals (Structural Steel, Decking, CFMF, Composite Metal Panels)

1. Provide (fabricate and install) all structural steel indicated on the contract drawings including shop welded column base plates, entrance and roof canopy structures, steel floor members with headed shear connectors, stiffener plates, bearing plates, metal deck, all edge of slab and opening conditions, bent plates, slab edge angles, catwalk framing and galvanized steel decking, and tube steel members, spandrel beams and structural member wall systems for support of exterior wall assemblies and metal fabrications for a complete installation.
2. Provide all weld plates, embeds, seat angles, bearing plates and anchorage.
3. This contractor shall temporarily brace the structure as required until all elements are connected and in their final position (in accordance to the final condition design shown on the contract documents) and until all concrete slabs have been placed.
4. Upon completion of the structural steel installation, the Contractor shall provide a post erection survey indicating any deviations from plans (As-Builts), and confirming that the steel is installed within erection standards (plumb) and specified tolerances.
5. Furnish, hoist and install all exterior wall and ceiling Metal Panel systems. Provide all required support materials (both shown or required by the manufacturer's installation instructions) such as metal framing/attachment steel, reinforcing steel, clip angles, shims, attachment hardware, etc. as required and/or detailed to provide for a complete installation. Include all trim, supports, hardware, accessories, sealant etc. for a complete system.
6. Furnish all loose lintels as required for door openings, coiling doors, window openings, clear passages, etc (whether or not shown on contract drawings). All lintels shall be properly identified with specific locations to avoid confusion during installation. If a door is shown on the door schedule, a lintel shall be provided regardless of if it is shown on the structural drawings.
7. All exterior wall lintels are to be galvanized.
8. Provide all steel members, decking, and/or angle frames for all MEP roof penetrations, rooftop equipment support, deck and slab infills, and deck and slab openings. This contractor is required to review all Demolition, Mechanical, Plumbing and Electrical documents to establish quantities prior to bid. Coordinate locations with contractors in the field prior to installation.
9. Provide and install powder coated steel plate and metal grating for loading dock leveler infills. Installation of Geotextile fabric, Washed stone drainage layer and 6" landscape rocks by **Sitework Contractor**. Coordinate installation of steel plate and grating with **Site Contractor**.
10. Provide all miscellaneous metals including, stairs, stringers, gratings, handrails/railings, ladders, ships ladders, and all associated connections and inserts. Include all fixed guardrails and removable guardails at stage.
11. Provide all canopy façade metal panels including all subgirts, assemblies clips, anchors and closure trim and transitions between different material types.
12. Stairs or ladders exposed to weather shall be galvanized as per spec.

13. Provide all cold-formed metal framing that is part of exterior wall assemblies and roofing assemblies. This includes but is not limited to framing behind metal composite panels, framing behind brick veneer, framing for parapet walls, framing for roof edge/integral gutter, etc. Any new framing shown as part of an exterior assembly shall be treated as cold-formed metal framing whether shown on drawings or not. Include any modifications to existing exterior framing as required to install new. Provide framed openings for all ductwork penetrations. Provide all CFMF for walls and roofs at storage room and green room.

14. Provide all handrails with integral LED Lighting within stair 1, 2 as indicated on L series drawings. Coordinate installation with electrical contractor during installation of stairs and foundation walls to allow for a completely concealed installation of power wiring for the LED handrails. Provide product data and shop drawings to Electrical Contractor.

15. Provide all fencing indicated on the documents inside the building footprint (Ref A101A)

H. Concrete/Foundations/Slab on Grade

1. Provide all foundation walls, spread footings, grade beams, elevator pits, piers, pile caps, slab-on-grade, slab-on-deck, elevated structural slabs, concrete shaft caps, reinforcing, recesses, haunches, depressions, stem walls, finishing, foundation insulation, vapor barriers, waterproofing and concrete work indicated on the contract drawings and specifically called for in this scope of work.

2. Provide all piles for the stage addition. Include testing requirements and piles per the drawings and specifications. Provide a survey of each pile location at the end of each day to the engineer for verification of proper height and location. This contractor will maintain and provide driving logs daily to Turner. The log will include the following: date, location, length of pile (actual cutoff to tip). At the end of the job certified pile reports will be submitted for record. Should a pile be driven incorrectly, i.e. incorrect location, eccentric etc. all remedial work required will be the contractor's responsibility.

3. Provide all excavation and backfill required for slab subgrade prep, pile caps, footings, foundation walls, slabs, demolition, and attachment to the existing building as required for a complete installation of the new foundations. Include all labor to drill and dowel existing foundations. Any fill required due to over-excavation is this contractor's responsibility. The excavation includes removal of the material from site and keeping existing soil separated from the engineered fill of the "working surface" or backfill.

4. Include all site concrete for the Sound Stage, Stair 1 and Stair 2. Include all excavation, footings, foundations, forming and backfill. Balance of site concrete (Concrete curbs and edging, concourse concrete and concrete walk in planting wedge 2 by Site Contractor.

5. If the alternate for Overlook Deck is selected, this package is to include all excavation, footings, foundation work, backfill, wood framing, decking and overhead canopy element.

6. Provide installation of all anchor bolts and leveling plates – receive, inventory, store, layout and install anchor bolts in the proper location, poured into the footings or grade beams as indicated. Provide grouting of all base plates and leveling plates. Once complete, the steel subcontractor will do a survey of the anchor bolt installation noting all out of tolerance work. A copy of the survey will be provided to this contractor who will repair or replace the nonconforming work within 72 hours of receipt of the noted deficiency to the satisfaction of the engineer. Provide inventory receipts to Turner's Superintendent for verification of receipt for all anchor bolts. In the event that inventory receipts are not provided this contractor will be responsible for all costs to replace any missing materials.

7. Contractor is responsible to coordinate with site, mechanical, plumbing, fire protection and electrical contractors for under-slab drain and piping locations prior to foundation installation.
8. Slope the concrete to floor drains at all locations. Pan or dish the immediate area surrounding the drains 1/4" per foot for 30". Coordinate the Pan/dish with the partition layout so that the pan/dish doesn't affect the flooring on the opposite side of the wall.
9. Provide all concrete cure and seal products, compounds, hardening/dust-proofing compounds, concrete admixtures for your work. All cure and seal products MUST be compatible with finish flooring products. It is the responsibility of THIS contractor to obtain written acceptance from the manufacture (not the subcontractor) that all cure and sure products and admixtures are compatible with the finished floor products. A copy of this acceptance is to be forwarded to Turner and each flooring contractor
10. Provide all necessary Concrete and CMU and masonry demolition required.
11. All control joints required for any portion of the work provided under this contract. This contractor shall provide all caulking on the exterior envelope of the building whether the scope is indicated on the contract drawings or not. Details on the drawings are typical and work that is shown once is implied for all and may not be indicated or called for.
12. Provide joints sealant where any two dissimilar materials touch and as required to complete finishes for this work. Sealant between your work and the intersections of work of others is also included (including between concrete stairs and sidewalk).
13. Provide a $5,000 miscellaneous concrete patching allowance for unforeseen conditions associated with repairs to the exposed concrete, concrete foundation walls, and slabs. Allowance shall be tracked on a Time and Material ticket. Unused portion of allowance will be deducted from the contract and all overhead and profift is included with this allowance.

I. Wood, Plastics and Composites

1. Provide all miscellaneous carpentry required to complete the work indicated on the contract documents.
2. Provide all architectural woodwork, trim, solid surfaces, casework and finish carpentry for a complete installation.
3. Include blocking/support for all cabinet uppers shown to be attached to existing walls to accommodate cabinets being fully loaded. Include all cutting/patching as required.
4. Provide all new architectural woodwork/millwork/casework including grommets, hardware and trim as described on the drawings and specifications. Confirm grommet size, color and location with CM and owner prior to installation. All areas must be field measured or properly coordinated and documented prior to fabrication.
5. Provide ALL wood, blocking, sheathing, nailers, cants, misc. angles etc. required to complete or support the work required under this contract. All blocking for exterior walls shall be pressure treated and fire treated for interior walls.
6. Provide all PT Wood sleepers and blocking required for stage floor. Provide all 2x6 thermally modified lumber.
7. Provide all wood materials for sound stage (Secondary Deck) installation. Reference LS120A for details.

8. If overlook deck alternate is selected provide all wood framing and decking materials as well as overhead canopy structure.
9. Provide, maintain, and remove all temporary protection around the new architectural woodwork / casework with cardboard whether secured in place or not. Any damage to the finishes is this contracts responsibility.
10. Provide complete interlocking rubber paver system on Storage room roof.
11. Store all wood materials in an area with a controlled atmosphere as per the contract specifications.
12. Provide all millwork keying, cores, and keys for lockable cabinets. All cabinets and drawers within the same room are to be keyed the same. All cabinets and drawers are to be openable by a master key. Turnover an additional (6) sets of keys to the Owner.

J. Thermal and Moisture Protection

1. Provide foundation insulation.
2. Provide all thermal insulation behind new metal composite panels and in all cold-formed metal framing installed as part of this contract. Include insulation behind exterior ceiling/soffits at entryways.
3. Provide all interior and exterior metal composite material wall panels. Include all miscellaneous framing and supports for a complete system whether shown on drawings or not. Provide all shimming, trueing, leveling horizontally and vertically to properly align panels and joints. All touch-up shall be completed for a seamless look.
4. Provide all flashings and trim associated with the metal composite panels.
5. Provide all insulation, (rigid and/or batt), framing, and exterior sheathing indicated on head, sill, and jamb details. Provide membrane air barrier compatible with exterior sheathing and lap barrier onto adjacent air barriers. Insulation installed over exterior sheathing shall be by this contractor.
6. The **General Contractor** shall procure the services of a Firestop Contractor as a single source responsibility for all fire stopping and smoke sealing as required per the plans and specifications, for all MEP penetrations, using UL Assemblies as required to maintain the UL floor and wall assembly rating required by the contract documents. MEP Contractors shall coordinate the installation of their work so that is conforms to the UL Assembly provided by the General Trades Contractor for each penetration, and shall provide all sleeves preinstalled on all piping required by that Assembly. All existing floors (excludes slab-on-grade) shall be treated as 2hr assemblies. Any excessive demolition will be in this Contractor's responsibilities to patch .Coordinate firestopping inspections with owner provided inspection agency.
7. Provide joint firestopping for both new and temporary walls constructed by this contract.
8. Provide acoustical sealant at all penetrations and/or joints not fire rated.
9. Provide all expansion joints indicated on contract drawings.
10. Provide joint sealants where any two dissimilar materials touch, when one or more items are a part of this package is included. Provide all sealants (color to be determined from full range by Architect) between adjoining pieces and intersections with any other material to ensure a complete, weatherproof system. Sealant warranty shall be included with roof system warranty.
11.

12. Provide (furnish and install) all requirements of the Roofing Work as specifically defined in the drawings and specifications.
13. All deck flutes, wall intersections, and any areas where debris may exist are to be vacuumed and cleaned prior to the installation of the new roofing material. Roofing subcontractor for General Trades Contractor to request inspection from Construction Manager prior to installation of new work.
14. Furnish and install all roofing work including, but not limited to membranes, substrate boards, cover boards, vapor retarders, sheet waterproofing, sheet flashing, drainage panels, welding, pipe boots, adhesive, insulation, tapered insulation, drain sumps, fasteners, perimeter termination bars, blocking, battens, snow guards, walkways, etc. Include all termination details and flashing as shown or required by the existing conditions. The Roofing Contractor will flash in all new curbs, pipe penetrations, etc. Include any additional blocking not shown to match insulation thickness at roof perimeters.
15. Provide all copings, fascia, fascia extender pieces, counter flashings, drip edge, gutter lining, etc. for a complete system. (color to be selected by A/E from full range of colors).
16. Roof drains are to be set by PC & flashed by GC. GC to set the clamping rings.
17. Provide slip resistant walkway pads.
18. Provide roof access hatch at storage room.
19. Flash all roof drains, curbs, equipment rails, penetrations, vent pipes, guy wire anchors, etc furnished by other trades according to the drawings for Plumbing, Mechanical, Electrical, and Architectural (This includes new additions and renovated areas). Provide pre moulded pipe flashings, water cut off and clamping rings.
20. Include removal of existing and installation of new downspouts, gutters, scuppers and splash blocks as shown on the contract drawings.
21. Provide all fastener pull out tests. Include all cost for appropriate fasteners deemed acceptable per test results.
22. Include final cleaning of the roof when directed by CM. Each and every roof shall have drains cleared and loose debris picked up and disposed of in a dumpster. Include removal of all unidentified materials left by all trades. Video all roof areas upon completion and obtain sign-off from CM.
23. Provide all temporary weather protection for any portion of the work of this contract. BUILDINGS MUST BE KEPT DRY AT ALL TIMES!! Any damages to the existing building due to weather infiltration and/or other environmental issues due to improper weather protection will be the financial responsibility of this contractor. If any remediation work is required, the appropriate specification section must be followed and all rework will be approved by the Owner, Architect, and Construction Manager prior to proceeding.
24. Provide temporary utilities required to execute your own work including temporary lighting, power, etc. No temporary power for roof work is supplied by the Electrical Contractor per their base contract.
25. <u>Coordination of Roof Work:</u>

- **Plumbing Contractor, HVAC Contractor, Electrical Contractor** are to furnish roof curbs, sleepers, rails to **General Contractor** as required for their work. Contractors shall provide these items a minimum of 10 days prior to roof work. Each **Prime Contractor** is required to anchor their equipment to roof curb. Anchor/ attachment method shall not interfere with roof system and keep roof penetration water tight. Non-penetrating type roof supports are the responsibility of the **Prime Contractor** whose work is supported by the non-penetrating type support.
- **General Contractor** to provide steel/CFMF support framing at all new roof penetration's as shown on all contract drawings. Coordinate layout with **EC, and Mechanical Trades**.
- **General Contractor** to provide blocking, sleepers, boots, pitch pockets and flashing material for roof penetrations. Other trades will layout new curbs in field for sleepers, rails support systems etc. Example (mechanical curb)
    a. HVAC furnishes curb and layout.
    b. GC provides structural support at penetration
    c. GC will cut roofing material and roof sub structure
    d. GC provide wood blocking under curb,
    e. GC sets and secures curb to blocking level.
    f. GC flashes and seals curb.
    g. GC protects and maintains protection at opening until unit is set (keeps opening water tight).
    h. GC coordinates removal of protection with HVAC.
- **GC and MC** shall have shared responsibility of keeping the building watertight during the construction period. MEP trades are responsible for covering roof openings made during demolition of existing equipment and installation of new equipment, pipe, etc.
- **Mechanical Trades Contractor** to provide temporary roof drain piping to existing plumbing connections and/or exterior of building.

K. Doors and Openings

1. Provide all interior and exterior doors, frames, hardware, as well as the finishing of bondo in each fastener dimple. Include all paint finishes as specified (Including sealing of all door tops and bottoms).
2. Provide all overhead doors (Stage Sliding Panels), frames and hardware complete.
3. Provide all requirements of doors, frames and finish hardware as specifically defined in the drawings and specifications.
4. Provide temporary construction cores at all new doors and (6) construction master keys for use during construction.
5. Once partitions are erected and prior to the installation of the door leaf, the General Trades Contractor shall protect all door jambs 5'-0" AFF with cardboard secured to the opening. This protection shall remain and/or be maintained by the general contractor until the door leafs and finished hardware is installed.
6. Include repairs of minor dents, dings and scratches (assume 1 ½" round or 3" long and shorter for scratches) to metal frames and doors with bondo. All sanding, priming and painting is also included.
7. Provide all special frame prep work (whether field or shop) and required coordination for the proper and complete installation of security, electronic strikes, etc.

8. Provide all door hardware as specifically defined in the contract documents and specifications. Door hardware will be provided be the General Trades contractor. General Contractor is responsible for furnishing and installing credential readers, request to exist devices, door position switches, power transfer devices, electric strikes, fire/life safety wall/floor magnetic hold open, electrified panic hardware, electrified fire exist hardware. The Electrical Contractor shall provide raceways, boxes, and final termination to each device as noted above. All work associated with the security contractor is also included in this contract and shall be coordinated with the General Trades contractor door hardware vendor to provide a complete and functional system.
9. Caulking around all doorframes & windows, prior to painting, is included.

L. Finishes

1. Provide all requirements up to but not limited to rough carpentry, finished carpentry, walls, drywall walls and ceilings, suspended ceilings, finishes, millwork, flooring, and specialties work complete as specifically defined in the drawings and specifications listed in the contract documents.
2. Provide all expansion joint assemblies and accessories on floors, walls, ceilings and fire rated expansion joint covers.
3. Provide all prefabricated benches within the existing Terminal B Building Footprint. Benches associated with the site construction to be furnished and installed by the **Sitework Contractor**.
4. Installation of all MEP access doors as noted. Provide all necessary stud framing and blocking required for installation. **MEP Contractor will furnish access doors**. Coordinate with the MEP Contractor for locations.
5. Include all taping and finishes complete of new work and to adjacent walls where new work ties in. Vacuum all metal tracks prior to enclosing.
6. Provide beading/taping/mudding/finishing at all raw edges including corners where new wall panels/FRP panels are overlapping/butting.
7. Prepare all floors to receive new flooring as required by each manufacturer. At a minimum, this contract will be responsible to broom clean, scrape, and vacuum all areas to receive floor finishes as part of the floor preparation. In addition, provide chipping, scarifying, bush hammering, sanding, shot blasting floating, patching, floor leveling, crack repair etc. as required for proper installation of all floor finishes provided under this contract. Utilize materials that are compatible with the floor finishes to provide the proper bonding to the substrate.
8. Provide all porcelain and ceramic wall, floor tile, marble thresholds, and transitions complete as indicated on the contract drawings.
9. Provide all tile layouts to avoid less than half a tile piece being installed at the walls/ends of the installed tile. This is applicable to porcelain, ceramic, VCT, LVT, and acoustical ceilings.
10. Provide all finished flooring types, base and transition strips as noted on the contract documents. Provide temporary protection wall to wall until acceptance by the Owner via commercial grade “Ram Board” taped at edges and seams.
11. Provide all gypsum board, metal studs, furring, shaft wall, insulation, acoustical ceilings, plaster, trim, acoustical sealant and accessories to complete all metal stud partitions, soffits and ceilings as indicated on the contract documents.

12. All interior metal stud/cold-formed metal framing/GWB work including, but not limited to, Type X GWB, shaftwall, exterior soffit board, moisture-resistant board, cement board, furring, kickers and/or bracing, channel bridging, metal studs, top and bottom tracks, furring, expansion anchors, slip tracks, firestop track, hold-down clips, continuous sealant at top and bottom for UL assemblies, insulation, sound attenuation, acoustic sealant, etc. Extend all partitions full height unless otherwise noted.

13. Install all GWB 5/8" off the floor for moisture protection. Any drywall showing evidence of exposure to moisture will be removed and replaced. Depending on the severity contractor to include a minimum removal of 3'-0"AFF.

14. GWB/stud work shall occur using the following sequence: This contract shall proceed with the track and metal studs for all full height partitions immediately following demolition & concrete slab placement. The HVAC Contractor will clearly mark on the floor the duct sizes, centerlines and bottom elevations where they penetrate walls. Contractor shall frame out for all ducts and install top portion of GWB above ceiling prior to ductwork proceeding. Firesafing of MEP penetrations will be by the General Trades Contractor. ALL MEP Contractors shall provide proper sleeves for a complete fire safe penetration. This Contract must coordinate with HVAC Contractor to stay ahead of their work. Bottom sections of wall will be boarded 1-side only to provide a reasonable opportunity for other trades to complete rough-in or blocking. Each trade will indicate when rough-in for walls is complete and ready for GWB on the 2nd side at the Daily Huddle meetings held with Turner during the week. If there is an area where GWB installation will completely interfere with MEP systems and there is a reasonable opportunity for the General contractor to install at a later date, the Construction Manager reserves right to make judgment decision and alter the above sequence.

15. Provide all fire resistant compressible filler and required fire caulking at tops of GWB partitions

16. Install stud framing as required for installation of the fire damper sleeves. Coordinate with the Mechanical Contractor for locations and layout of stud framing.

17. Provide Acoustical ceiling systems complete. Contractor is warned that all acoustical ceiling hanger wires cannot penetrate ductwork, touch ductwork or attach to ductwork or other pipes, conduits or the supports thereof.

18. Include all trapeze hangers and additional tees, mains, runners, filler tiles etc. for the installation of light fixtures, sprinkler heads, diffusers, grilles, speakers, etc.

19. Include all labor for cutting in tile for all ceiling mounted devices indicated or specified.

20. Contractor is cautioned that doors and frames are embedded in concrete. Provide saw cutting, patching of concrete floor and adjacent materials as required to complete the work.

21. Provide and execute in situ moisture/RH tests on concrete floor slabs to assure concrete is ready for concrete topping and flooring installation per the specifications. Contractor is to at a minimum provide a new "Wagner Rapid RH L6 Concrete Moisture Test Starter Kit+" Model# 880-R0002-012 (or equal) along with required accessories and additional probes for a total (15) moisture probes. Contractor to provide a floor map with the probe locations for record.

22. Provide all finished flooring types, base, transitions, reducers, primers and flash patching/floor leveling required to complete the flooring as indicated on the contract drawings and within the specifications. Contractor to include additional labor required to install patterned floor with accent colors as shown on the contract documents.

23. Provide final scrubbing, stripping, cleaning and waxing (2 coats) of all new flooring per the manufacturer's recommendations. Contractor to coordinate final sign off prior to turning over final cleaning.
24. Upon completion of the initial installation of all flooring materials, contractor shall be responsible to protect the flooring from the damage of others. Any damages shall be repaired at no additional cost to the contract.
25. Provide all requirements of painting/priming and high performance coatings as indicated on the contract drawings and specifications.
26. Include all painting up to and including painting of metals as indicated.
27. Provide all interior painting of new work and adjacent existing finishes that were patched and repaired due to installation of new work. Include final touch up of finishes as required. Painting shall be applied in a manner where the paint is terminated at the next closest break or transition point from the new work to existing finishes such as inside/outside corners, control joints, door frame, etc.
28. General Trades Contractor to provide adequate protection of all adjacent finishes during final painting. It is the responsibility of this Contract to provide and maintain protection by placing drop cloths, or poly plastic cover over existing and/or new installations. All joint compounds, and paint overspray and/or drips must be scraped and adequately cleaned from finished surfaces immediately. Care must be taken during removal from finishes. Any damages and/or staining to the finishes will be the responsibility of the Contractor to repair or replace at no cost to the Owner.
29. Neatly cover, protect and cut around all UL labels on hollow metal frames and doors. Do not remove or paint over fire rated labeling.
30. General Trades Contractor shall install prime coat and first coat of finish before all casework, millwork, ceiling grid etc. All other primes will then be permitted to install devices, specialties etc. General Trades Contractor shall assume "cutting-in" second coat to all devices.
31. Caulk all inside corners where GWB meets dissimilar materials.
32. Provide all plaster patching as indicated for work done under this contract. Prior to starting any work, submit patching procedure and sample for approval by the Architect and Owner.
33. General Trades Contractor is to include an allowance for providing (5) 2'x2' access panels to be used at the discretion of the construction manager for MEP access. Priming and painting of all access panels to match existing finishes is also included. Contractor to coordinate with MEP trades for locations. Unused portion of allowance will be deducted from the contract and credited back to the Owner via a deduct change order
34. vProvide (40) journeyman carpenter hours and (40) laborer hours to be used at the discretion of The Construction Manager's Superintendent only. Allowance shall be tracked on a Time and Material ticket. Unused portion of allowance will be deducted from the contract. Costs include all overhead and profit.
35. Provide (20) Painter Journeyman hours to be used at the discretion of The Construction Manager's Superintendent only. Allowance shall be tracked on a Time and Material ticket. Unused portion of allowance will be deducted from the contract. Costs include all overhead and profit.
36. Include all other allowances as specified in Specifications Section 012100 "Allowances" section of the Project Manual.

M. Specialties, Special Construction, Kitchen Equipment, and Furnishings

1. Provide all toilet partitions, mirrors, toilet accessories, and associated blocking complete.
2. Provide all countertops for architectural millwork as noted on the contract documents.
3. Furnish & Install Toilet partitions and accessories as indicated on the drawings and listed in the specifications. Furnish & Install wood blocking and support systems.
4. Furnish & Install FE cabinets as indicated on the drawings and listed in the specifications. Furnish & Install wood blocking as required.
5. Provide Residential Appliances/Kitchen Equipment including microwave, refrigerator and wood shelves. Coordinate equipment requirements with MEP trades.

3. **The Scope of The General Trades Specifically Excludes the following**:

1. General building permit – by Owner
2. Environmental and Materials Testing – By Owner
3. MEP concrete housekeeping pads – by MEP Contractors
4. Removal of ceiling and wall mounted electrical fixtures, and devices – by Electrical Contract

4. **The Scope of the General Trades Includes, but is Not Necessarily Limited to, the Following Understandings and Stipulations**:

A. Schedule:

1. ALL submittals and shop drawings, with the exception of those to be determined as "long lead" must be received within (45) calendar days of notice to proceed.
2. Submittal Schedule is due within (10) working days from Notice to Proceed. Submittals shall be sent directly to the Architect with a copy to The Construction Manager. All costs to recapture lost time due to late submittals will be the responsibility of that Contractor

5. Additional Provisions:

18. This contractor is cautioned that scope of work to be provided under this contract is also detailed in the Special Provisions.
19. Contractor to provide a third party utility marking company (i.e. "GPRS" Ground Penetrating Radar Services) to mark out and identify the underground utilities prior to excavation. Contractor shall also produce and submit an as-built survey to the Owner with their findings for record. Contractor is also responsible to maintain line markings for the duration of their work. Any lines that have been struck, cut or damaged due to the failure of the Contractor to mark out the lines will be the responsible of the Contractor to fix, repair and/or replace so that the services are restored to the original operating conditions.
20. All costs for labor premiums, submittal expedition costs, material fabrication and delivery expedition costs, additional supervision, additional field staff and additional office support are included in the base bid.
21. Adapt work to job conditions and make changes as required, such as moving work to clear beams, joists, windows and openings, etc. and raising or lowering work to permit the passing of the other work trades as job conditions dictate.

22. If any part of work depends upon the work of another contractor for proper execution and results, notify The Construction Manager in writing of any conditions that conflict with the furnishing and installation of the Work. Failure to do so shall constitute an acceptance of the other Contractor's work by this Contractor.

END OF GENERAL TRADES
CONTRACT PH1A-02

SECTION 011200.3 MECHANICAL TRADES CONTRACT PH1A-03
SCOPE OF WORK

1. **Scope of Work:**

The Work of this Agreement shall include, but not be limited to, all labor, materials, tools, equipment, plant, supplies, shop drawings, layout, transportation, supervision, contributions, insurance compliance with all agencies (Town, County, State and Federal as may be required), and shall cover all other items necessary for the performance of the **Mechanical Trades Contract** as shown detailed and/or implied by the following documents and as defined herein. This requisition is intended to supplement the Contract Specifications and drawings and must be used in coordination with these documents to fully understand the Scope of Work. Requirements given in one area thus are applicable to all. This requisition does not generally repeat scope requirements given in the Contract Documents but clarifies and coordinates the work. Work in the Documents repeated here is for specific coordination purposes.

If a direct conflict exists between this requisition and direction on the documents, this requisition shall govern.

The scope of your work is generally defined as all work included in specification sections as indicated in the specification matrix Exhibit C, and as here in:

a. Contract Documents Bid Set
b. Exhibit A – Milestone Schedule
c. Exhibit B – Site Logistics Plans (SL-1)
d. Exhibit C – Specification Matrix
e. Special Provisions - 011100

2. **The Scope of the Mechanical Trades Contract PH1A-03 includes, but is not limited to, providing the following**:

A. General

1. This work shall include all scope of work items in other drawings defined as; but not limited to "MECH", "HVAC" and/or "Mechanical Contractor", "Mechanical Trades", "Mechanical Work", "HVAC/Mechanical Work". This work shall include all scope of work items in other drawings defined as; but not limited to "PC", "PLUMB", and/or "Plumbing Contractor", "Plumbing Trades", Plumbing Trades Contract", "Plumbing Work". Contractor is advised that you must review ALL drawings to fully understand the scope of work and coordination with other trades as required by this contract.

2. Note: The work of this contract will occur over multiple phases, spanning a period two years that will a winter shutdown from December through March, starting in September of 2021 ending in May 2023. Refer to Milestone Schedule (Exhibit A) for substantial completion dates.

3. Provide any additional second shifts, double shifts Saturday, and Sunday work as necessary to meet the Project Milestone Schedule.

4. Adapt work to job conditions and make changes as required, such as moving work to clear beams, joists, conduits and piping. Raising or lowering work to permit the passing of work by other trades as job conditions dictate will be done at no additional cost.

5. Include all documents and related costs of permits, including tapping fees, to execute your work.
6. Provide all field coordination, layout and field engineering required to perform the Mechanical equipment and piping installation work.
7. Verify existing conditions before starting the Work. Notify the Construction Manager immediately if any discrepancies are discovered.
8. All contractors are responsible for coordinating their work with the building room numbers as shown on the contract documents. Reference the contract documents for further details and information.
9. This contractor is responsible to investigate existing building systems to determine the effect and extent of mechanical system shutdowns.
10. All HVAC and Mechanical related testing and inspection requirements as specified in the Contract Documents will be the responsibility of the Mechanical Contractor.
11. Provide all air-safing/fire-safing and/or fire-stopping of all new ductwork, piping and conduit penetrations through rated walls, ceilings and floors pertaining to this contract with the appropriate UL assembly/rating.
12. Provide any and all blocking required to support in wall or in chase rough-in. All wood blocking shall be fire treated.
13. Coordinate blocking in new walls with General Trades Contractor.
14. Provide ALL roof curbs required for mechanical installation complete.
15. Provide all necessary core drilling, saw cutting and patching required for floors, walls, ceilings and roof penetrations. All floor slab penetrations shall be DRY CUT/CORED with continuous vacuum apparatus to prevent dust propagation.
16. Provide all sleeves at walls, ceiling and floor penetrations as specified in the Contract Documents.
17. Provide sealants at joints between any piece of this contract work and adjacent materials by others. Colors (if required) to be selected by the Architect.
18. Provide painting of mechanical lines, equipment, and hangers.
19. Provide all unloading, hoisting, scaffolding, planking, man-lifts etc. for safe access, material handling and storage to complete the scope of this work.
20. Include dunnage and temporary protection of materials stockpiled on site to prevent damage from other trades, dirt/mud and moisture infiltration. Barricade as necessary. Include moving these items as required for completing your work.
21. GWB and stud work shall occur using the following sequence: The General Contractor shall proceed with the track and metal studs for all full height partitions immediately following demolition & concrete slab placement. The Mechanical Contractor will clearly mark on the floor the duct sizes, centerlines and bottom elevations where they penetrate walls. The General Contractor shall frame out for all ducts and install top portion of GWB above ceiling prior to ductwork proceeding. Firesafing of MEP penetrations will be by the General Trades Contractor. ALL MEP Contractors shall provide proper sleeves for a complete fire safe penetration. The Mechanical Trades Contractor MUST coordinate with the General Trades Contractor so that they can stay ahead of the HVAC work. Bottom sections of wall will be boarded 1-side only to provide a reasonable opportunity for other trades to complete rough-in or blocking. Each trade will indicate when rough-in for walls is complete and ready for GWB on the 2nd side at the Daily Huddle meetings held with Turner during the week. If

there is an area where GWB installation will completely interfere with MEP systems and there is a reasonable opportunity for the General contractor to install at a later date, the Construction Manager reserves right to make judgment decision and alter the above sequence.

22. The drawings are diagrammatic and may not be complete in every detail. They reflect the intent of the Architect/Engineer to provide for a complete working system in compliance with all codes as shown by the documents. This contractor shall include any other equipment or devices necessary to provide a complete functioning system

B. Demolition

1. Demolition and disposal of all Plumbing, Fire protection and HVAC, mechanical equipment, grilles, louvers, insulation, accessories, etc. not shown or identified on the hazardous materials drawings is the responsibility of the Mechanical Contractor. Salvage existing grilles, louvers, etc. for re-installation as noted on the contract documents.
2. Disconnect, demolish and dispose of all existing Plumbing Fire Protection, HVAC and mechanical equipment as shown on the contract drawings to complete the work of this contract. Include modifications to existing piping and ductwork that is to remain as necessary to prepare for new connections.
3. Disconnect, demolish and dispose of all miscellaneous piping, piping accessories, ductwork accessories, insulation, supports, controls, control accessories, control wiring and associated conduits, g and accessories as required to complete this contract.
4. Demolish and dispose of all existing hot water piping, condensate piping, branch piping, risers, and heating hot water mains, etc. where indicated. Include all associated valves, traps, hangers and accessories. Prepare existing piping to remain for re-connection.
5. Provide any and all plumbing system demo of piping and fixtures, floor drains etc. in floors, walls, chase ways and ceilings in areas scheduled for selective demolition (coordinate with Architectural Drawings).
6. Provide all saw cutting, hand excavation and backfill, as necessary for interior work outside of the slab removal limits shown. Work includes reinforcement and concrete replacement for trenching at interior existing slabs for installation of work per your contract including but not limited to, floor drains, storm drains, storm lines, trench drains, etc. All saw cutting and slab removals shown will be by the General Trades contractor.
7. Provide evacuation of refrigerant or glycol from any of the existing equipment being demolished prior to disposal. Owner has the right to reclaimed refrigerant, which is to be reclaimed and cleaned to ARI 700-1993 standard of purity, stored in appropriate, marked containers and turned over to a location the owner chooses. This contractor shall dispose of chemicals at a legal disposal site if not claimed by the owner. Disposal into on site dumpsters is prohibited.
8. Mechanical Contractor to furnish all access panels/doors as noted on the contract documents to the General Trades Contractor for installation along with detailed layout drawings and coordination for access panel locations.
9. Include removal and replacement of any portions of existing gypsum board or hard ceilings located above the existing acoustical ceiling system as required to complete this work whether shown on the contract documents or not.

C. New Work – Plumbing

1. Provide all plumbing materials, equipment, fixtures, and devices shown, noted or scheduled on the drawings and in the specifications, ie. natural gas piping, domestic cold water, domestic hot water, domestic hot water returns, storm lines, sanitary waste and vent lines and compressed air piping, etc. shown on the drawings and/or as required to complete this scope of work.
2. Provide any in wall blocking to support the work required under this contract provided by this contractor. All blocking shall be fire treated.
3. Provide all condensate drain piping to collect discharge of all equipment provided in this contract and pipe to nearest drain whether indicated on plans or not.
4. Furnish all access doors of appropriate size required for your work, whether shown or not, to the General Trades Contractor for their installation.
5. Provide all valves, hangers, support devices, tie rods, dunnage, escutcheons etc., whether shown on the drawings or not, required to complete this scope of work.
6. Provide all elbows, fittings, offsets, etc. as required whether or not shown on the Contract Drawings in order to complete a run of pipe. Contractor should anticipate complicated routing as this is a partial renovation of an existing building.
7. Provide new fire suppression system work as indicated on the Contract Documents.
8. Provide all floor drain frames/grates and area drains as indicated on the drawings. Provide all roof drains and stormwater piping.
9. Provide disconnection and final connection of gas & water lines to all mechanical, or misc. equipment shown or scheduled to be disconnected, modified, relocated or replaced.
10. Coordinate rough in with other prime Contractors. All power requirements to be coordinated with the Electrical Contractor.
11. Provide any and all sealants required to complete the scope of this work. Include caulking all fixtures to surrounding materials.
12. Provide all concrete housekeeping equipment pads required for this contract. All concrete equipment pads are to be painted safety yellow vertically and 6 inches horizontally.
13. Furnish to and coordinate with the General Trades Contractor all sleeves for this work that penetrate concrete and masonry walls (via dimensioned transmitted drawing). Plumbing contractor shall verify that the sleeves are installed in the correct location prior to the placement of concrete/masonry. This Contractor shall provide necessary sawing and coring for penetrations through walls, floors, and ceilings that sleeves were not provided.
14. Provide all vibration isolators and expansion compensators.
15. Provide all pipe ID work as required per specifications. Valve tags for all valves with valve chart are required.
16. Provide drip pans or gutters with piped open drains to the nearest floor drain for plumbing lines running through or in electrical closets, at temperature control panels, fire alarm panels, IT closets or IT rooms.
17. Clean-outs shall be flush with finished flooring, concrete so as not to allow the formation of puddles of water on them or create a tripping hazard.
18. Provide all sterilizing / disinfection of all water piping complete. Provide certification reports to CM.
19. Provide all insulating of new and existing plumbing equipment as specified and noted on the Drawings. For any insulation that is not specifically called for on the documents, this

contractor shall comply with the requirements of the New York State Energy Conservation Code.

20. Provide all piping insulation complete as specified or noted on the drawings.
21. System check and startup of all equipment and systems provided by this contract or in coordination with systems provided by other trades when Plumbing work is interfacing. This may require out of sequence work for individual trades even though it is in sequence with overall completion schedule. This start-up and testing will, when possible, be scheduled during normal business hours (however, any premium hours shall be included).
22. Provide forty (40) journeyman plumber hours to be used at the discretion of The Construction Manager's Superintendent only. Allowance shall be tracked on a Time and Material ticket. Unused portion of allowance will be deducted from the contract. Costs for these hours include all overhead and profit.

D. New Work - HVAC

1. Provide all HVAC and mechanical equipment and piping shown, noted or scheduled on the drawings and specifications. Up to and including all refrigerant and gas piping as required whether shown on the drawings or not for a complete functioning system.
2. Provide all new mechanical supply/return piping, risers, and thermal expansion loops up to and including new insulation complete as shown on the contract documents.
3. Provide new concrete housekeeping pads for all new floor mounted HVAC and mechanical equipment including all reinforcing complete as shown on the drawings. Painting of all new concrete housekeeping pads "safety yellow" is also included. At a minimum the edge of the pads shall be painted full height vertically and 6" horizontally.
4. Provide all new HVAC systems, ductwork, and associated accessories, etc. complete as shown on the contract documents up to and including all preparations for connections to existing systems to remain.
5. Provide all sheet metal work complete up to and including all required dampers as specified.
6. Provide all new AHU's, ACCU's, Fin-tube Radiator, MAUs, heat pump units, unit heaters, HEPA units complete including GRD's, insulation, piping, tie-ins and wind bracing, etc. for a complete system installation.
7. Provide all intake hoods, relief hoods, goosenecks, exhaust fans and vents as indicated on the contract documents.
8. Provide all registers, diffusers and grilles as shown.
9. Provide all HVAC, mechanical pedestals and equipment support as required.
10. The General Trades Contractor will provide all steel members, decking, and/or angle frames for all MEP roof penetrations, rooftop equipment support, deck and slab infills, and deck and slab openings. Mechanical Contractor to provide all roof curbs. The Mechanical Contractor is required to review all Demolition, Structural, Roofing and Mechanical documents to coordinate locations with the General Trades Contractor in the field prior to installation of steel.
11. All equipment and frames with equipment shall be primed painted or galvanized. Finish painted equipment is to be standard factory issue. All primed, galvanized and finish painted equipment is to be field touched up if scratched, marred or dented prior to Owner's acceptance.

12. Provide roof protection as necessary to complete the installation of this contract. Patching, repair, and/or replacement of damaged roof areas will be the responsibility of this contract.
13. Furnish all new mechanical access doors as specified to the General Trades Contractor for installation. Mechanical Contractor to provide locations and layout.
14. Provide all new temperature control work complete as specified. This includes but not limited to all control wiring, conduit and raceway for equipment/devices, temperature sensors and thermostats. Modifications of existing controls identified to remain are also included.
15. Furnish all louvers complete up to and including all mounting hardware, insulated blank off panels, bird screens, extruded sills, etc as required at all window locations as noted on the contract documents. General Trades Contractor to install all louvers within the window openings. Mechanical Contractor to reconnect all mechanical equipment to louver after louver has been installed.
16. Furnish all information required for connection of power to all Mechanical equipment to the electrician. The electrician will provide power as required to all Mechanical equipment per the equipment connection schedules.
17. Furnish all loose motor starters and controllers (and associated fusing) required to operate equipment furnished under this contract to the Electrical Contractor. These loose starters shall be mounted as close as possible to the equipment served. All power and wiring from the electrical panel to the starters shall be by the Electrical Contractor. All interconnecting wiring and power wiring from the starter to the equipment shall be provided by the Electrical Contractor. The Mechanical Contractor shall provide all low voltage wiring and terminations required for complete operation of controls.
18. Provide all variable frequency drives and all associated components complete, including sensors, transmitters, controllers, and disconnect switches, etc. Electrical Contractor will bring power to drive locations and terminate.
19. Provide all air and water balancing of new and reconfigured installations to the required specifications as indicated on the contract documents and specifications.
20. Provide all insulation for new work (pipe and duct) up to and including connections and/or overlaps to existing insulated pipes and ductwork. Internally lined ducts must be labeled on the outside.
21. Provide all valves, inserts, required pipe and duct hangers, clamps, trapezes, tie rods, pipe and duct supports, dunnage, escutcheons, grout, and other items required for suspension of HVAC work from above and from the floor. Provide sheet metal inserts of a size and gauge to prevent crushing of insulation at all hangars.
22. Ductwork, piping, conduit, etc. systems are to be independently supported and not supported from each other or from other equipment or ceiling systems steel/hanger wires, etc. All work to be secured to slabs, walls, or structural members.
23. Provide all elbows, fittings, offsets, etc. as required whether or not shown on the Contract Drawings in order to complete a run of pipe, ductwork, reconfiguration and/or modification of existing piping designated to remain.
24. Provide all stenciling and pipe ID materials and installation per specifications. Include flow arrows and color coding. Provide equipment labels, which shall be permanent plastic laminate type.
25. All valves shall be tagged and a valve tag list shall be provided to the Owner for each building with the O&M materials.
26. Provide coordination of mechanical rough-in with other Prime Contractors.

27. Provide all new fire dampers and smoke dampers complete at locations shown on the contract documents and as per the specifications. The mechanical contractor is required to review the code compliance drawings and provide dampers for all duct that pass through fire-rated partitions/floors

28. The General Contractor shall procure the services of a Firestop Contractor as a single source responsibility for all fire stopping and smoke sealing as required per the plans and specifications, for all MEP penetrations, using UL Assemblies as required to maintain the UL floor and wall assembly rating required by the contract documents. Mechanical Contractors shall coordinate the installation of their work so that is conforms to the UL Assembly provided by the General Trades Contractor for each penetration, and shall provide all sleeves preinstalled on all piping required by that Assembly. All existing floors (excludes slab-on-grade) shall be treated as 2hr assemblies. Any excessive demolition will be in this Contractor's responsibilities to patch.

29. Provide all testing, adjusting, and balancing work per the specifications of both air, water, and hot water.

30. Provide testing in sections / zones of piping and sections of ductwork in a manner that allows other trades to complete their work within the schedule. One or more of the following must witness and sign-off on each test: The Construction Manager, the Owner or the Architect / Engineer. Provide 24-hour notice before testing takes place. Include all balancing valves and devices shown and as required to properly balance the system, whether on drawings or not. All testing and adjusting is to occur during normal work hours, but if it becomes necessary to perform this work after hours to facilitate meeting the completion schedule, all costs shall be absorbed by the M/E trades.

31. All reports must be filed with The Construction Manager for release of Substantial Completion Certificate issued by the Architect. Testing shall be completed in a manner to allow for partial areas to be completed and utilized.

32. Include twenty (20) additional Journeyman Fitter hours and twenty (20) sheet metal journeyman hours for use at the Construction Managers discretion for unforeseen mechanical conditions. This will be tracked utilizing daily time tickets signed by the Construction Manager Superintendent. Any unused allowance will be credited back to the Owner via a deduct change order. Labor hours include all overhead and profit.

3. **The Scope of The Mechanical Trades Specifically Excludes the following**:

1. General building permit – by Owner
2. Environmental and Materials Testing – by Owner
3. Asbestos abatement – by General Trades Contract
4. Installation of motors and starters - by Electrical Contract
5. Electrical power to equipment – by Electrical Contract
6. Cutting and installation of mechanical access panels – by General Trades Contract

4. **The Scope of the Mechanical Trades Includes, but is Not Necessarily Limited to, the Following Understandings and Stipulations**:

A. Schedule:

1. In order to maintain project milestone schedule, all long lead submittals, up to and including any product data, and shop drawings are required to be submitted to the Architect (15) working days from notice to proceed for an expedited review by the Architect and Engineer.

   Mechanical Contractor to include ALL additional expedited manufacturing costs or expedited shipping costs, etc. to ensure that the Mechanical and HVAC equipment is delivered on time. This contract must have ALL approved submittals in time to have the units manufactured and delivered to meet this date. Due to the limited site availability, all materials and equipment shall be stored off site and ready for just in time delivery. Progress billing on stored materials can be made upon receipt. Coordinate with the CM for offsite inspections.

B. Additional Provisions:

1. This contractor is cautioned that scope of work to be provided under this contract is also detailed in the Special Provisions.
2. All costs for labor premiums, submittal expedition costs, material fabrication and delivery expedition costs, additional field staff and additional office support are included in the base bid.
3. All warranties for mechanical equipment, components, systems and accessories, etc. are to commence from the date of either partial substantial completion and/or final substantial completion issued by the Architect. Any cost associated with providing extended warranties to meet this requirement shall be included in the base bid.
4. The work of this package shall be installed as coordinated with other trades and the Construction Manager. Allow sufficient time for installation of work so as not to delay any work.
5. If any part of work depends upon the work of another contractor for proper execution and results, notify The Construction Manager in writing of any conditions that conflict with the furnishing and installation of the Work. Failure to do so shall constitute an acceptance of the other Contractor's work by this Contractor.
6. Coordinate with all parties' start-up and testing of systems and equipment. This may require out of sequence work for individual trades even though it is in sequence with overall completion schedule. This start-up and testing will, when possible, be scheduled during normal business hours (however, any premium hours shall be included).
7. Where material is specified to be furnished by others or furnished delivered only, the Contractor installing the material shall be responsible for scheduling the delivery, receiving, unloading, storing, handling, relocating, hoisting, distributing, laying out, and installing. Upon receipt, risk of loss and damage shall be borne by this Contractor.
8. Restoration to any existing finishes, inside and outside, for damage caused by the work of this Contractor. This includes, but is not limited to, floors, ceilings, soffits, GWB, wall tile, trim, paint, brick, lawn, landscaping etc.
9. This Contractor is responsible to produce any and all field sketches needed to identify, evaluate, coordinate or resolve construction conflicts for this work and for the submission of a 'Request for Proposal' to the Construction Manager.

END OF MECHANICAL TRADES
CONTRACT PH1A-03

SECTION 011200.3 ELECTRICAL TRADES CONTRACT PH1A-04
SCOPE OF WORK

1. **Scope of Work:**

The Work of this Agreement shall include, but not be limited to, all labor, materials, tools, equipment, plant, supplies, shop drawings, layout, transportation, supervision, contributions, insurance compliance with all agencies (Town, County, State and Federal as may be required), and shall cover all other items necessary for the performance of the **Electrical Trades Contract** as shown detailed and/or implied by the following documents and as defined herein. This requisition is intended to supplement the Contract Specifications and drawings and must be used in coordination with these documents to fully understand the Scope of Work. Requirements given in one area thus are applicable to all. This requisition does not generally repeat scope requirements given in the Contract Documents but clarifies and coordinates the work. Work in the Documents repeated here is for specific coordination purposes.

If a direct conflict exists between this requisition and direction on the documents, this requisition shall govern.

The scope of your work is generally defined as all work included in specification sections as indicated in the specification matrix Exhibit C, and as here in:

a. Contract Documents Bid Set
b. Exhibit A – Milestone Schedule
c. Exhibit B – Site Logistics Plans (SL-1)
d. Exhibit C – Specification Matrix
e. Special Provisions - 011100

2. **The Scope of the Electrical Trades Contract PH1-04 includes, but is not limited to, providing the following:**

A. General

1. All existing systems are to remain operational until end of school year with the exception of the early abatement and demolition work as noted on the Milestone Schedule. Contractor shall include rerouting of all systems and components required to maintain power, data, fire alarm, safety and security system, etc. to the remainder of the building. Temporary removal and reinstallation of existing systems as necessary to complete this work is also included.
2. Provide additional second shifts, double shifts and Sunday work as necessary to meet the Project Milestone Schedule.
3. Note: The work of this contract will occur over multiple phases, spanning a period two years that will a winter shutdown from December through March, starting in September of 2021 ending in May 2023. Refer to Milestone Schedule (Exhibit A) for substantial completion dates.
4. Include all documents and related costs of permits, including tapping fees, to execute your work.
5. Light fixture layout should be coordinated with Architectural reflective ceiling drawings. Any discrepancies shall be resolved before installation.

6. This work shall include all scope of work items in other drawings defined as; but not limited to "EC" and/or "Electrical Contractor". Contractor is advised that you must review ALL drawings to fully understand the scope of work required by this contract.
7. Provide all field coordination, layout and field engineering required to perform the Electrical installation work.
8. Provide all unloading, hoisting, scaffolding, planking, man-lifts etc. for safe access, material handling and storage to complete the scope of this work. Include dunnage and temporary protection of materials stockpiled on site to prevent damage from other trades, dirt/mud and moisture infiltration. Barricade as necessary. Include moving these items as required for completing your work.
9. All contractors are responsible for coordinating their work with the new building room numbers. Reference the contract documents for further details and information.
10. This contractor is responsible to investigate existing building systems and cable routings to determine the effect and extent of electrical system shutdowns.
11. Provide all removal and reinstallation complete, of existing electrical equipment, systems, and devices as noted on the drawings.
12. Verify existing conditions before starting the Work. Notify The Construction Manager immediately if any discrepancies are discovered.
13. All necessary core drilling, saw cutting and patching required for floors, walls, ceilings and roof penetrations. All floor slab penetrations shall be DRY CUT/CORED with continuous vacuum apparatus to prevent dust propagation.
14. All Electrical-related testing and inspection requirements as specified in the Contract Documents will be the responsibility of the Electrical Contractor. All existing fire alarms and wireless systems (WAP), and ceiling mounted devices removed and replaced are to be tested and inspected after reinstallation. Provide copies of all UL inspection receipts and test reports to the Construction Manager.

B. Demolition

1. All demolition and disposal of electrical, communications, safety and security equipment as specified and required to complete this scope of work. Cleaning and storing of existing equipment and fixtures for re-installation as noted is also included.
2. Protect, support and ID cables to remain in areas scheduled for demolition regardless of contractor performing the demolition. If this is not practical, include splicing and rerouting as necessary.
3. Temporarily support and maintain all existing lights, conduits, branch circuits and systems wiring during demolition of ceilings and above ceiling work. Including but not limited to rehanging and maintaining any lighting, speakers, FA, cabling, tele/data, devices, etc. that were secured to the ceiling. Provide for reinstallation once new ceiling work is installed.
4. Disconnect and remove all associated electrical work back to source panel as indicated on the contract documents.
5. Provide any/all electrical system demo for piping in floors, walls and ceilings in areas scheduled for selective demolition (coordinate with Architectural Drawings). Include all Electrical disconnections/removals/relocations for lines in walls, floors, ceilings as may be required by the other trades (This may require multiple mobilizations). Verify all lines are deactivated prior to the start of any demolition work. Patch, insulate and finish all wall penetrations where old piping was removed. Patch floor slabs as required.

6. Disconnect and remove all empty and abandoned raceways unless noted otherwise. Cut flush with floor where applicable and plug with grout as indicated on the contract documents.

7. Disconnect all power to renovated/reconstructed areas and to all equipment being replaced/relocated prior to the start of demolition (refer to Architectural, Plumbing, Mechanical and Electrical Drawings). Remove any electrical hangers, supports, conduit, raceway, wiring, equipment, panels, transformers, devices, disconnects, motor starters, etc in these spaces unless specifically shown to remain

C. New Work

1. Provide all electrical equipment shown, noted or scheduled on the drawings, including all electrical equipment in the specifications.

2. Provide all power and data/communications requirements; to be coordinated with the other trade contractors. Provide all A/V equipment located in the utility room (Ref E402A, E403A)

3. The electrical contractor will be responsible to furnish and install site electrical materials including conduit, duct bank spacers, wire, handholes, vendor receptacles, site lighting pole bases and heads, etc. Sitework Contractor will provide excavation for underground electrical work as shown on the contract documents. This includes backfill, pipe bedding materials, ductbank concrete conduit encasement (including reinforcing bar), rough grading, road paving, curbs, sidewalk saw cut removal and replacement, backfill and compaction, placement of topsoil, fine grading and seeding.

4. Install all power, motor starters, disconnect switches, and controllers complete, including those furnished by the Mechanical and Plumbing contractors.

5. Provide all panel board and back box modifications necessary to complete the electrical work including new circuits as specified or indicated.

6. Provide any in wall blocking to support the work required under this contract. All in-wall blocking shall be fire treated.

7. Update all panel board directories to reflect any changes done throughout the project.

8. Provide all in slab and in wall wire rough in, raceway, etc as required to complete the work. No surface-mounted raceway is acceptable in new construction areas. Provide floor boxes and floor trench box raceways where indicated.

8. Provide all saw cutting, hand excavation and backfill, as necessary <u>for interior work outside of the slab removal limits shown</u>. Work includes reinforcement and concrete replacement for trenching at interior existing slabs for installation of work per your contract. All saw cutting and slab removals shown will be by the General Trades contractor.

9. Work includes reinforcement and concrete reinforcement for trenching at interior existing slabs for installation of work per your contract.

10. Provide power wiring to control unit at each mechanical device as shown on the electrical schedule. Also included is the wiring from the control unit to the mechanical equipment indicated on the schedule.

11. Provide all power systems complete, including but not limited to, panel board, back boxes, transformers, conduit, wire, grounding, boxes, switches, receptacles, occupancy switches etc. All wiring shall be in appropriate pathways as noted in the contract documents.

12. Provide power and data pathway and boxes as required for all equipment including owner's stage equipment and sound equipment. This contractor is reminded to review all of the drawings prior to pouring of concrete slabs and provide all necessary conduits/raceways within the slabs.

13. Furnish and Install all lighting fixtures, interior and exterior, complete with conduits, wiring and termination as required for system functionality. Provide all lighting control systems. This Contractor shall refer to the architect's reflected ceiling plan for exact locations of all lighting fixtures, as well as the electrical drawings. All exit signs shall be connected to dedicated "constant on" emergency circuits. Reference electrical drawings for light fixtures which shall be connected to "constant on" emergency circuits. Provide all painting of all exposed conduit and support brackets. Paint to match ceiling colors.

14. Provide all grounding and bonding for the project. Grounding and bonding includes as follows:

    a. Provide ground rods and grounding of building structure

    b. Provide grounding of mechanical and plumbing systems.

    c. Ground generator set and related emergency equipment.

    d. Provide grounding for communications/data systems and cable tray.

    e. Provide all test reports for grounding systems.

15. All equipment and frames with equipment are to be prime painted or galvanized. Finish painted equipment is to be standard factory issue. All primed, galvanized and finish painted equipment is to be touched up in the field if scratched, marred or dented prior to Architect/Owner acceptance. This contractor owns protection of their work and correction of any damage that occurs to it for not protecting properly.

16. Provide all electrical identification including but not limited to nameplates for all electrical equipment power and control panels, panel directories, wire markers, cable tags, low and medium voltage raceway identification, and color-coded tape. In addition, electrical contractor shall provide new labeling for all disconnects provided by all other contractors as part of this contract indicating panel number and circuit. Pre-clean area where label is to be placed to insure adhesion.

17. Electrical Contractor shall provide 6" concrete pads for all Electrical equipment as indicated on the Contract documents. All concrete equipment pads shall be painted safety yellow. (6" vertically – 6" horizontally).

18. Furnish all access doors of appropriate size required for your work, whether shown or not, to the General Trades Contractor for their installation.

19. Include complete replacement of all broken / defective items caused by this contractor prior to acceptance by the Architect.

20. Restoration of landscape and site finishes due to damages incurred by this scope of work is included.

21. Include all light switching, key switches and timer switches per the drawings. Include connection of existing light switching to replacement lights and the modification of any circuiting to match as indicated on the documents.

22. Include all occupancy sensors, power packs and associated wiring.

23. Provide all wiring devices (outlets/receptacles, poke through, toggle switches, occupancy sensors and GFI/duplex outlets); telephone, door switches, and security system conduit runs.

Include convenience outlets at all RTU's circuited to a panel separate from the main power to the RTU.

24. Provide all waterproofing and counterflashing of conduit for penetrations in roofs, walls and other weather-barrier surfaces.
25. On all equipment scheduled, Electrical contractor shall wire and terminate power to the motor for each piece of equipment. Coordinate phasing and size with respective contractor.
26. Include all labor and materials necessary to provide power for the sanitary force main pump, control panel etc. required. All power wiring will be installed by the Electrical Contractor. Provide labor to coordinate installation with materials furnished by Sitework Contractor.
27. Provide power to all Automatic Temperature Control panels.
28. All data and system work complete as indicated on documents. Include new data racks, patch panels, patch cords, etc. as indicated on drawings and specifications. Include new fiberoptic/telephone conduit and wiring
29. This Contractor shall include all labor and materials to keep network operations continuous throughout the construction period. In the event that a cable is damaged the Electrical contractor shall provide new cable to keep service to the end user.
30. Provide all low voltage systems equipment and as specified including all pathways, cable, speakers, headend, etc. All terminations, labeling, programming, start-up, testing and training are included. Provide all A/V patch panels and racks as indicated. Provide all Stage equipment and wiring
31. Provide the security system as specified including all CCTV cameras and equipment as indicated.
32. Door hardware will be provided be the General Trades contractor. The wiring, power, security connections, etc. is to be supplied and installed by the Electrical Contractor. Electrical Contract is to make connections to the electronic strikes and/or any other hardware requiring power (i.e. electronic closers, ADA push pads, etc.). General Trades will install ALL other components. Electrical Trades shall coordinate for installation and sequencing with the security system vendor. All work associated with Day automation will be by the General Trades. Electrical Trades portion of the work shall be coordinated with the General Trade's contractor door hardware vendor and DAY to provide a complete and functional system.
33. Provide all interfaces with the Temperature Controls subcontractor who will design, furnish and install a combination direct digital control (DDC) temperature control system and Building Controls System (BCS), which will network back to the Buildings Automation Systems (BAS). Coordinate this work with the Mechanical Contractor.
34. Provide all labor and materials for the fire alarm system as specified. Provide devices, modules, wiring for connection to the fire alarm. Provide controls and wiring to interface with HVAC systems for shutdown and control. Provide controls and wiring to interface with security & access systems for shutdown and control. Provide controls and wiring to interface with smoke & fire/smoke dampers for shutdown and control.
35. Provide 120 volt emergency circuit as required. Review mechanical drawings for all damper locations. The mechanical contractor is required to review the code compliance drawings and provide dampers for all duct that pass through fire-rated partitions/floors. The Electrical Contractor shall do the same to calculate the number of FA connections that will be required for a complete system.
36. Electrical Contractor is responsible for protecting panel boards from dust and debris during construction. This contract is responsible for all final cleaning of electrical panel boards (i.e.

shop vac), transformers and devices prior to energizing equipment or installing devices. Electrical Contractor shall get written sign offs from Construction Manager that cleaning is satisfactorily completed.

37. Provide all J-hooks, cable trays, straps, cords, and supporting devices of all new wiring, and cabling per the specifications.
38. This Contractor shall include furnishing, painting and installing backboards for wall mounted equipment and panels. All plywood is required to be fire treated. Coordinate with finishes contract to install backboards prior to equipment installation to allow for painting of all surfaces.
39. Provide all stenciling and conduit ID materials and installation per specifications.
40. Provide all sealants necessary between your work and dissimilar materials.
41. The General Contractor shall procure the services of a Firestop Contractor as a single source responsibility for all fire stopping and smoke sealing as required per the plans and specifications, for all MEP penetrations, using UL Assemblies as required to maintain the UL floor and wall assembly rating required by the contract documents. ALL MEP Contractors shall coordinate the installation of their work so that is conforms to the UL Assembly provided by the General Trades Contractor for each penetration and shall provide all sleeves preinstalled on all piping required by that Assembly.
42. Provide forty (40) electrician journeyman hours to be used at the discretion of The Construction Manager's Superintendent only. Allowance shall be tracked on a Time and Material ticket. Unused portion of allowance will be credited back to the owner. All overhead and profit is included with this labor hours
43. Provide $5,000 allowance for additional wiring devices or replacements. Unused portion of allowance will be credited back to the owner. All overhead and profit is included with this allowance.

3. **<u>The Scope of The Electrical Trades Specifically Excludes the following</u>**:

1. General building permit – by Owner
2. Environmental and Materials Testing – by Owner
3. Asbestos abatement – by General Trades Contract

4. **<u>The Scope of the Electrical Trades Includes, but is Not Necessarily Limited to, the Following Understandings and Stipulations</u>**:

A. <u>Schedule:</u>

1. In order to maintain project milestone schedule, all long lead submittals, up to and including any product data, and shop drawings are required to be submitted to the Architect (15) working days from notice to proceed for an expedited review by the Architect.
2. **<u>Due to the critical nature of the project, all electrical equipment and materials are required to be delivered to the contractor ready for install to meet the milestone schedules.</u>** This contract must have ALL approved submittals in time to have the units manufactured and delivered to meet this date. Due to the limited site availability, all materials and equipment shall be stored off site and ready for just in time delivery.
3. Work to be performed per The Milestone Schedule. Contractor shall be responsible for staffing the job to meet this schedule in terms of activity duration and general sequencing of work. All costs associated to meet this schedule will be the responsibility of this contractor. The job will

be made available for off-shift and weekend work by providing 48 hours' notice to the Construction Manager.

B. Additional Provisions:

1. All costs for labor premiums, submittal expedition costs, material fabrication and delivery expedition costs, additional supervision, additional field staff and additional office support are included in the base bid.
2. All warranties for electrical equipment, lighting, components, systems and accessories, etc. are to commence from the date of either partial substantial completion and/or final substantial completion issued by the Architect. Any cost associated with providing extended warranties to meet this requirement shall be included in the base bid.
3. The work of this package shall be installed as coordinated with other trades and The Construction Manager. Allow sufficient time for installation of work so as not to delay any work.
4. If any part of work depends upon the work of another contractor for proper execution and results, notify The Construction Manager in writing of any conditions that conflict with the furnishing and installation of the Work. Failure to do so shall constitute an acceptance of the other Contractor's work by this Contractor.
5. Adapt work to job conditions and make changes as required, such as moving work to clear beams, joists, windows and openings, etc. and raising or lowering work to permit the passing of the other work trades as job conditions dictate.
6. Coordinate with all parties start-up and testing of systems and equipment. This may require out of sequence work for individual trades even though it is in sequence with overall completion schedule. This start-up and testing will, when possible, be scheduled during normal business hours (however, any premium hours shall be included).
7. Price shall include all fees and other costs for securing and maintaining, for the life of the job, all permits, PE licenses, connection fees, inspection etc. applicable to, or customarily secured for the Work. In addition, any permits to be issued in the name of the Contractor as required for the Work. Originals of all permits are to be furnished to the Construction Manager prior to commencement of the Work.
8. Furnish and install any temporary weather protection required for work exposed to the environment including work performed during weather events.
9. The drawings are diagrammatic and may not be complete in every detail. They reflect the intent of the Architect/Engineer to provide for a complete working system in compliance with all codes as shown by the documents. This contractor shall include any other equipment or devices necessary to provide a complete functioning system
10. Restoration to any existing finishes, inside and outside, for damage caused by the work of this Contractor. This includes, but is not limited to, ceilings, soffits, GWB, wall tile, trim, paint, brick, lawn, landscaping etc.
11. This Contractor shall contact Dig Safe NY and local utility companies to verify underground utilities prior to any trenching and excavating.

END OF ELECTRICAL TRADES
CONTRACT PH1A-04

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices may be used for changes to the scope of work, whether the change is processed via an allowance authorization or change order. Unit prices shall include all necessary labor, material, handling, delivery, installation, equipment, tools, fittings, insulation, storage, hoisting, distribution, protection of materials, clean-up, field and office supervision, fringe benefits, and insurance. Overhead and profit are not to be included with unit prices. If unit prices are used for a change order, overhead and profit may be added as a separate line item. For allowance authorization, no additional charges except the unit price shall be included. The unit prices apply for the NET change in quantity for each change request issued. If additional bonding costs are required, a new change percentage will be added to the net total cost of the change. Additional bonding costs apply to formal change orders only, not to allowance disbursements. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. Schedule of Unit Prices: A schedule of unit prices is included in Part 3 and is listed on the individual bid forms for each contract. Specification Sections referenced in the schedule contain requirements for materials described under each unit price. Contractors must provide all unit prices with their respective bid submission. The unit prices will be reviewed by the Owner's Representative and Architect prior to awarding the contract to ensure that the unit prices are fair and reasonable. Final unit prices will be negotiated and approved by the Owner's Representative, Architect, and Contractor. The Owner reserves the right to reject any bid whereby all parties cannot come to an agreement on the unit prices.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Excavation, Handling, and Off-Site Disposal of Contaminated Soil

1. Description: Excavate, handle, transport and legally dispose of contaminated soil as non-hazardous waste in accordance with all applicable regulations. The soil may be mixed with other non-hazardous debris and waste. Assume disposal characterization testing and screening shall be included in unit cost.
2. Unit of Measurement: Ton of contaminated material disposed of offsite.

B. Unit Price No. 2: Excavation, Handling, and Off-Site Disposal of Construction and Demolition (C&D) Debris

1. Description: Excavate, handle, transport and legally dispose of C&D debris and other materials classified as solid waste in accordance with all applicable regulations.
2. Unit of Measurement: Ton of C&D material disposed of offsite.

C. Unit Price No. 3: Cover Material – General Fill

1. Description: Provide and install cover materials according to Division 31 Section "Earth Moving." Cost shall include all labor and materials to procure and place materials meeting the criteria for cover material including NYSDEC DER-10 analytical characterization testing.
2. Unit of Measurement: Cubic yard of material, in place.

D. Unit Price No. 4: Demarcation Fabric

1. Description: Provide and install demarcation fabric according to Division 31 Section "Earth Moving." Cost shall include all labor and materials to procure and place demarcation fabric.
2. Unit of Measurement: Square yard of demarcation fabric, in place.

E. Unit Price No. 5: Asphalt Trail

1. Description: Provide and install Greenway Asphalt Trail according to Division 32 Section "Asphalt Paving." Cost shall include all labor and materials to procure and place asphalt paving courses, subbase course, and geotextile separation fabric in accordance with Contract Documents and details. Compaction of subgrade shall be included in cost.
2. Unit of Measurement: Square yard of asphalt paving, in place.

F. Unit Price No. 6: Deer Exclusion Fence

1. Description: Provide and install deer exclusion fence as shown in Drawings.
2. Unit of Measurement: Linear foot of deer exclusion fence, installed.

G. Unit Price No. 7: Common Fence

1. Description: Provide and install common fence as shown in Drawings.
2. Unit of Measurement: Linear foot of common fence, installed.

H. Unit Price No. 8: Crack Filling and Asphalt Repair

1. Description: Provide patching in cracks in asphalt paving over 1/2-inch in width throughout the area of existing pavement to remain. Cut to clean existing cracks, then remove lose asphalt. Fill cracks with joint filler, melt, and trowel smooth. Fill larger voids with trowel patch or new asphalt.
2. Unit of Measurement: Square foot of asphalt paving, in place and Linear foot of joint filler.

END OF SECTION 012200

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Overlook Deck - Deduct Alternate for BP-01 (Sitework), Additional Work for BP-02 (General Trades).

1. Base Bid: Grading and plantings as indicated on Drawings L301A, L402A, and L403A and as specified in Section 329200 "TURF AND GRASSES."
2. Alternate: Site platform with wood decking on concrete foundations and an overhead canopy element as indicated on Drawings LS100A, LS110A, LS200A, and LS500A, and as specified in Sections 033001 “CAST-IN-PLACE CONCRETE”, 061500 “WOOD DECKING”, and 051201 “STRUCTURAL STEEL (ALTERNATE 1)”.

B. Alternate No. 2: Slab Graphics – All General Trades Scope (PH1A-02).

1. Base Bid: None.
2. Alternate: Paint graphics on the sealed concrete slab of Terminal B as indicated on Drawings A104A, A902A, A903A, A904A, A905A, A906A and A907A and as specified in Section 321723 “PAVEMENT MARKINGS (ALTERNATE 2)”.

C. Alternate No. 3: Canopy Tail Roofs – All General Trades Scope (PH1A-02).

1. Base Bid: No roof.
2. Alternate: Structural framing with inverted corrugated metal panels and a gutter system over the slab behind the stage as indicated on Drawings S106A and A105A and as specified in Sections 051200 “STRUCTURAL STEEL FRAMING”, 074113.13 “FORMED METAL PANELS”, and 076200 “SHEET METAL FLASHING AND TRIM”.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Document 000003 "Procurement Forms" for requirements for substitution requests prior to award of Contract.
2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided in Project Manual.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size,

durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES or the State of New York.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.

i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on web-based Project management software.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect or Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect or Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on form provided as part of web-based Project management software.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect or Construction Manager may issue a Construction Change Directive on form provided as part of web-based Project management software. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than fifteen (15) days after the formal Notice To Proceed.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Arrange schedule of values consistent with format of AIA Document G703.
2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.

4. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in accordance with the values as identified in Section 011100 “Special Provisions” Paragraph 3.3.
8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by Owner.

B. Payment Application Times: Submit final Application for Payment to Architect by the last day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment by the twentieth (20th) day of each month for review by Architect and Construction Manager.
2. Draft copies will be returned for corrections by the twenty-fifth (25th) day of each month.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit four signed and notarized original copies of each Application for Payment to Construction Manager by upload to web-based Project management software website. Enter required data in web-based software site to fully identify each Application. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706.
5. AIA Document G706A.
6. AIA Document G707.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:

1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.3 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.4 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-alarm, and electrical equipment.
4. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

5. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format:

   a. Same digital data software program, version, and operating system as original Drawings.
   b. DWG, Version 2018, operating in Microsoft Windows operating system.

2. File Submittal Format: Submit or post coordination drawing files using PDF format.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into BIM established for Project.
4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
   b. Digital Data Software Program: Drawings are available in AutoCAD 2018 and/or Revit 2019 for Microsoft Windows.
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.5 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect / Construction Manager will return without response those RFIs submitted to Architect / Construction Manager by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Owner name.
2. Owner's Project number.
3. Name of Architect and Construction Manager.
4. Architect's Project number.
5. Date.
6. Name of Contractor.
7. RFI number, numbered sequentially.

8. RFI subject.
9. Specification Section number and title and related paragraphs, as appropriate.
10. Drawing number and detail references, as appropriate.
11. Field dimensions and conditions, as appropriate.
12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
13. Contractor's signature.
14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within five days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.

6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.

F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within three days if Contractor disagrees with response.

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD 2018 and/or Revit 2019 for Microsoft Windows.
4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

    a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.
5. The following digital data files will be furnished for each appropriate discipline:

    a. Floor plans.
    b. Reflected ceiling plans.

B. Web-Based Project Management Software Package: Use Construction Manager's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    g. Processing and tracking of payment applications.

h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Critical work sequencing and long lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Use of web-based Project software.
g. Procedures for processing field decisions and Change Orders.
h. Procedures for RFIs.
i. Procedures for testing and inspecting.
j. Procedures for processing Applications for Payment.
k. Distribution of the Contract Documents.
l. Submittal procedures.
m. Preparation of Record Documents.
n. Use of the premises and existing building.

o. Work restrictions.
p. Working hours.
q. Owner's occupancy requirements.
r. Responsibility for temporary facilities and controls.
s. Procedures for moisture and mold control.
t. Procedures for disruptions and shutdowns.
u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.

w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Construction Manager will conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Status of sustainable design documentation.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site use.
10) Temporary facilities and controls.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Status of RFIs.

16) Status of Proposal Requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.
3. Three paper copies, of sufficient size to display entire period or schedule, as required.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Construction Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Primavera P6 for current Windows operating system.

B. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than five (5) days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 20 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Commissioning Time: Include no fewer than 15 days for commissioning.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
2. Work Restrictions: Show the effect of the following items on the schedule:

   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use-of-premises restrictions.
   f. Provisions for future construction.
   g. Seasonal variations.
   h. Environmental control.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

I. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.7 CPM SCHEDULE REQUIREMENTS

A. Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice of Award.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and inspection.
j. Commissioning.
k. Punch list and final completion.
l. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

1.8 REPORTS

A. Daily Construction Reports: Through the Construction Manager’s web-based project management software, input a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.

10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

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SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect and Construction Manager.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and timefrom camera.

D. File Names: Name media files with date, Contract Number, Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and Construction Manager.

1. Flag construction limits before taking construction photographs.
2. Take photographs to show existing conditions adjacent to property before starting the Work.
3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.

E. Periodic Construction Photographs: Take 50 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents. Architect and Construction Manager will inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.

8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Physical Submittals:

1. Only submit in this format if utilization of web-based Project Management Software is infeasible.
2. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
3. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Action Submittals: Submit four paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return two copies.
5. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
6. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using facsimile of sample form included in Project Manual transmittal form.
7. For tracking, submit a cover sheet with photo of the physical submittal as a PDF utilizing the web-based Project Management Software.

E. Submittals for Utilizing Web-Based Project Management Software: Prepare submittals as PDF files, or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
3. Physical: Prepare submittals in physical form, and deliver to Construction Manager.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal from Construction Manager. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.

d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. PDF Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

a. Name of evaluation organization.
b. Date of evaluation.
c. Time period when report is in effect.
d. Product and manufacturers' names.
e. Description of product.
f. Test procedures and results.
g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return it.

1. Physical Submittals, if necessary: Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

2. Submittals by Web-Based Project Management Software: Architect and Construction Manager will indicate, on Project management software website, the appropriate action.

   a. Actions taken by indication on Project management software website have the following meanings:

      1) No Exception: Architect or Construction Manager has no comments regarding the submittal and it is approved.

      2) Furnish As Corrected: Architect or Construction Manager has noted deviations from the specified products but does not require further review if the items are addressed by the Contractor.

      3) Revise and Resubmit: Architect or Construction Manager has noted deviations from the specified products and does require further information, detail, or engineering to determine approval. Contractor is to correct the submittal, or portion of the submittal as indicated, and return to the Construction Manager for review.

      4) Rejected: The submittal does not meet the requirements as set forth in this section. Notes on deviation may or may not be provided by the Architect and Construction Manager. Contractor is to correct the submittal and resubmit for review.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect and Construction Manager will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 013516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, Construction Manager will conduct conference at Project site.

1. Attendees: In addition to representatives of Owner, Construction Manager, Architect, and Contractor, testing service representative, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:

    a. Fire-prevention plan.
    b. Governing regulations.
    c. Areas where existing construction is to remain and the required protection.
    d. Hauling routes.
    e. Sequence of alteration work operations.
    f. Storage, protection, and accounting for salvaged and specially fabricated items.
    g. Existing conditions, staging, and structural loading limitations of areas where materials are stored.

3. Reporting: Construction Manager will record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1.5 INFORMATIONAL SUBMITTALS

A. Alteration Work Program: Submit 30 days before work begins.

B. Fire-Prevention Plan: Submit 30 days before work begins.

1.6 QUALITY ASSURANCE

A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

C. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.

2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F (3 deg C) or more above the dew point.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.

3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

a. Train each fire watch in the proper operation of fire-control equipment and alarms.

b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
e. Maintain fire-watch personnel at each area of Project site until two hours after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 013233 "Photographic Documentation."

B. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

C. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.
b. Demonstrate aesthetic effects.
c. Demonstrate the qualities of products and workmanship.

d. Demonstrate successful installation of interfaces between components and systems.
e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Statement on condition of substrates and their acceptability for installation of product.
2. Statement that products at Project site comply with requirements.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Statement that equipment complies with requirements.
2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
3. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as

well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
3. Notify Architect and Construction Manager three days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's and Construction Manager's approval of mockups before starting corresponding work, fabrication, or construction.

a. Allow three days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Section 014100 “Special Inspections and Testing” and Section 014100B “Statement of Special Inspections” and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014100 – SPECIAL INSPECTIONS AND TESTING

PART 1 – GENERAL

1.1 The Owner shall employ the services of an independent testing agency/laboratory to perform specified field inspections and laboratory testing, as defined in Section 014100B. Laboratory testing and preparation of concrete test specimens shall be paid for by Owner. Refer to respective sections for contractor's and Owner's requirements.

A. Contractor shall cooperate with laboratory to facilitate execution of its required services.

B. Employment of laboratory shall in no way relieve contractor's obligation to perform work of contract.

1.2 SPECIAL INSPECTION

A. Owner will employ services of an independent approved testing agency to perform special inspections during construction as required by the Building Code of New York State and authorities having jurisdiction. Inspections shall include but not limited to the following:

1. Verification and inspection of Steel Construction per section 1705.2, 1705.2.1, 1705.2.2 and 1705.2.3 of the Building Code of New York State.
2. Verification and inspection of Concrete Construction per section 1705.3 and Table 1705.3 of the Building Code of New York State.
3. Verification and inspection of Soils per section 1705.6 of the Building Code of New York State.
4. Verification and inspection of Driven Deep Foundations per section 1705.7 of the Building Code of New York State.

1.3 RELATED REQUIREMENTS IN OTHER PARTS OF PROJECT MANUAL

A. Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities: Conditions of the contract.

1.4 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS

A. Certification of products: Respective sections of specifications.

B. Test, adjust and balance of equipment: Respective sections of specifications.

C. Laboratory tests required and standards for testing: Each specification section listed.

PART 2 - PRODUCTS

2.1 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:
1. Release, revoke, alter or expand the requirements of the Contract Documents

2. Approve or accept any portion of work
3. Perform any duties of contractor

2.2 NOTIFICATION OF TEST FAILURE

A. Testing Laboratory shall notify the Architect/Construction Manager/Owner via telephone and in written form of any tests performed failing to meet specifications. Notification shall take place the same day the test results are obtained.

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel. Provide access to work, to manufacturer's operations.

B. Secure and deliver to laboratory, adequate quantities of representational samples of materials proposed to be used which require testing.

C. Provide to laboratory, preliminary design mix proposed to be used for concrete and other material mixes which require control by testing laboratory.

D. Furnish copies of products test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested
2. To obtain and handle samples at project site or at source of product to be tested
3. To facilitate inspections and tests
4. For storage and curing of test samples

F. Notify Construction Manager sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to contractor's negligence.

G. Make arrangements with laboratory and pay for additional samples and tests required for contractor's convenience.

H. When directed by Architect, employ and pay for services of a separate, equally qualified independent testing laboratory acceptable to Architect to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with Contract Documents.

I. Refer to respective sections of specifications for additional contractor responsibilities.

J. Refer to 014100B STATEMENT OF SPECIAL INSPECTIONS following this section.

END OF SECTION 014100

2020 NYS BUILDING CODE
STATEMENT OF SPECIAL INSPECTIONS

BCNYS §1704.3 requires that the project Registered Design Professional in responsible charge prepare a Statement of Special Inspections. Completion of this Statement of Special Inspections and submission to the Code Compliance Unit with the Construction Permit Application is a condition for issuance of the Construction Permit.

Project Title: Buffalo Outer Harbor Access and Activation Civic Project – Phase 1: Terminal B Redevelopment

Project #: 012774.01	**Project Manager: Steven Kushner**

Registered Design Professional (RDP): Steven Kushner, AIA & Michael Tracey, PE

Person Completing Statement: Steven Kushner, AIA & Michael Tracey, PE	**Phone: 585.498.7884**	**Date:** June 10, 2021

Comments:

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
A. Steel Construction.			1705.2			
1. Structural Steel			1705.2.1		051200	
a. Inspection tasks prior to welding;			1705.2.1			AISC 360 Table N5.4-1
i. Welder qualification records and continuity records		X	1705.2.1	☒		AISC 360 Table N5.4-1
ii. Welding procedure specifications (WPSs) available	X		1705.2.1	☒		AISC 360 Table N5.4-1
iii. Manufacturer certifications for welding consumables available	X		1705.2.1	☒		AISC 360 Table N5.4-1
iv. Material identification (type/grade)		X	1705.2.1	☒		AISC 360 Table N5.4-1
v. Welder identification system		X	1705.2.1	☒		AISC 360 Table N5.4-1 The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
vi. Fit up of groove welds (including joint geometry)		X	1705.2.1	☒		AISC 360 Table N5.4-1
vii. Fit up of CJP groove welds of HSS, T-, Y-, and K-joints without backing (including joint geometry)		X	1705.2.1	☒		AISC 360 Table N5.4-1

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
viii. Configuration and finish of access holes		X	1705.2.1	☒		AISC 360 Table N5.4-1
ix. Fit-up of fillet welds		X	1705.2.1	☒		AISC 360 Table N5.4-1
x. Check Welding equipment		X	1705.2.1	☒		AISC 360 Table N5.4-1
b. Inspection Tasks During Welding			1705.2.1			AISC 360 Table N5.4-2
i. Control and Handling of welding consumables.		X	1705.2.1	☒		AISC 360 Table N5.4-2
ii. No welding over cracked tack welds.		X	1705.2.1	☒		AISC 360 Table N5.4-2
iii. Environmental Conditions		X	1705.2.1	☒		AISC 360 Table N5.4-2
iv. Verify WPS followed		X	1705.2.1	☒		AISC 360 Table N5.4-2
v. Verify Welding Techniques		X	1705.2.1	☒		AISC 360 Table N5.4-2
vi. Placement and installation of steel headed stud anchors		X	1705.2.1	☐		AISC 360 Table N5.4-2
c. Inspection Tasks after Welding			1705.2.1			AISC 360 Table N5.4-3
i. Welds cleaned		X	1705.2.1	☒		AISC 360 Table N5.4-3
ii. Size, length, and location of welds	X		1705.2.1	☒		AISC 360 Table N5.4-3
iii. Welds meet visual acceptance criteria	X		1705.2.1	☒		AISC 360 Table N5.4-3
iv. Arc strikes	X		1705.2.1	☒		AISC 360 Table N5.4-3
v. K-area			1705.2.1	☒		AISC 360 Table N5.4-3; When welding of doubler plates, continuity plates or stiffeners has been performed i the k-area, visually inspect the web k-area for cracks within 3 in. (75mm) of the weld.
vi. Weld access holes in rolled heavy shapes and built-up heavy shapes	X		1705.2.1	☒		AISC 360 Table N5.4-3
vii. Backing removed and weld tabs removed (if required)	X		1705.2.1	☐		AISC 360 Table N5.4-3
viii. Repair activities	X		1705.2.1	☒		AISC 360 Table N5.4-3
iv. Document acceptance or rejection of welded joint or member	X		1705.2.1	☒		AISC 360 Table N5.4-3
x. No prohibited welds have been added without the approval of the EOR		X	1705.2.1	☒		AISC 360 Table N5.4-3

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
d. Inspection Tasks Prior to Bolting			1705.2.1			AISC 360 Table N5.6-1
i. Manufacturer's certification available for fastener materials	X		1705.2.1	☒		AISC 360 Table N5.6-1
ii. Fasteners marked in accordance with ASTM requirements		X	1705.2.1	☒		AISC 360 Table N5.6-1
iii. Proper fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)		X	1705.2.1	☒		AISC 360 Table N5.6-1
iv. Proper bolting procedure selected for joint detail		X	1705.2.1	☒		AISC 360 Table N5.6-1
v. Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements.		X	1705.2.1	☒		AISC 360 Table N5.6-1
vi. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used.		X	1705.2.1	☒		AISC 360 Table N5.6-1
vii. Proper storage provided for bolts, nuts, washers and other fastener components.		X	1705.2.1	☒		AISC 360 Table N5.6-1
e. Inspection Tasks During Bolting			1705.2.1			AISC 360 Table N5.6-2
i. Fastener assemblies, of suitable condition, placed in all holes and washers (if required) are positioned as required.		X	1705.2.1	☒		AISC 360 Table N5.6-2
ii. Joint brought to the snug-tight condition prior to the pretensioning operation.		X	1705.2.1	☒		AISC 360 Table N5.6-2
iii. Fastener component not turned by the wrench prevented from rotating.		X	1705.2.1	☒		AISC 360 Table N5.6-2
iv. Fasteners are pretensioned in accordance with the RCSC Specification, progressing systematically from the most rigid point toward the free edges.		X	1705.2.1	☒		AISC 360 Table N5.6-2

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
f. Inspection Tasks After Bolting			1705.2.1			AISC 360 Table N5.6-3
i. Document acceptance or rejection of bolted connections.	X		1705.2.1	☒		AISC 360 Table N5.6-3
2. Cold-Formed Steel Deck			1705.2.2	☒	053100	
a. Inspection or Execution Tasks prior to Deck Placement			1705.2.2			SDI QA/QC Table 1.1
i. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness.	X		1705.2.2	☒		**SDI QA/QC Table 1.1**
ii. Document acceptance or rejection of deck and deck accessories.	X		1705.2.2	☒		**SDI QA/QC Table 1.1**
b. Inspection or Execution Tasks after Deck Placement						**SDI QA/QC Table 1.2**
i. Verify compliance of deck and all deck accessories installation with construction documents.	X		1705.2.2	☒		**SDI QA/QC Table 1.2**
ii. Verify deck materials are represented by the mill certifications that comply with the construction documents.	X		1705.2.2	☒		**SDI QA/QC Table 1.2**
iii. Document acceptance or rejection of installation of deck and deck accessories.	X		1705.2.2	☒		**SDI QA/QC Table 1.2**
c. Inspection or Execution Tasks Prior to Welding			1705.2.2			**SDI QA/QC Table 1.3**
i. Welding Procedure Specifications (WPS) available.		X	1705.2.2	☒		**SDI QA/QC Table 1.3**
ii. Manufacturer certifications for welding consumables available		X	1705.2.2	☒		**SDI QA/QC Table 1.3**
iii. Material identification (type/grade).		X	1705.2.2	☒		**SDI QA/QC Table 1.3**
iv. Check welding equipment.		X	1705.2.2	☒		**SDI QA/QC Table 1.3**
d. Inspection or Execution Tasks during Welding			1705.2.2			**SDI QA/QC Table 1.4**
i. Use of qualified welders.		X	1705.2.2	☒		**SDI QA/QC Table 1.4**

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
ii. Control and handling of welding consumables.		X	1705.2.2	☒		**SDI QA/QC Table 1.4**
iii. Environmental conditions (wind speed, moisture, temperature).		X	1705.2.2	☒		**SDI QA/QC Table 1.4**
iv. Verify WPS followed.		X	1705.2.2	☒		**SDI QA/QC Table 1.4**
e. Inspection or Execution Tasks after Welding			1705.2.2			**SDI QA/QC Table 1.5**
i. Verify size and location of welds, including support, sidelap, and perimeter welds.	X		1705.2.2	☒		**SDI QA/QC Table 1.5**
ii. Welds meet visual acceptance criteria.	X		1705.2.2	☒		**SDI QA/QC Table 1.5**
iii. Verify repair activities.	X		1705.2.2	☒		**SDI QA/QC Table 1.5**
iv. Document acceptance or rejection of welds.	X		1705.2.2	☒		**SDI QA/QC Table 1.5**
f. Inspection or Execution Tasks prior to Mechanical Fastening			1705.2.2			**SDI QA/QC Table 1.6**
i. Manufacturer installation instructions available for mechanical fasteners.		X	1705.2.2	☒		**SDI QA/QC Table 1.6**
ii. Proper tools available for fastener installation.		X	1705.2.2	☒		**SDI QA/QC Table 1.6**
iii. Proper storage for mechanical fasteners.		X	1705.2.2	☒		**SDI QA/QC Table 1.6**
g. Inspection or Execution Tasks during Mechanical Fastening			1705.2.2			**SDI QA/QC Table 1.7**
i. Fasteners are positioned as required.		X	1705.2.2	☒		**SDI QA/QC Table 1.7**
ii. Fasteners are installed in accordance with manufacturer's instructions.		X	1705.2.2	☒		**SDI QA/QC Table 1.7**
h. Inspection or Execution Tasks after Mechanical Fastening			1705.2.2			**SDI QA/QC Table 1.8**
i. Check spacing, type, and installation of support fasteners.	X		1705.2.2	☒		**SDI QA/QC Table 1.8**
ii. Check spacing, type, and installation of sidelap fasteners.	X		1705.2.2	☒		**SDI QA/QC Table 1.8**
iii. Check spacing, type, and installation of perimeter fasteners.	X		1705.2.2	☒		**SDI QA/QC Table 1.8**
iv. Verify repair activities.	X		1705.2.2	☒		**SDI QA/QC Table 1.8**

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
v. Document acceptance or rejection of mechanical fasteners.	X		1705.2.2	☒		**SDI QA/QC Table 1.8**
3. Open-Web Steel Joists and Joist Girders			1705.2.3			
a. Installation of open-web steel joists and joist girders			Table 1705.2.3	☐		
i. End connections – welded or bolted.		X	Table 1705.2.3	☐		SJI Specifications listed in Section 2207.1.
ii. Bridging – Horizontal or diagonal.			Table 1705.2.3			
a. Standard bridging.		X	Table 1705.2.3	☐		SJI Specifications listed in Section 2207.1.
b. Bridging that differs from the SJI specifications listed in Section 2207.1		X	Table 1705.2.3	☐		
4. Cold-Formed Steel Trusses spanning 60 feet or Greater		X	1705.2.4	☐		The Special Inspector shall verify that the temporary restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.
B. Concrete Construction			1705.3			
1. Inspect reinforcement, including prestressing tendons, and verify placement.		X	Table 1705.3	☒	032000	ACI 318 Ch. 20, 25.2, 25.3, 26.6.1-26.6.3 IBC 1908.4
2 Reinforcing Bar Welding:			Table 1705.3			AWS D1.4, ACI 318: 26.6.4
a. Verify weldability of reinforcing bars other than ASTM A706:		X	Table 1705.3	☐		AWS D1.4 ACI 318: 26.6.4
b. Inspect single pass fillet welds, maximum 5/16”; and		X	Table 1705.3	☐		AWS D1.4 ACI 318: 26.6.4
c. Inspect all other welds	X		Table 1705.3	☐		AWS D1.4 ACI 318: 26.6.4
3. Inspect anchors cast in concrete.		X	Table 1705.3	☒	055000	ACI 318: 17.8.2
4. Inspect anchors post-installed in hardened concrete members.			Table 1705.3	☒		
a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.	X		Table 1705.3	☒		ACI 318: 17.8.2.4

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
b. Mechanical anchors and adhesive anchors not defined in item 4a.		X	Table 1705.3	☒		ACI 318: 17.8.2
5. Verify use of required design mix		X	Table 1705.3	☒	033000	ACI 318: Ch. 19, 26.4.3, 26.4. IBC 1904.1, 1904.2, 1908.2, 1908.3
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of concrete.	X		Table 1705.3	☒	033000	ASTM C172, ASTM C31; ACI 318: 26.5, 26.12; IBC 1908.10
7. Inspect concrete and shotcrete placement for proper application techniques.	X		Table 1705.3	☒	033000	ACI 318: 26.5; IBC 1908.6, 1908.7, 1908.8
8. Verify maintenance of specified curing temperature and techniques.		X	Table 1705.3	☒	033000	ACI 318: 26.5.3-26.5.5 IBC: 1908.9
9. Inspect Prestressed concrete for:			Table 1705.3	☐		
a. Application of prestressing forces; and	X		Table 1705.3	☐		ACI 318: 26.10
b. Grouting of bonded prestressing tendons	X		Table 1705.3	☐		ACI 318: 26.10
10. Inspect erection of precast concrete members		X	Table 1705.3	☐		ACI 318: Ch. 26.9
11. Verify in-situ concrete strength, prior to stressing tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.		X	Table 1705.3	☐		ACI 318: 26.11.2
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.		X	Table 1705.3	☒	031000	ACI 318: 26.11.2b

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
C. Masonry Construction (Check L1, L2 or L3 below) ☐ L1 = Level 1 Quality Assurance ☐ L2 = Level 2 Quality Assurance ☐ L3 = Level 3 Quality Assurance			1705.4			TMS 402 Table 3.1 TMS 602 Table 3 & Table 4
Level 1 Quality Assurance: Minimum Verification						
1a. Prior to construction, verification of compliance submittals		X		☐		TMS 602 Table 3
Level 2 Quality Assurance: Minimum Verification & Special Inspections						
2a. Prior to construction, verification of compliance submittals		X		☐		TMS 602 Table 3
2b: Prior to construction, verification of f'm and f'aac, except where specifically exempted by code		X		☐		TMS 602 Table 3
2c: During construction, verification of Slump flow and Visual Stability Index(VSI) when self-consolidating grout is delivered to the project site.		X		☐		TMS 602 Table 3
2d: As masonry construction begins verify that the following are in compliance:						TMS 602 Table 4
i. Proportions of site-prepared mortar		X		☐		TMS 602 Table 4
ii. Grade and size of prestressing tendons and anchorages		X		☐		TMS 602 Table 4
iii. Grade, type and size of reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages		X		☐		TMS 602 Table 4
iv. Prestressing technique		X		☐		TMS 602 Table 4
v. Properties of thin-bed mortar for AAC masonry	X	X		☐		TMS 602 Table 4

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
						Continuous for the first 5,000 s ft of AAC; Periodic after the fi 5,000 sq. ft of AAC
vi. Sample panel construction		X		☐		TMS 602 Table 4
2e: Prior to grouting, verify that the following are in compliance:						TMS 602 Table 4
i. Grout space		X		☐		TMS 602 Table 4
ii. Placement of prestressing tendons and anchorages		X		☐		TMS 602 Table 4
iii. Placement of reinforcement, connectors, and anchor bolts		X		☐		TMS 602 Table 4
iv: Proportions of site-prepared grout and prestressing grout for bonded tendons		X		☐		TMS 602 Table 4
2f: Verify compliance of the following during construction:						TMS 602 Table 4
i: Materials and procedures with the approved submittals		X		☐		TMS 602 Table 4
ii: Placement of masonry units and mortar joint construction		X		☐		TMS 602 Table 4
iii: Size and location of structural members		X		☐		TMS 602 Table 4
iv: Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.		X		☐		TMS 602 Table 4
v: Welding of reinforcement	X			☐		TMS 602 Table 4
vi: Preparation, construction, and protection of masonry during cold weather or hot weather		X		☐		TMS 602 Table 4
vii: Application of measurement of prestressing force	X			☐		TMS 602 Table 4
viii: Placement of grout and prestressing grout for bonded tendons in compliance	X			☐		TMS 602 Table 4
iv: Placement of AAC masonry units and construction of thin bed mortar joints.	X	X		☐		TMS 602 Table 4 Continuous for the first 5,000 s ft of AAC; Periodic after the fi 5,000 sq. ft of AAC

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
2g: Observe preparation of grout specimens, mortar specimens, and/or prisms		X		☐		TMS 602 Table 4
Level 3 Quality Assurance: Minimum Verification & Special Inspections						
3a. Prior to construction, verification of compliance submittals		X		☐		TMS 602 Table 3
3b: Prior to construction, verification of f'm and f'aac, except where specifically exempted by code		X		☐		TMS 602 Table 3
3c: During construction, verification of Slump flow and Visual Stability Index(VSI) when self-consolidating grout is delivered to the project site		X		☐		TMS 602 Table 3
3d: During construction, verification of f'm and f'aac for every 5,000sq. ft.		X		☐		TMS 602 Table 3
3e: During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.		X		☐		TMS 602 Table 3
3f: As masonry construction begins verify that the following are in compliance:						TMS 602 Table 4
i. Proportions of site-prepared mortar		X		☐		TMS 602 Table 4
ii. Grade and size of prestressing tendons and anchorages		X		☐		TMS 602 Table 4
iii. Grade, type and size of reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages		X		☐		TMS 602 Table 4
iv. Prestressing technique		X		☐		TMS 602 Table 4
v. Properties of thin-bed mortar for AAC masonry	X			☐		TMS 602 Table 4
vi. Sample panel construction	X			☐		TMS 602 Table 4

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
3g: Prior to grouting, verify that the following are in compliance:						TMS 602 Table 4
i. Grout space	X			☐		TMS 602 Table 4
ii. Placement of prestressing tendons and anchorages		X		☐		TMS 602 Table 4
iii. Placement of reinforcement, connectors, and anchor bolts	X			☐		TMS 602 Table 4
iv: Proportions of site-prepared grout and prestressing grout for bonded tendons		X		☐		TMS 602 Table 4
3h: Verify compliance of the following during construction:						TMS 602 Table 4
i: Materials and procedures with the approved submittals		X		☐		TMS 602 Table 4
ii: Placement of masonry units and mortar joint construction		X		☐		TMS 602 Table 4
iii: Size and location of structural members		X		☐		TMS 602 Table 4
iv: Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.	X			☐		TMS 602 Table 4
v: Welding of reinforcement	X			☐		TMS 602 Table 4
vi: Preparation, construction, and protection of masonry during cold weather or hot weather		X		☐		TMS 602 Table 4
vii: Application of measurement of prestressing force	X			☐		TMS 602 Table 4
viii: Placement of grout and prestressing grout for bonded tendons in compliance	X			☐		TMS 602 Table 4
iv: Placement of AAC masonry units and construction of thin bed mortar joints.	X			☐		TMS 602 Table 4
3i: Observe preparation of grout specimens, mortar specimens, and/or prisms	X			☐		TMS 602 Table 4

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
D. Wood Construction			1705.5			
1. High Load Diaphragms		X	1705.5.1	☐		
2. Metal Plate Connected Wood Trusses spanning 60 feet or Greater		X	1705.5.2	☐		
E. Soils			1705.6			
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.		X	Table 1705.6	☒	Refer to Geotechnical Report	
2. Verify excavations are extended to a proper depth and have reached proper material.		X	Table 1705.6	☒	Refer to Geotechnical Report	
3. Perform classification and testing of compacted fill materials.		X	Table 1705.6	☒	Refer to Geotechnical Report	
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	X		Table 1705.6	☒	Refer to Geotechnical Report	
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.		X	Table 1705.6	☒	Refer to Geotechnical Report	
F. Driven Deep Foundations			1705.7			
1. Verify element materials, sizes and lengths, comply with the requirements.	X		Table 1705.7	☒	316216	
2. Determine capacities of test elements and conduct additional load tests, as required.	X		Table 1705.7	☒	316216	
3. Inspect driving operations and maintain complete and accurate records for each elements.	X		Table 1705.7	☒	316216	
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document	X		Table 1705.7	☒	316216	

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
any damage to foundation element.						
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	-	-	Table 1705.7	☒	316216	
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3.	-	-	Table 1705.7	☐		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	-	-	Table 1705.7	☐		
G. Cast-in-place Deep Foundations			1705.8			
1. Inspect drilling operations and maintain complete and accurate records for each element.	X		Table 1705.8	☐		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X		Table 1705.8	☐		
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3.	-	-	Table 1705.8	☐		
H. Helical Pile Foundations	X		1705.9			
I. Fabricated Items			1705.10 1704.2.5			Where fabrication of structural, load-bearing, or lateral load resisting members or assemblie is being conducted on the premises of a fabricators shop
1. Structural Steel		X		☒	051200	
2. Steel Joists		X		☐		
3. Precast Concrete		X		☐		
4. Wood Construction		X		☒	061000, 061600 and 061753	

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
K. Special Inspections for Wind Resistance			1705.11		Note: V_{asd} = 90.6 < 110 mph This project is exempt from Section K Inspections per 2020 NYS Building Code, 1705.11	RDP to identify the main windforce-resisting systems and wind-resisting components that are subject to special inspection per BCNYS Section 1704.3.3.
1. Structural Wood	X	X	1705.11.1	☐		
2. Cold Formed steel light framed Construction		X	1705.11.2	☐		
3. Wind-resisting Components		X	1705.11.3	☐		
L. Special Inspections for Seismic Resistance			1705.12		Note: S_{DS} = .254g < .5g and building height < 35 ft. This project is exempt from Section L Inspections per 2020 NYS Building Code, 1705.12	RDP to identify the designated seismic systems and seismic force-resisting systems that are subject to special inspection per BCNYS Section 1704.3.2.
1. Structural Steel		X	1705.12.1	☐		AISC 341 Section J
2. Structural Wood	X	X	1705.12.2	☐		
3. Cold Formed steel light framed Construction		X	1705.12.3	☐		
4. Designated seismic systems	X	X	1705.12.4	☐		ASCE 7 Section 13.2.2
5. Architectural Components		X	1705.12.5	☐		
6. Plumbing, Mechanical, and Electrical Components		X	1705.12.6	☐		
7. Storage Racks		X	1705.12.7	☐		
8. Seismic Isolation Systems		X	1705.12.8	☐		
9. Cold Formed steel special bolted moment frames		X	1705.12.9	☐		
M. Testing for Seismic Resistance			1705.13			
1. Structural Steel		X	1705.13.1	☐		
2. Nonstructural Components		X	1705.13.2	☐		
3. Designated Seismic Systems		X	1705.13.3	☐		
4. Seismic Isolation Systems		X	1705.13.4	☐		
N. Sprayed Fire-Resistant Materials			1705.14			Not required
1. Physical and visual tests		X	1705.14.1	☐		
2. Structural Member Surface Conditions		X	1705.14.2	☐		
3. Application		X	1705.14.3	☐		

INSPECTIONS AND TESTS (Continuous & Periodic is as defined by the IBC)	CONTINUOUS	PERIODIC	BCNYS REFERENCE	CHECK IF REQUIRED	SPECIFICATION REFERENCE AND CLARIFYING NOTES (by RDP)[1]	COMMENTARY/NOTES and REFERENCE STANDARDS
4. Thickness		X	1705.14.4	☐		
5. Density		X	1705.14.5	☐		
6. Bond Strength		X	1705.14.6	☐		
O. Mastic and Intumescent Fire-Resistant Coatings		X	1705.15	☐		None
P. Exterior Insulation and Finish Systems (EIFS)			1705.16			None
1. Exterior Insulation and Finish Systems (EIFS)		X	1705.16	☐		
2. Water Resistive Barrier Coating		X	1705.16.1	☐		
Q. Fire-Resistant Penetration and Joints			1705.17			None
1. Penetration Firestops		X	1705.17.1	☐		
2. Fire-resistant joint systems		X	1705.17.2	☐		
R. Testing for Smoke Control			1705.18			None
1. Testing Scope		X	1705.18.1	☐		
2. Qualifications		X	1705.18.2	☐		
S. Additional Special Inspections/Tests			The registered design professional of record shall identify if additional tests and inspections defined by BC Section 1705.1.1 are required and provide specific requirements below.			
1.	☐	☐		☐		

NOTES:

1. RDP to provide reference specification section detailing the requirements for inspections and/or tests and other clarifying notes, as necessary.
2. Commentary are provided for information only and are not intended to provide complete details of the required tests and inspections. Refer to the 2018 International Building Code for complete and detailed requirements.

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).

31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
72. DHI - Door and Hardware Institute; www.dhi.org.

73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.ecianow.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.
87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Association; www.theicpa.com.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.

117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHIA - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.
158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.

160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
166. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
167. PDI - Plumbing & Drainage Institute; www.pdionline.org.
168. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
169. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
170. RFCI - Resilient Floor Covering Institute; www.rfci.com.
171. RIS - Redwood Inspection Service; www.redwoodinspection.com.
172. SAE - SAE International; www.sae.org.
173. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
174. SDI - Steel Deck Institute; www.sdi.org.
175. SDI - Steel Door Institute; www.steeldoor.org.
176. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
177. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
178. SIA - Security Industry Association; www.siaonline.org.
179. SJI - Steel Joist Institute; www.steeljoist.org.
180. SMA - Screen Manufacturers Association; www.smainfo.org.
181. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
182. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
183. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
184. SPIB - Southern Pine Inspection Bureau; www.spib.org.
185. SPRI - Single Ply Roofing Industry; www.spri.org.
186. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
187. SSINA - Specialty Steel Industry of North America; www.ssina.com.
188. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
189. STI - Steel Tank Institute; www.steeltank.com.
190. SWI - Steel Window Institute; www.steelwindows.com.
191. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
192. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
193. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
194. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
195. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
196. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
197. TMS - The Masonry Society; www.masonrysociety.org.
198. TPI - Truss Plate Institute; www.tpinst.org.
199. TPI - Turfgrass Producers International; www.turfgrasssod.org.
200. TRI - Tile Roofing Institute; www.tileroofing.org.
201. UL - Underwriters Laboratories Inc.; www.ul.com.
202. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.

203. USAV - USA Volleyball; www.usavolleyball.org.
204. USGBC - U.S. Green Building Council; www.usgbc.org.
205. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
206. WA - Wallcoverings Association; www.wallcoverings.org.
207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
210. WI - Woodwork Institute; www.wicnet.org.
211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
212. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. BCNYS – Building Code of New York State, 2020 Edition
2. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
3. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
4. DSCC - Defense Supply Center Columbus; (See FS).
5. FED-STD - Federal Standard; (See FS).
6. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

7. MILSPEC - Military Specification and Standards; (See DOD).
8. USAB - United States Access Board; www.access-board.gov.
9. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 011200 “Multiple Contract Summary” for responsibilities for temporary facilities and controls.

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these

operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 or higher at each

return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of

authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Coordinate with Construction Manager for temporary telephone service for use by construction personnel. Construction Manager will provide telephone service in the field office for access by Architect and Owner as required.

I. Electronic Communication Service: Coordinate with Construction Manager for temporary communication service for use by construction personnel. Construction Manager will provide WiFi service in the field office for access by Architect and Owner as required.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
2. Utilize designated area within existing building for temporary field offices.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Storage and Staging: Use designated areas of Project site for storage and staging needs.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

   a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs so they are legible at all times.

H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.

5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

1.5 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.

   a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

   a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

3. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.

a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

4. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

   a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type,

function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.

3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of Owner-furnished products, Owner's separate contracts, and limits on use of Project site.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 INFORMATIONAL SUBMITTALS

A. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.

B. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.

1.4 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of Work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even

surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's separate contractors.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 – EXCAVATED SOIL AND CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following activities related to above grade construction activities:

1. Salvaging nonhazardous construction and demolition (C&D) waste.
2. Recycling nonhazardous construction and demolition waste.
3. Disposing of nonhazardous construction and demolition waste.

B. This Section also includes administrative and procedural requirements for the following activities related to subgrade construction, regrading, landscaping, and covering of regraded and disturbed soil:

1. Identification and disposition of non-reusable cut material.
2. Recycling nonhazardous construction and demolition waste.
3. Disposing of nonhazardous construction and demolition waste.
4. Disposing of nonhazardous waste.
5. Disposition of cut material.
6. Acceptable surface conditions for the placement of cover.
7. Excavation and disposal of contaminated soil.

C. Related Sections include the following:

1. Division 01 Section "Multiple Contract Summary" for coordination of responsibilities for waste management.
2. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.
3. Division 01 Section “Health and Safety” for minimum requirements for health and safety related to environmental exposure.
4. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.
5. Division 31 Section "Earth Moving" for underground utility clearance, preparing subgrades for foundations, walks, pavements, and turf and grasses, excavating and backfilling for buildings and structures, and applying site Cover soil layer.

D. The site subsurface conditions are described in the *Buffalo Outer Harbor Civic Improvements – Area D Phase II Environmental Site Investigation Report*, LiRo Engineers Inc., November 2017,

the *Limited Human Health Exposure Assessment for Portions of the Buffalo Outer Harbor*, URS Corporation, New York, February 2012 (including appendices), and *Human Health Risk Characterization – Buffalo Outer Harbor*, GEI Consultants, Inc., September 2020.

E. Based on the investigations performed, the area consists of soil and fill that includes foundry sands, slag, brick, layers of silt/clay particles of ash and/or flue dust, hydraulic fill (dredged material), gravel, and crushed concrete. The subsurface material at the site shall either be left undisturbed, minimally disturbed and overlain with cover (clean soil or pavement), relocated/regraded onsite for beneficial use (in accordance with 6NYCRR Part 360) and overlain with cover, or removed from the site and disposed of in accordance with all applicable codes, rules, and regulations. Material disposition is summarized in the table below.

Material Type	Location/Description	Disposition
Construction Waste	Generated by Contractor During Construction	Disposed of Off-Site Under the Base Bid
Non-Salvageable Surficial C&D Waste	Existing Non-Salvageable Above Grade C&D Material	Disposed of Off-Site Under the Base Bid
Cut Material	Site Subsurface Material Moved from Its In-Situ Condition	Reused Onsite for Beneficial Use. Must be Covered.
Non-Reusable Cut Material	Site Subsurface Material Moved from Its In-Situ Condition Deemed Unusable by Owner's Representative	Disposed of Off-Site Under Unit Price Allowance
Visually Contaminated Soil	Cut Contaminated Soil That May Not Meet 6NYCRR Part 360.13(C) Beneficial Use Requirements	Disposed of Off-Site Under Unit Price Allowance
Petroleum-Contaminated Soil	Cut Soil That is Identifiable to Contain Petroleum Either Visually, Through Strong Petroleum Odor, or by Elevated Contaminant Vapor.	Disposed of Off-Site Under Unit Price Allowance

F. Contractor shall be compensated for testing, off-site transportation and disposal of non-recyclable or reusable C&D material and trash uncovered during subsurface construction activities by unit using the unit price allowance for C&D Debris Disposal. Waste not pre-existing at the site and generated from Contractor's own activities will not be compensated under the unit price allowance.

G. Contractor shall be compensated for testing, off-site transportation and disposal of visually contaminated soil and petroleum-contaminated soil by unit using the unit price allowance for Contaminated Soil Disposal.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Non-Salvageable Surficial C&D Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Cut Material: Site subsurface material that is excavated, moved, regraded, or otherwise disturbed from its in-situ condition present at the initiation of the project.

D. Non-Reusable Cut Material: C&D waste and trash or garbage encountered during subgrade construction operations deemed unusable by the Owner's Representative.

E. Disposal: Removal off-site of excavated contaminated soil, trash, or demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

F. Recycle: Recovery of non-salvageable surficial C&D waste or construction waste for subsequent processing in preparation for reuse.

G. Salvage: Recovery of surficial C&D materials or construction waste and subsequent sale or reuse in another facility.

H. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

I. Nonhazardous Waste: Non-reusable cut material or contaminated soil not meeting any of the characteristics defined in 40 CFR Part 261 Subpart C and not a universal waste (e.g. batteries, pesticides, mercury-containing equipment, and bulbs).

J. Visually Contaminated Soil: Cut contaminated soil material that may not meet 6NYCRR Part 360.13(c) beneficial use requirements based on visual observations.

K. Petroleum-Contaminated Soil: Soil that contains a petroleum source such as a UST, AST or piping and contains substantial quantities of mobile petroleum contamination (i.e., petroleum saturated) that is identifiable either visually, through strong odor, by elevated contaminant vapor or is otherwise readily detectable without laboratory analysis.

1.4 PERFORMANCE REQUIREMENTS

A. General: The Contractor is solely responsible to comply (and for complying with) with all current federal, state and local regulations concerning waste characterization, waste handling, transportation and proper disposal of all waste generated from the project. Contractor is responsible for characterizing waste as hazardous, non-hazardous or otherwise regulated and shall employ methods including testing of composite samples of waste material (through Toxic Characteristic Leachate Potential (TCLP) or other suitable protocols). Copies of all information and reports shall be provided to the Owner's Representative.

B. Material that is reused onsite is not required to be tested.

C. Contractor is to practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators.

1.5 SUBMITTALS

A. Soil and Waste Management Plan: Submit plan within 10 days of date established for the Notice to Proceed. Refer to requirements in Subsection 1.08 of this Section.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Characterization Reports or information classifying waste as hazardous, non-hazardous or otherwise regulated.

B. Waste Facility and Transporter Information: Provide evidence of licenses, certifications and other associated documentation demonstrating that waste facilities and transporters have the means to handle, accept and/or transport intended waste streams.

C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

D. Landfill and Incinerator Disposal Records: Indicated Receipt and acceptance of recyclable waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts and invoices.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Soil and Waste Management Conference: Conduct pre-construction conference at Project site to review methods and procedures related to Contaminated Soil and Waste Management including, but not limited to, the following:

1. Review and discuss contaminated soil and waste management plan including responsibilities of waste coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for on-site direct load contaminated soil containerization, manifesting and transportation to recycling and disposal facilities.
5. Review and discuss equipment decontamination procedures and control following excavation activities.

1.8 SOIL AND WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of:

1. Methodology for excavated soil handling, non-reusable cut material segregation and stockpiling, contaminated soil segregation and stockpiling, and C&D waste handling.

2. Methodology for waste identification, characterization, means to establish waste quantities by weight or volume, identification of salvaged materials slated for reuse, and waste reduction.
3. Identification of permitted waste transporters
4. Identification of disposal and recycling facilities.
5. Proposed soil sampling plans and laboratory analytical plans (identifying the frequency of sampling, analytical schedule, and environmental analytical laboratory) for any materials that will be disposed off-site at a regulated facility.
6. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

B. Waste Identification: Indicate anticipated types and quantities of non-salvageable surficial C&D waste, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. The receipt and/or review of the Contractor's Soil and Waste Management Plan shall not relieve the Contractor of related responsibilities under all governing laws and regulations.

1.9 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement soil and waste management plan as approved by Owner's Representative. Provide excavation equipment, staging and loading area(s), covered roll-off containers, storage, signage, emissions control and transportation including any and all other items as required to implement soils and waste management during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be disposed, reused, salvaged, recycled, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

C. Training: Train workers, subcontractors, and suppliers on proper contaminated soils management and decontamination procedures, as appropriate for the Work occurring at Project site.

D. Transportation:

1. Transport items required to be disposed off-site to an approved receiving facility permitted to accept non-hazardous contaminated soil and debris.
2. Protect items from damage during transport and storage.

3.2 SALVAGING C&D WASTE

A. Comply with requirements in Section 024119 "Selective Demolition" for salvaging demolition waste.

A. Salvaged Items for Reuse in the Work as Show in the Contract Drawings:

1. Clean salvaged items.
2. Store items in a secure area until installation.
3. Protect items from damage during transport and storage.
4. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

3.3 RECYCLING CONSTRUCTION AND DEMOLITION WASTE, GENERAL

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, recycle waste materials to the greatest extent practicable.

1. Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

   a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 IDENTIFICATION AND DISPOSITION OF NON-REUSABLE CUT MATERIAL

A. Contractor shall remove all non-reusable cut material (C&D waste and trash or garbage) contained in subsurface materials encountered during subgrade construction, regrading, and landscaping operations and legally dispose or recycle these materials off-site.

B. Non-reusable cut material includes in-situ subsurface material that contains a significant quantity of trash or garbage. Identification of non-reusable cut material shall be done in coordination with the Owner’s Representative and shall be determined by the Owner’s Representative.

C. Non-reusable cut material also includes large sized C&D debris such as tires, appliances, equipment and equipment parts, plastic tarps, and salvaged building components, etc. Identification of non-reusable cut material shall be done in coordination with the Owner’s Representative or his designated representative and shall be determined by the Owner’s Representative.

D. Non-reusable cut material also includes visually contaminated soil that may not meet 6NYCRR Part 360.13(c) beneficial use requirements or petroleum contaminated soil. Identification of contaminated soil shall be done in coordination with the Owner’s Representative or his designated representative and shall be determined by the Owner’s Representative. Contaminated soil shall be stockpiled, tested, removed from the site, and disposed of in accordance with Subsection 3.08 of this Section.

E. Recordkeeping: Non-reusable cut material, other than visually contaminated or petroleum contaminated soil, disposed off-site will accrue for payment under the C&D Waste Disposal unit price allowance based on Certified Weight Tickets obtained from the receiving facility.

3.5 RECYCLING NONHAZARDOUS CONSTRUCTION AND DEMOLITION WASTE

A. Remove excess soil from C&D materials recovered during subgrade construction, regrading, and landscaping operations.

B. Segregate and legally recycle offsite salvageable metals and other salvageable materials to the extent practicable.

C. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch (38-mm) size.

D. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

E. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.

F. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 1-1/2-inch (38-mm) size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

G. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

H. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

I. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

J. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

K. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

L. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

M. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

N. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

O. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

P. Conduit: Reduce conduit to straight lengths and store by material and size.

Q. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.6 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Paint: Seal containers and store by type.

3.7 DISPOSITION OF CUT MATERIAL

A. In accordance with 6NYCRR Part 360.13(c) beneficial use requirements, cut subsurface material shall be repurposed and used as fill to meet designed grades in areas of similar physical characteristics on Site. Cut material will be generated during grading, excavation, tree stump removal, utility installation, the establishment of white pine posts, standing snags, and rootwads, and the planting of trees and shrubs and other site related activities. Soil cover shall be placed over the regraded cut material to depths shown by the Contract Drawings.

B. Import of fill from off-site sources will be required to meet design elevation requirements and cover requirements. Imported fill and cover material shall meet physical property requirements

in Section 312000 - Earth Moving. Contractor must demonstrate by analytical testing that all imported soil and fill meets 6NYCRR Part 375 Restricted Residential Soil Cleanup objectives.

C. Saturated cut materials shall be allowed to drain in the area from where they are generated, repurposed, and covered in accordance with the requirements of this Section.

D. The Contractor shall not cut material from areas of the Site outside the limits of regrading shown on the Contract Drawings. Any areas where material is cut from outside of the excavation lines and grades shown on the Contract Drawings must be covered with a minimum of 1-foot of imported soil and otherwise restored to its originally existing condition at the Contractor's expense at no cost to the Owner.

E. Contractor shall not traverse on areas not designated to be disturbed. Any ruts or disturbance in these areas must be covered with a minimum of 1-foot of imported soil and otherwise restored to its originally existing condition at the Contractor's expense at no cost to the Owner.

F. Contractor shall minimally disturb the existing surfaces of Habitat Zones, and other otherwise un-regraded and uncovered areas of the site in the course of tree removal, rubble pile salvage, establishing brush piles, large woody debris features, white pine posts, standing snags, and rootwads, in the course of planting of trees and shrubs, an/or in the course of placing soil and seed. Any ruts or disturbances of greater than 3-inches deep must be restored with imported soil and otherwise restored to its originally existing condition at the Contractor's expense at no cost to the Owner.

3.8 ACCEPTABLE SURFACE CONDITION FOR PLACEMENT OF COVER

A. Prior to the placement of clean cover, the surface over which the cover is to be placed shall be inspected by the Owner's Representative or his designated representative and the Contractor. The Owner's Representative shall determine whether the surface is acceptable for placement of cover.

B. The surface must be free of protruding debris or material of any type, surfacing of large debris, or soft areas. The surface must meet compaction requirements of Section 312000 - Earth Moving.

C. The Contractor shall correct any surface condition deemed unacceptable by the Owner's Representative.

D. Any material removed from the surface during correcting the condition shall be disposed of off-site or recycled.

3.9 EXCAVATION AND DISPOSAL OF CONTAMINATED SOIL

A. Although not previously detected during the site investigation work, the Contractor may encounter non-hazardous petroleum-contaminated soil or other materials or soils exhibiting visual indication of chemical or physical contamination.

B. Identification of contaminated soil shall be done in coordination with the Owner's Representative or his designated representative and shall be determined by the Owner's Representative.

C. Contaminated soil shall be stockpiled/staged for off-site disposal. All stockpiled contaminated soils shall be placed on and covered with minimum 20 mil HDPE sheeting and secured.

D. Recordkeeping: Contaminated soil disposed off-site will accrue for payment under the Contaminated Soil Disposal unit price allowance based on Certified Weight Tickets obtained from the receiving facility.

E. The Contractor shall collect soil samples as required for disposal characterization. Minimum soil sample frequency and analysis shall be as required by the disposal facility. The Contractor shall package and ship soil samples to an approved independent laboratory. All expenses related to collection, packaging, shipping and analysis of soil samples shall be the responsibility of the Contractor and factored into the allowance unit price.

3.10 DISPOSAL OF NONHAZARDOUS WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site, including those recovered from above grade and from below grade construction activities and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them. Provide analytical testing as required by each receiving facility. Trucks leaving the site shall be fully loaded.

END OF SECTION 017419

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect and Construction Manager.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site.

D. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
    b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
    e. Vacuum and mop concrete.
    f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    h. Remove labels that are not permanent.
    i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
    n. Clean strainers.
    o. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Systems and equipment operation manuals.
3. Systems and equipment maintenance manuals.
4. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
2. Submit three paper copies. Architect, through Construction Manager, will return two copies.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.

8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.

6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

   a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

H. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.7 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of Record Drawings as follows:

a. Final Submittal: Submit one paper-copy set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files and one paper copy of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories and one paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect through Construction Manager for resolution.
5. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect and Construction Manager.
    e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as paper copy and scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as paper copy and scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.

b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.8 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera capable of recording in full HD mode.

1. Submit video recordings on CD-ROM or thumb drive to the Owner as part of the closeout documents and by uploading to web-based Project software site.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.

D. Predemolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is expected that hazardous materials will be encountered in the Work. Hazardous materials will be removed as part of the Work.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

F. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA and NYSDEC notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and for at least two hours after flame-cutting operations.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 02 82 13 – ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the procedures for disturbance and removal of existing asbestos-containing materials (ACM) and disposal of removed materials. The results of the testing for ACM, PCB, and Lead Based Paint are listed in the Building Asbestos Survey Reports located at the end of this Section.

1. All project work will comply with the procedures outlined in the New York State Department of Labor (NYSDOL) regulations and 12 New York Codes, Rules and Regulations (NYCRR) Part 56, including amendments.
2. The Project Specific Asbestos Survey reports were compiled by a Licensed Asbestos Firm using an ELAP certified laboratory.
3. In order to determine asbestos content, samples were analyzed by polarized light microscopy (PLM) and/or transmission electron microscopy (TEM).
4. The report is intended for design and estimate purposes only and is included to provide bidders with the same information available to the Owner.
5. The Bulk Samples are representative of like materials in the Work area. All ACM may not have been sampled.

B. Type of Asbestos Abatement Project:

1. Large Asbestos Abatement Project: An asbestos project involving the removal, disturbance, enclosure, encapsulation, repair, or handling of more than 160 square feet or 260 linear feet of ACM.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Summary of Work: Section 01 10 00.

B. Asbestos Abatement Plan(s)

1. AD101A: Demolition Floor Plan Phase I

1.3 TABLE OF CONTENTS INSTRUCTION

A. New York State Department of Environmental Conservation (DEC) 6NYCRR:

1. Part 360 Solid Waste Management Facilities.
2. Part 364 Waste Transporter Permits.
3. Part 370 Hazardous Waste Management System-General.
4. Part 371 Identification and Listing of Hazardous Wastes.
5. Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities.
6. Part 373 Hazardous Waste Management Facilities.

B. Occupational Safety and Health Administration (OSHA): Asbestos Regulations (29 CFR Part 1926.1101).

C. U.S. Environmental Protection Agency (USEPA):

1. National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule.
2. Asbestos Emergency Response Act (AHERA) (40 CFR Part 763, Subpart E).

D. New York State Department of Labor (DOL): Industrial

1.4 DEFINITIONS

A. Authorized Personnel: Facility or the Owner Representative, and all other personnel who are authorized officials of any regulating agency, be it State, Local, Federal or Private entity who possess legal authority for enforcement or inspection of the work.

B. Clearance Criteria: Shall be determined and established by a Certified Asbestos Project Monitor with an independent testing lab employed by the Owner's Representative, conforming to all standards set forth by all authorities having jurisdiction, mentioned in the references, and issue the certification of cleaning.

C. Site Specific Variance: Relief in accordance with section 30 of the Labor Law from specific sections of Industrial Code Rule 56 for a specific project.

D. Phase I & II: Asbestos Project phases as defined and subcategorized in ICR 56-2.

1.5 ABBREVIATIONS

A. ASTM: American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

B. CFR: Code of Federal Regulations
Government Printing Office
Washington, DC 20402

C. DOL: New York State Department of Labor
Harriman State Office Building Campus
Albany, NY 12240

D. NIOSH: National Institute for Occupational Safety and Health
Building J.N.E. Room 3007
Atlanta, GA 30333

E. OSHA: Occupational Safety and Health Administration
200 Constitution Avenue
Washington, DC 20210

F. USEPA: United States Environmental Protection Agency
401 M Street SW
Washington, DC 20460

1.6 ASBESTOS SITE-SPECIFIC VARIANCE

A. If a site-specific variance is sought, the application must be submitted by the contractor's NYS DOL Certified Asbestos Project Designer with 14 days after the Contract Agreement is approved by the Owner. Forward the required forms to the Department of Labor for their action.

1.7 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each item specified.

B. Asbestos Site-Specific Variance Submittals; if a site specific variance is sought submit the following:
1. One copy of the completed DOSH-751 and DOSH-465 forms.
2. One copy of the New York State Department of Labor site specific variance decision.

C. Quality Control Submittals:
1. Notification Compliance Data: Within 2 days after notification is sent to the regulatory agencies submit one copy of each notice sent to each regulatory agency (USEPA and DOL).
2. Asbestos Removal Company Data: Name and address of proposed asbestos removal company and abatement contractor license issued by DOL.
3. Asbestos Worker Certification Data: Name and address of proposed asbestos abatement workers and licenses issued by DOL, valid medical examination and valid fit test.
4. Work Plan: For information only, submit one copy of the work plan required under Quality Assurance Article.
5. Waste Transporter Permit: One copy of transporter's current waste transporter permit from NYS DEC (NYS Part 364 Permit).
6. Landfill: Landfill to be used for ACM disposal shall be licensed to receive asbestos waste by NYS DEC (NYS Part 360 Permit) and by USEPA. Out of state landfills shall provide licenses from local agencies having jurisdiction.
7. Negative Air Pressure Equipment: Copy of manufacturers and performance data of all units and HEPA filters used.

D. Asbestos Work Closeout Submittals:
1. Waste Shipment Records and Disposal Site Receipts: Copy of waste shipment record and disposal site receipt showing that the ACM has been properly disposed.
   a. Waste shipment record and disposal site receipt must be received within 35 days of the ACM waste leaving the Site. If receipts are not received within the specified time-period, the Owner's Representative will notify USEPA in writing within 45 days of the ACM waste leaving the Site.

E. Contract Closeout Submittals:
1. Daily Log: Submit copy of Project Monitor's daily air sample log and a copy of Asbestos Abatement Contractor's Daily project log.
2. Air Monitoring Data: Submit copy of air test results and chain of custody.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the referenced standards.

B. Pre-Work Conference: Before the Work of this Section is scheduled to commence, a conference will be held by the Owner's Representative at the Site for the purpose of reviewing the Contract Documents, discussing requirements for the Work, and reviewing the Work procedures.
   1. The conference shall be attended by the Contractor, the asbestos removal subcontractor, and the testing laboratory employed by the Owner.

C. Work Plan: At the conclusion of the pre-work conference, before the physical abatement Work begins, prepare a detailed work plan.
   1. The work plan shall include, but not be limited to, work procedures, types of equipment, details of equipment used, decontamination unit locations, crew size, and emergency procedures for fire and medical emergencies and for failure of containment barriers.
   2. If a site-specific variance is sought, do not finalize the work plan until the Department of Labor decision is received.

1.9 PROJECT CONDITIONS

A. In addition to the postings required by law, post at the entrance to the abatement area the following documents:
   1. Copy of the printed Work plan.
   2. Copy of Industrial Code Rule 56.

B. Maintain electric services to those portions of the building and remaining facility not a part of the asbestos abatement work area at all times. Follow all regulations for electric power shut down exemptions as per DOL regulations.

C. Do not obstruct any aisle or passageway so as to reduce its required width as an exit.

1.10 HEALTH AND SAFETY

A. Where in the performance of the work, workers, supervisory personnel or sub-contractors may encounter, disturb, or otherwise function in the immediate vicinity of contaminated items and materials, all personnel shall take appropriate continuous measures as necessary to protect all ancillary building occupants from the potential ACM exposure.
   1. Such measures shall include the procedures and methods described herein and shall be in compliance with all applicable regulations of Federal, State and Local agencies.

1.11 FIRE PROTECTION, EMERGENCY EGRESS AND SECURITY

A. Establish emergency and fire exits from the work area containment. Provide first aid kits and two full sets of protective clothing and respirators for use by qualified emergency personnel outside of the work area.

B. Provide a logbook throughout the entire term of the project. All persons who enter the regulated abatement work area or enclosure shall sign the logbook. Document any intrusion or incident in the log book.

1.12 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

A. Workers must wear personal protective equipment for all projects as per OSHA and DOL regulations. Provide respiratory protection in accordance with OSHA regulation 1910.134 and ANSI Z88.2.

B. Workers must be trained as per OSHA and DOL requirements, have medical clearance and must have recently received pulmonary function test (PFT) and respirator fit tested by a trained professional.
1. A personal air sampling program shall be in place as required by OSHA.
2. The use of respirators must also follow a complete respiratory protection program as specified by OSHA.

PART 2 - PRODUCTS

2.1 DISPOSAL BAGS

A. Type: Minimum 6 mil thick, black, and preprinted with a Caution Label.

2.2 EQUIPMENT

A. Temporary lighting, heating, hot water heating units, ground fault interrupters, and all other equipment on site shall be UL listed.

B. All electrical equipment shall be in compliance with the National Electric Code, Article 305 - Temporary Wiring.

2.3 GLOVE BAGS

A. Type: Minimum 6 mil thick, clear, fire retardant polyethylene. Select glove bag sizes appropriate for the size and location of the project.

2.4 NEGATIVE AIR PRESSURE UNITS

A. Type: Local exhaust system, capable of maintaining negative air pressure within the containment, and provides for HEPA filtration of efficiency not less than 99.97 percent with 0.3-micron particles. Equip the unit with filter alarms lights and operation time meter.

2.5 PLASTIC SHEETS

A. Type: Minimum 6 mil thick, clear, fire retardant polyethylene.

2.6 RESPIRATORS

A. Type: As approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

2.7 VACUUM CLEANERS

A. Type: Vacuums equipped with HEPA filters.

PART 3 - EXECUTION

3.1 ASBESTOS-CONTAINING MATERIAL HANDLING AND REMOVAL PROCEDURES

A. Comply with the standards referenced in Part 1 of this Section.

3.2 CLEAN UP PROCEDURES

A. Comply with the standards referenced in Part 1 of this Section.

3.3 PROJECT AIR SAMPLING, MONITORING AND ANALYSIS

A. Air Sampling and Analysis: The Owner will employ the services of an independent testing laboratory to perform air sample monitoring. The laboratory shall use the methods described in standards referenced in Part 1 of this Section.
   1. The equipment, duration, flow rate, calibration of equipment, number and location of samples are as per ICR 56-4.
   2. Air sampling technician shall be on site to observe and maintain air sampling equipment for the duration of the air sampling collection.
   3. Period of time permitted between completion of air sample collection and receipt of results on the project site shall be equal or less than 48 hours.

B. If air samples collected outside the regulated work area indicate airborne fiber concentrations at or above 0.01 fibers per cubic centimeter, or the established background level, whichever is greater, work shall stop immediately for inspection of barriers and negative air ventilation systems. Clean up surfaces outside the regulated work area using HEPA filter equipped vacuums and wet cleaning methods. Work methods shall be altered to reduce fiber concentrations to acceptable levels.

C. Elevated air sample results, if any, along with background and all other air sample results collected during Phase IIA through Phase IIC shall be submitted to the Commissioner of appropriate Asbestos Control Bureau within the same business day of receipt of results.

3.4 FINAL CLEANING AND CLEARANCE PROCEDURES

A. Negative Pressure Ventilation: Negative air pressure machines if used, shall remain in continuous operation during the entire length of the project.

B. Cleaning and Visual Inspection: After first, second, third cleaning and required waiting/settling and drying periods, perform a final visual inspection.

1. Final clearance air sampling shall commence after the waiting/settling and drying time as per ICR 56 has elapsed.

C. Project Monitor Visual Inspection: The Owner will employ the services of a DOL certified asbestos project monitor employed by an independent testing laboratory to perform visual inspection as required by ICR 56.

D. Final Clearance Air Sampling: The Owner will employ the services of an independent testing laboratory to perform final air sampling.
1. The laboratory shall use the methods described in standards referenced in Part 1 of this Section.
2. The equipment, duration, flow rate, calibration of equipment, number and location of samples are as per ICR 56-4.
3. If initial Post-Abatement (Clearance Air) Monitoring results do not comply with the standards referenced in Part 1 of this Section the Contractor shall either re-clean or order a full set of TEM analysis.
    a. Results of the TEM analysis will be conclusive, and if the results do not comply with the standards referenced in Part 1 of this Section, the Contractor shall re-clean and additional full set of air samples will be collected and analyzed until the standards are met.
    b. All satisfactory PCM clearance air sample results along with background air sample results, if they are greater than or equal to 0.01 fibers per cubic centimeter, shall be submitted to the Commissioner of appropriate Asbestos Control Bureau within two business days of receipt of satisfactory clearance air results.
    c. All satisfactory TEM results of previously unsatisfactory PCM clearance air sample results, along with the unsatisfactory PCM results shall be submitted to the Commissioner of appropriate Asbestos Control Bureau within two business days of receipt of satisfactory clearance air results.
4. Prior to removal of isolation barriers the Owner's Representative at the site will receive an affidavit from the air monitoring laboratory certifying the final air samples comply with the standards referenced in Part 1 of this Section.

E. Dismantling of Regulated Abatement Work Area:
1. Remove all tools and equipment after proper decontamination as per Part 1 of this section.
2. Dismantle and remove each tent enclosure and air lock and any barriers only after final clearance air monitoring has been performed and satisfactory results obtained.
3. All remaining polyethylene, duct tape, expandable foam and other barrier materials shall be bagged, wrapped, containerized and labeled as asbestos waste.
4. Remove all temporary hard walled barriers from site, unless approved otherwise by Owner's Representative.
5. Dismantle any remote decontamination units and plastic sheeting shall be disposed as asbestos waste.
6. Remove all waste generated to the holding area, lockable trailer or dumpster.
7. Contractor's Supervisor shall certify in writing to the Owner that abatement work is complete and no debris/residue remains.

3.5 DISPOSAL OF ASBESTOS-CONTAINING MATERIAL AND RELATED DEBRIS

A. Remove all waste generated as part of the asbestos project from the project site within ten calendar days from the site after completion of Phase IIC of the project or within one day of the waste disposal container/trailer becomes full, whichever occurs first.

B. Transport and dispose of all the asbestos-containing waste, related debris, and wastewater to the approved disposal site.

C. All generated waste removed from the site must be documented, accounted for and disposed of in compliance with the requirements of USEPA NESHAP.

D. Comply also with the standards referenced in Part 1 of this Section.

3.6 RESTORATION

A. Remove temporary decontamination facilities and restore area designated for these facilities to its original condition or better.

B. Where existing work is damaged or contaminated, restore work to its original condition or better.

END OF SECTION 028213

SECTION 02 82 14 – PROTECTION WORKER – LEAD-BASED PAINT

PART 1 - GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Contractors are alerted to the fact that the paint coating on surfaces in this project contains lead. Lead is a toxic metal capable of causing damage to the nervous system, kidneys, bones, heart and reproductive system.

C. Any surface coated with paint is considered to contain some percentage of lead, based on the age of the building. Any alteration and/or repair, including painting and decorating shall meet the requirements of OSHA CFR 29 1926.62 Construction Lead Standard.

1.2 SUBMITTALS

A. Contractors of each trade shall submit their written Lead Program prior to the start of work. The plan must identify potential sources of lead exposure and propose specific procedures to protect workers from those exposures.

1.3 DEFINITIONS

A. Action Level means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 ug/m^3) calculated as an 8-hour time weighted average (TWA).

B. Exposure Assessment means a Contractor's requirement to determine if any Contractor's employees may be exposed to lead at or above the action level.

C. Lead means metallic lead, all inorganic lead compounds and organic lead soaps. Excluded from this definition are all other organic lead compounds.

D. Permissible Exposure Limit means employee exposure, without the use of respirators, to an airborne concentration of lead of 50 ug/m^3 averaged over an 8-hour period.

PART 2 - PRODUCTS

None Specified.

PART 3 - EXECUTION

3.1 PROTECTION OF WORKERS

A. All Contractors shall be responsible to conduct an exposure assessment and shall initially determine if any Contractor's employee may be exposed to lead at or above the action level. Until the Contractor performs a Contractor's employee exposure assessment, the Contractor shall provide to Contractor's employees interim protection as specified in 29 CFR 1926.62, as follows:

1. Appropriate respiratory protection
2. Appropriate personal protective clothing and equipment
3. Change areas
4. Hand Washing Facilities
5. Biological Monitoring to consist of blood sampling and analysis for lead and zinc protoporphyrin levels
6. Training

3.2 EXPOSURE ASSESSMENT

A. The Contractor shall collect personal samples representative of a full shift including at least one sample for each job classification in each work area either for each shift or for the shift with the highest exposure.

1. Below the Action Level - should the initial personal air monitoring results be less than 30 ug/m^3 the Contractor shall make a written record of such determination. Further exposure determination need not be repeated except as follows:

   a. Whenever there has been a change of equipment, process, control, personnel or a new task has been initiated that may result in additional employees being exposed to lead at or above the action level or may result in employees already exposed at or above the action level being exposed above the PEL, the employer shall conduct additional monitoring.

2. At or Above the Action Level but at or Below the PEL - the Contractor shall perform monitoring until at least two consecutive measurements taken at least 7 days apart, are below the action level at which time the Contractor may discontinue monitoring for that employee except as otherwise provided in paragraph 3.02.A.1.a.

3. Above the PEL - the Contractor shall perform monitoring until at least two consecutive measurements taken at least 7 days apart, are at or below the PEL but at or above the action level at which time the Contractor shall repeat monitoring for that Contractor's employee as specified in 3.02 A.2.

3.3 METHODS OF COMPLIANCE

A. To the extent feasible, Contractors must reduce worker lead exposure to the Permissible Exposure Limit (PEL) of 50 ug/m^3 by a combination of engineering controls, work practice, and administrative controls.

B. Respiratory protection and other protective equipment must be provided and used to the extent that the engineering and work practice controls cannot reduce exposure to the PEL as specified within 29 CFR 1926.62.

3.4 HOUSEKEEPING (required whenever lead is disturbed)

A. All surfaces shall be maintained as free as practical of accumulations of lead.

B. Clean up of floors and other surfaces where lead accumulates shall wherever possible be cleaned by vacuuming or other methods that minimize the likelihood of lead becoming airborne.

C. Shoveling, dry or wet sweeping and brushing may be used only where vacuuming or other equally effective methods have been tried and found not to be effective.

D. Where vacuuming methods are selected, the vacuums shall be equipped with HEPA filters and used and emptied in a manner which minimizes the reentry of lead into the workplace.

E. Compressed air shall not be used to remove lead from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air.

3.5 HYGIENE FACILITIES AND PRACTICES (required above the PEL)

A. The Contractor shall assure that in areas where Contractor's employees are exposed to lead above the PEL without regard to the use of respirators, food or beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied.

B. Change Areas (required above the PEL and during exposure assessment)
1. The Contractor shall provide clean change areas for employees whose airborne exposure to lead is above the PEL, and as interim protection for employees.
2. The Contractor shall assure that change areas are equipped with separate storage facilities for protective work clothing and equipment and for street clothes which prevent cross-contamination.
3. The Contractor shall assure that Contractor's employees do not leave the workplace wearing any protective clothing or equipment that is required to be worn during the work shift.

C. Showers (required above the PEL)
1. The Contractor shall provide shower facilities, where feasible, for use by Contractor's employees whose airborne exposure to lead is above the PEL.

2. The Contractor shall assure where shower facilities are available, that Contractor's employees shower at the end of the work shift and shall provide an adequate supply of cleansing agents and towels for use by affected Contractor's employees.

D. Eating Facilities (required above the PEL)
1. The Contractor shall provide lunchroom facilities or eating areas for Contractor's employees whose airborne exposure to lead is above the PEL, without regard to the use of respirators.
2. The Contractor shall assure that lunchroom facilities or eating areas are as free as practicable from lead contamination and are readily accessible to Contractor's employees.
3. The Contractor shall assure that Contractor's employees whose airborne exposure to lead is above the PEL, without regard to the use of a respirator, wash their hands and face prior to eating, drinking, smoking or applying cosmetics.
4. The Contractor shall assure that Contractor's employees do not enter lunchroom facilities or eating areas with protective work clothing or equipment unless surface lead dust has been removed by vacuuming, downdraft booth, or other cleaning method that limits dispersion of lead dust.

E. Handwashing Facilities (required whenever lead is disturbed)
   1. The Contractor shall provide adequate handwashing facilities for use by Contractor's employees exposed to lead.
   2. Where showers are not provided the Contractor shall assure that Contractor's employees wash their hands and face at the end of the work shift.

3.6 MEDICAL SURVEILLANCE (required whenever lead is disturbed)

A. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by 29 CFR 1926.62 (j) Medical Surveillance.

3.7 TRAINING (required whenever lead is disturbed)

A. For all Contractor's employees who are subject to exposure to lead at or above the action level on any day or who are subject to exposure to lead compounds which may cause skin or eye irritation, the Contractor shall provide a training program in accordance with 29 CFR 1926.62 (l)(2).

3.8 SIGNS (required above the PEL)

A. The Contractor shall post the following warning signs in each work area where Contractor's employees exposure to lead is above the PEL.

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

B. The Contractor shall assure that signs are illuminated and cleaned as necessary so that the legend is readily visible.

3.9 RECORDKEEPING (required whenever lead is disturbed)

A. The Contractor is responsible to establish and maintain an accurate record of all monitoring and other data used in conducting Contractor's employee exposure assessments and for each Contractor's employee subject to medical surveillance as required per 29 CFR 1926.62 (n).

3.10 OBSERVATION OF MONITORING (required whenever lead is disturbed)

A. The Contractor shall provide affected Contractor's employees or their designated representatives an opportunity to observe any monitoring of employee exposure to lead.

B. Whenever observation of the monitoring of employee exposure to lead requires entry into an area where the use of respirators, protective clothing or equipment is required, the Contractor shall provide the observer with and assure the use of such respirators, clothing and equipment.

C. Without interfering with the monitoring, observers shall be entitled to:

1. Receive an explanation of the measurement procedures;
2. Observe all steps related to the monitoring of lead performed at the place of exposure; and
3. Record the results obtained or receive copies of the results when returned by the laboratory.

END OF SECTION 028214

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301 (ACI 301M).

    a. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

a. Plywood, metal, or other approved panel materials.
b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
1) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2. Form release agent for form liners shall be acceptable to form liner manufacturer.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:
   1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch (6 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

   1. Provide and secure units to support screed strips.
   2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

   1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
   2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches (305 mm).

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings.

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

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SECTION 032000 - CONCRETE REINFORCING

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

B. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

C. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

    a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

    a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
2. Stagger splices in accordance with ACI 318 (ACI 318M).

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches (305 mm).

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
2. Concrete sealers.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at

time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

7. Vapor retarders.
8. Liquid floor treatments.
9. Curing materials.
10. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.

4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

2. Maximum Coarse-Aggregate Size: 1-1/2 nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Barrier One, Inc.
b. Stego Industries, LLC.
c. W.R. Meadows, Inc.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

C. Water: Potable or complying with ASTM C1602/C1602M.

D. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters, Inc.

b. Dayton Superior.
c. Euclid Chemical Company (The); an RPM company.
d. W.R. Meadows, Inc.

E. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters, Inc.
b. Dayton Superior.
c. Euclid Chemical Company (The); an RPM company.
d. Master Builders Solutions.
e. W.R. Meadows, Inc.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ChemMasters, Inc.
b. Dayton Superior.
c. Euclid Chemical Company (The); an RPM company.
d. W.R. Meadows, Inc.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Floor Slab Protective Covering: Eight-feet- (2438-mm-) wide cellulose fabric.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.

3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in [pumped concrete, and concrete with a w/cm below 0.50.

2.7 CONCRETE MIXTURES

A. Normal-weight concrete used for footings, grade beams, and interior piers.

1. Exposure Class: ACI 318 (ACI 318M) F0, S1, W0, C1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.45
1. Slump Limit: 5 inches, plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
2. Air Content:
   a. Exposure Classes F0: 2 percent, plus or minus 1 percent at point of delivery.

3. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

B. Normal-weight concrete used for foundation walls, and exterior piers.

1. Exposure Class: ACI 318 F2, S0, W0, and C1.
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Maximum w/cm: 0.45
4. Slump Limit: 5 inches, plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
   a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery.

6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 (ACI 318M) F0, S0, W0, C0.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: .45.
4. Minimum Cementitious Materials Content: 470 lb/cu. yd.

5. Slump Limit: 5 inches, plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
6. Air Content:

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

7. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Normal-weight concrete used for exterior retaining walls.

1. Exposure Class: ACI 318 F3, S0, W0, and C2.
2. Minimum Compressive Strength: 5000 psi at 28 days.
3. Maximum w/cm: 0.40
4. Slump Limit: 5 inches, plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
    a. Exposure Classes F3: 6 percent, plus or minus 1 percent at point of delivery.

6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Normal-weight concrete used for exterior slab-on-grade.

1. Exposure Class: ACI 318 F3, S0, W0, and C2.
2. Minimum Compressive Strength: 5000 psi at 28 days.
3. Maximum w/cm: 0.40
4. Slump Limit: 5 inches, plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
    a. Exposure Classes F3: 6 percent, plus or minus 1 percent at point of delivery.

6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.2 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

3.3 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.

b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.4 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

   a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
   b. Remove projections larger than 1 inch (25 mm).
   c. Tie holes do not require patching.
   d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
   e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 (ACI 301M)Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

   a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
   b. Remove projections larger than 1/4 inch (6 mm).
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
   e. Locations: Apply to concrete surfaces exposed to public view.

3. ACI 301 (ACI 301M) Surface Finish SF-3.0:

   a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
   b. Remove projections larger than 1/8 inch (3 mm).
   c. Patch tie holes.
   d. Surface Tolerance: ACI 117 (ACI 117M) Class A.
   e. Locations: Apply to concrete surfaces to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

A. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

B. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

   a. Slabs on Ground:

      1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
      2) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 21; and of levelness, F_L 15.

C. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.8 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb./sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12-inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

g. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.10 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

6. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of three 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
    b. Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    b. Test one set of four field-cured specimens at seven days and one set of two specimens at 28 days.
    c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.12 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior polished concrete finishing, including staining.
2. Existing exterior concrete finishing for slip resistance.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.3 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Cast-in-place concrete subcontractor.
e. Polished concrete finishing Subcontractor.

2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete finishing, and protection of polished concrete.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Verification: For each type of exposed color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Stain materials.

1.7 QUALITY ASSURANCE

A. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Demonstrate curing, finishing, and protecting of polished concrete.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Scofield, a Business Unit of Sika Corporation.
b. Green Umbrella
c. QC Construction Products.
d. Surecrete Ecostain (Basis of design product)
e. Or Architect Approved Equal.

2. Color: Titanium Gray (68)

2.2 SLIP RESISTANCE MATERIALS

A. Concrete hardener: Clear, Low VOC chemical hardener.

1. Manufacturers: Basis of design product: L&M Chem Hard by Laticrete. Subject to compliance with requirements, provide basis of design product or equal.

B. Concrete Sealer: Clear, Low VOC waterborne penetrating sealer.

1. Manufacturers: Basis of design product: L&M Aquapel by Laticrete. Subject to compliance with requirements, provide basis of design product or equal.

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Level 4: Gloss shine, 3000 grit.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth.
2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
6. Control and dispose of waste products produced by grinding and polishing operations.
7. Neutralize and clean polished floor surfaces.

3.2 STAINING

A. Newly placed concrete shall be at least 14 days old before staining.

B. Prepare surfaces according to manufacturer's written instructions and as follows:

1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.

    a. Do not use acidic solutions to clean surfaces.

2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.

C. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

D. Reactive Stain: Apply reactive stain to concrete surfaces according to manufacturer's written instructions and as follows:

1. Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
2. Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.

3.3 EXISTING SLAB PREP FOR SLIP RESISTANCE

A. Repair concrete surface, including grinding areas deemed to be trip hazards, fill holes deeper than 2”, and fill cracks, consistent with American Concrete Institute (ACI) Standard 302.IR. Remove and replace metal expansion joint cover.

B. Machine grind floor surfaces to receive slip resistance materials. Include three passes of a planetary head grinder and hone the surface. Hand grind to smooth transitions across shifted expansion joints.

C. Apply Sealer and Hardener to prepared slabs to match accepted mockup.

1. Apply concrete hardener in sequence and according to manufacturer's written instructions.
2. Apply penetrating concrete sealer in sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Do not install products if substrate temperature is below 45 degrees F or above 100 degrees F.
4. Protect installation from traffic for at least 2 hours and per the manufacturer’s instructions.

END OF SECTION 033543

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Forged-steel hardware.
6. Shop primer.
7. Galvanized-steel primer.
8. Etching cleaner.
9. Galvanized repair paint.
10. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Allowable Stress Design; data are given at service-load level.

C. Moment Connections: Type FR, fully restrained.

D. Construction: Combined system of moment frame and braced frame.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: **ASTM A992**.

B. Channels, Angles: **ASTM A572, Grade 50**.

C. Plate and Bar: **ASTM A36 ASTM A572/A572M, Grade 50**.

D. Cold-Formed Hollow Structural Sections: **ASTM A500, Grade C** structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts[**or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends**]; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1 (Type 10.9-1), compressible-washer type with plain finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hexhead assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain..

D.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.

1. Configuration: Straight.
2. Finish: Plain ..

B. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Finish: Plain.

C. Threaded Rods: ASTM A36.

1. Finish: Plain.

2.5 PRIMER

A. Steel Primer:

1. Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. .
5. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
   1. SSPC-SP 3.

C. "Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: **Owner will engage** a qualified testing agency to perform shop tests and inspections.

   1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
   2. Bolted Connections: Inspectand test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

      a. Liquid Penetrant Inspection: ASTM E165/E165M.
      b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      c. Ultrasonic Inspection: ASTM E164.
      d. Radiographic Inspection: ASTM E94/E94M.
   4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tightenanchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspectand test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3) Ultrasonic Inspection: ASTM E164.

4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

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SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Roof deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Research reports.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. Epic Metals Corporation.
3. Nucor Corporation.
4. Nucor Corporation, Verco Group.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), **Grade 33, G90** zinc coating.

2. Deck Profile: **Type WR, wide rib**.
3. Profile Depth: **1-1/2 inches.**
4. Design Uncoated-Steel Thickness: **0.0358 inch.**

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

G. Galvanizing Repair Paint: ASTM A780

H. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

F. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

G. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.

   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

H. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

I. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

3.2 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Roof joist framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Single deflection track.
5. Double deflection track.
6. Roof joist framing.
7. Post-installed anchors.
8. Power-actuated anchors.
9. Sill sealer gasket.
10. Sill sealer gasket/termite barrier.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ClarkDietrich.
2. MarinoWARE.
3. The Steel Network, Inc.
4. United Steel Deck, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST50H
2. Coating: G60

2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538.
2. Flange Width: 1-5/8
3. Effective Section Properties: Sx = .916 in.^3, Ix = 2.86 in.^4, Mal = 23.17 in-k.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch.
2. Flange Width: 1-5/8.
3. Effective Section Properties: Sx = .1.66 in.^3, Ix = .7.07in.^4, Mal = 43.23 in-k.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538.
2. Flange Width: 1-5/8
3. Effective Section Properties: Sx = .916 in.^3, Ix = 2.86 in.^4, Mal = 23.17 in-k.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

2.6 ROOF JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0966 inch.
2. Flange Width: 2-1/2 inches **(63 mm)**, minimum.
3. Effective Section Properties: Sx = 6.01 in.^3, Ix = 48.7 in.^4, Mal = 153.28 in-k.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel joists.
2. Flange Width: 2 inches , minimum.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by [hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor, or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil (1.7-mm) nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil-(0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side[**;** formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Physical Properties:

a. Peel Adhesion: 17.0 lb/in of width (2.9 N/mm of width) when tested in accordance with ASTM D412.
b. Low-Temperature Flexibility: Pass at minus 25 deg F (minus 32 deg C) when tested in accordance with)ASTM D146/D146M.
c. Water Vapor Permeance: 0.05 perm (0.44 ng/Pa x s x sq. m) maximum when tested in accordance with ASTM E96/E96M, Method B.
d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: To match stud spacing.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track.

1. Fasten both flanges of studs to top and bottom tracks.
2. Space studs as follows:

a. Stud Spacing: 16 inches and As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches and As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

E. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

1. Joist Spacing: 16 inches .

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Leveling Plates
3. Metal floor plate.
4. Abrasive metal thresholds.

B. Products furnished, but not installed, under this Section include the following:
1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Abrasive metal thresholds.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

D. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

E. Rolled-Stainless Steel Floor Plate: ASTM A793.

F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated.
2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.
3. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33 (Grade 230); 0.0677-inch (1.7-mm) minimum thickness; hot-dip galvanized after fabrication.

I. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

B. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches (600 mm) o.c.

C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:

1. Thickness: As indicated.

B. Provide steel, stainless steel, and aluminum angle supports as indicated.

2.8 ABRASIVE METAL THRESHOLDS

A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. American Safety Tread Company.
   b. Armstrong Products, Inc.
   c. Balco, a CSW Industrials Company.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

D. Apply clear lacquer to concealed surfaces of extruded units.

2.9 LEVELING PLATES

A. Provide loose leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.3 INSTALLATION LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

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SECTION 055119 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Industrial Class stairs with steel-grating treads.
2. Steel railings attached to metal stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs and railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings so wall attachments are made only to completed walls.

1. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:
1. Gratings.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Shop primer products.
5. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

C. Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

D. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.

E. Steel Pipe for Railings: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

F. Provide galvanized finish for exterior installations and where indicated.

2.3 FASTENERS

A. General: Provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.

E. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs and railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or channels.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel stringers.
c. Finish: Galvanized.

2. Construct platforms and tread supports of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel framing.
b. Finish: Galvanized.

3. Weld stringers to headers; weld framing members to stringers and headers.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from welded steel grating with 1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c.
2. Fabricate treads and platforms from welded steel grating with openings in gratings no more than 5/16 inch in least dimension.

a. Surface: Plain.
b. Finish: Galvanized.

D. Risers: Open.

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.

1. Material and Finish: Steel plate to match finish of other steel items.
2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

B. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inch-square top and bottom rails and 1-1/2-inch-square posts.
2. Picket Infill: 3/4-inch square pickets spaced less than 4 inches clear.
3. Intermediate Rails Infill: 1-1/2-inch-square intermediate rails spaced less than 12 inches clear.

C. Welded Connections: Fabricate railings with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.

a. Provide weep holes where water may accumulate internally.

2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Weld all around at connections, including at fittings.
4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
5. Obtain fusion without undercut or overlap.
6. Remove flux immediately.
7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter as shown in NAAMM AMP 521.

D. Form changes in direction of railings as follows:

1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.
3. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.

1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

H. Connect posts to stair framing by direct welding unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
4. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.

a. Clean bottom surface of baseplates.
b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
c. After stairs have been positioned and aligned, tighten anchor bolts.
d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts and rail ends to building construction as follows:

a. Anchor posts to steel by welding to steel supporting members.
b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

3.4 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055119

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless-steel pipe and tube railings.

B. Related Requirements:

1. Section 055112 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of New York, responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless-Steel Pipe and Tube Railings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Blum, Julius & Co., Inc.
b. Tubular Specialties Manufacturing, Inc.
c. Architect Approved Equal.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STAINLESS STEEL

A. Tubing: ASTM A554, Grade MT 304.

B. Pipe: ASTM A312/A312M, Grade TP 304.

C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

D. Plate and Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.5 FASTENERS

A. General: Provide the following:

1. Stainless-Steel Railings: Type 304 stainless-steel fasteners.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit

masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction by bending or by inserting prefabricated elbow fittings.

F. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

G. Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

2.8 STAINLESS-STEEL FINISHES

A. Stainless Steel Tubing Finishes:

1. Polished and Buffed Finish: 320-grit finish followed by buffing to a high luster finish.

B. Stainless Steel Sheet and Plate Finishes:

1. High Luster Finish: ASTM A480/A480M. No. 7.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

3.3 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055213

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SECTION 055316 - PLANK GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed-metal plank gratings.
2. Grating frames and supports.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for structural-steel framing system components.
2. Section 055213 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Formed-metal plank gratings.
2. Paint products.

B. Shop Drawings:

1. Include plans, sections, and attachment details.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittals: For gratings, including manufacturers' published load tables and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

B. Certificates:

1. Mill Certificates: Signed by manufacturers of stainless steel sheet certifying that products furnished comply with requirements.
2. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
3. Welding certificates.

C. Delegated design engineer qualifications.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Delegated Design Engineer: A professional engineer who is legally qualified to practice in New York State where Project is located and who is experienced in providing engineering services of the type indicated.
2. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

   a. AWS D1.1/D1.1M.
   b. AWS D1.2/D1.2M.
   c. AWS D1.3/D1.3M.
   d. AWS D1.6/D1.6M.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.

B. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).
2. Limit deflection to L/360 or 1/4 inch (6.4 mm), whichever is less.

C. Seismic Performance: Gratings to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.2 FORMED-METAL PLANK GRATINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. McNichols.
2. Grating Pacific, Inc.
3. Unistrut, Atkore International.

B. C-Shaped Channels: Rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.

1. Channel Width: As required to comply with structural performance requirements.
2. Channel Depth: As required to comply with structural performance requirements.
3. Material: 0.104-inch- (2.65-mm-) thick steel sheet, hot-dip galvanized after fabrication.

2.3 GRATING FRAMES AND SUPPORTS

A. Frames and Supports: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6.4 mm) thick by 8 inches (200 mm) long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum.
2. Provide stainless steel fasteners for fastening stainless steel.

B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; ASTM F593 (ISO 3506-1) for bolts and ASTM F594 (ASTM F836M) for nuts, Alloy [**Group 1 (A1)**] [**Group 2 (A4)**].

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593 (ISO 3506-1), and nuts, ASTM F594 (ASTM F836M).

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FERROUS METALS

A.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30 (Grade 205).

D. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.

E. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M, Type 304.

F. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

2.7 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B221 (ASTM B221M), alloys as follows:

1. Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. Alloy 6061-T1, for grating crossbars.

C. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 5052-H32.

2.8 FABRICATION

A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Fit exposed connections accurately together to form hairline joints.

C. Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

D. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates for attaching in the field.
2. Toeplate Height: 4 inches (100 mm) unless otherwise indicated.

E. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.

1. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

F. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3.2 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

2.9 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish: AA-M12C22A41 complying with AAMA 611.

2.10 STEEL FINISHES

A. Finish gratings, frames, and supports after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

C. Shop prime gratings, frames and supports not indicated to be galvanized unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Attach toeplates to gratings by welding at locations indicated.

F. Field Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

G. Corrosion Protection: With a heavy coat of bituminous paint, coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 INSTALLATION OF METAL PLANK GRATINGS

A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.

B. Attach removable units to supporting members by bolting at every point of contact.

C. Attach nonremovable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.

D. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

3.3 REPAIR

A. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on prime-painted gratings immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

   a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055316

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SECTION 057000 - DECORATIVE METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Decorative perforated metal fascia.

B. Related Requirements:

1. Section 057300 "Decorative Metal Railings" for decorative metal railings.
2. Section 057500 "Decorative Formed Metal" for decorative metal items made from sheet metal.

1.3 COORDINATION

A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative metal.

1. Include plans, elevations, component details, and attachment details.
2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Patterns, Models, or Plaster Castings: Made from proposed patterns for each design of custom casting required. Submit 12” x 12” sample of perforation pattern in required material thickness. Sample to include formed edges per system design and finish as specified.

D. Samples for Initial Selection: For products involving selection of color, texture, or design including mechanical finishes.

E. Samples for Verification: For each type of exposed finish.

1. Sections of linear shapes.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Mill Certificates: Signed by manufacturers of stainless steel certifying that products furnished comply with requirements.

C. Welding certificates.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Installer Qualifications: Fabricator of products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for the following types of decorative metal:

a. Perforated sheet metal with stainless steel anchors to subframing. Include perimeter trim of all conditions. Size: 24 inch by 24 inch.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Project Warranty: 1 year manufacturer’s warranty on fabrications and material

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

C. Finish Warranty: 5 year warranty (Anodized finish)

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DECORATIVE METAL MANUFACTURER

A. Manufacturers: Basis of design: Hendrick Architectural. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. VACCO Industries.
2. Diamond Manufacturing Company.
3. Remaly Manufacturing Company.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 ALUMINUM

A. Fabricate products from alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Perforated Sheet: ASTM B209 (ASTM B209M), Alloy 5005-H32.

1. Thickness: 3/16 inch minimum.
2. Sheet Size: Max size per manufacturer span chart and as indicated on drawings. Adjust thickness to meet sheet size per drawings.
3. Shape: Flat panel edges.
4. Finish: Clear Anodized.
5. Perforations: Round 1/2 inch diameter on 11/16 inch centers. Staggered.
6. Panel Margins: 1-1/4 inch minimum all sides.

2.4 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Aluminum Items: Type 304 stainless steel fasteners.
2. Dissimilar Metals: Type 304 stainless steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B.

2.6 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.
3. Use connections that maintain structural value of joined pieces.

B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

E. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

C. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057000

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel decorative railings.

B. Related Requirements:

1. Section 055213 "Pipe and Tube Railings" for nonornamental railings fabricated from pipes and tubes.

1.3 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Perforated metal infill panels.
3. Fasteners.
4. Post-installed anchors.

5. Handrail brackets.
6. Nonshrink, nonmetallic grout.
7. Anchoring cement.
8. Metal finishes.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters
2. Fittings, end caps, and brackets.
3. Welded connections.
4. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and guard infill. Sample need not be full height.

a. Show method of connecting members at intersections.

E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

E. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

   a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

   a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 STAINLESS STEEL DECORATIVE RAILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. C.R. Laurence Co., Inc.
2. Livers Bronze Co.
3. VIVA Railings, LLC.

B. Source Limitations: Obtain stainless steel decorative railing components from single source from single manufacturer.

C. Tubing: ASTM A554, Grade MT 304.

D. Pipe: ASTM A312/A312M, Grade TP 304.

E. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

F. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.

G. Flat Bar: ASTM A666, Type 304.

H. Bars and Shapes: ASTM A276/A276M, Type 304.

I. Perforated Metal Infill Panels: Stainless steel sheet, ASTM A240/A240M or ASTM A666, Type 304, 0.062 inch (1.59 mm) thick, with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows.

2.4 FASTENERS

A. Fastener Materials:

1. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
2. Dissimilar Metal Railing Components: Type 304 stainless steel fasteners.
3. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Top Rail Brackets: Cast stainless steel, center of handrail aligned with center of railing.

1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

I. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

M. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

N. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.

1. Provide socket covers designed and fabricated to resist being dislodged.

2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

O. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from stainless steel.

1. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch (1.1 mm) thick.
2. Orient perforated metal with pattern horizontal.

P. Toe Boards: Where indicated on Drawings, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Tubing Finishes:

1. 180-Grit Polished Finish: Uniform, directionally textured finish.
2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
3. Polished and Buffed Finish: 320-grit finish followed by buffing to a high luster finish.

D. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4.

2. High-Luster Finish: ASTM A480/A480M, No. 7.
3. Mirror Finish: ASTM A480/A480M, No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3 m).

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, attached to post with setscrews.

D. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Owner.

B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894 and ASTM E935 for compliance with performance requirements.

C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.

D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Simpson Strong-Tie Co., Inc.
2. Or Architect Approved Equal.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

D. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

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SECTION 061533 - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic decking.
2. Support framing for elevated decks.

1.3 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal (38 mm actual) in thickness and 2 inches nominal (38 mm actual) or greater in width.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

D. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For preservative-treated wood products and plastic decking .

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. For plastic decking. Include installation instructions.

B. Samples: For plastic decking, not less than 24 inches (600 mm) long, showing the range of variation to be expected in appearance of decking, including surface texture.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

C. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood products.
2. Plastic decking.
3. Expansion anchors.
4. Metal framing anchors.
5. Decking fasteners.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Handle and store plastic lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.

1. Factory mark each item with grade stamp of grading agency.
2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness.
3. Timber. 19 percent.

2.2 DIMENSION LUMBER FRAMING

A. Deck Framing: Construction or No. 2 grade and any of the following species:

1. Hem-fir (North); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (North); NLGA.
9. Spruce-pine-fir (South); NeLMA, WCLIB, or WWPA.

2.3 PRESERVATIVE TREATMENT

A. Pressure treat boards and dimension lumber with waterborne preservative according to AWPA U1; Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

B. Pressure treat timber with waterborne preservative according to AWPA U1; Use Category UC4a.

C. Preservative Chemicals: Acceptable to authorities having jurisdiction.

1. Do not use chemicals containing arsenic or chromium.

D. Use process for boards and dimension lumber that includes water-repellent treatment.

E. After treatment, redry boards dimension lumber and timber to 19 percent maximum moisture content.

F. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.

G. Application: Treat items indicated on Drawings and the following:

1. Framing members.
2. Sills and ledgers.
3. Members in contact with masonry or concrete.

2.4 PLASTIC DECKING

A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.

1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads and spans indicated.

B. All-Plastic Lumber: Solid or hollow shapes made from high-density polyethylene (HDPE), PVC, polystyrene, or cellular PVC with no cellulose fiber.

1. Manufacturers: Basis of design product: Vintage Collection Azek by TimberTech. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Fiberon.
   b. Versatex.

2. Decking Standard: ICC-ES AC174.
3. Decking Size: 1 by 5 inches (25 by 126 mm) actual.
4. Configuration: Provide product with straight edges with 1/8-inch edge radius for butted boards with no gap.
5. Surface Texture: Woodgrain.
6. Color: As selected by Architect from manufacturer's full range.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Use stainless steel unless otherwise indicated.
2. For pressure-preservative-treated wood, use stainless steel fasteners.
3. For plastic decking, use stainless steel fasteners.

B. Nails: ASTM F1667.

C. Power-Driven Fasteners: ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or Grade A4); with ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4) hex nuts and, where indicated, flat washers.

F. Postinstalled Anchors: Stainless steel, chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in

unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488 conducted by a qualified independent testing and inspecting agency.

1. Stainless steel bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or Grade A4).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.

C. Install plastic lumber to comply with manufacturer's written instructions.

D. Secure decking to framing with deck splines deck clips deck tracks or screws.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Apply copper naphthenate field treatment to comply with AWPA M4, to cut surfaces of preservative-treated lumber.

I. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. ICC-ES AC70 for power-driven fasteners.
2. "Fastening Schedule" in ICC's International Building Code.
3. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.

J. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

3.4 INSTALLATION OF ELEVATED DECK JOIST FRAMING

A. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1200 mm).

C. Lap members framing from opposite sides of beams or girders not less than 4 inches (102 mm,) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.

D. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at intervals of 96 inches (2438 mm) o.c., between joists.

END OF SECTION 061533

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Underlayment.
3. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings.

2.5 WALL SHEATHING

A. Plywood Sheathing: , Exterior, Structural I sheathing; interior exposure 1 backing panels.

B. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation.
   b. Georgia-Pacific Gypsum LLC.
   c. USG Corporation.

2. Type and Thickness: Regular and as indicated.

C. Cementitious Backer Units: ASTM C1325, Type A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Custom Building Products.
   b. USG Corporation.

2. Thickness: As indicated.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
2. For wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall Sheathing:
   a. Screw to cold-formed metal framing.
   b. Space panels 1/8 inch apart at edges and ends.

2. Underlayment:
   a. Space panels 1/32 inch apart at edges and ends.
   b. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to cold-formed metal framing with screws.

2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 061600

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SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Provide full size details.
2. Show locations and sizes of furring, blocking and hanging strips, including concealed blocking and reinforcement specified in other sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets, plumbing fixtures, faucets and other items installed in architectural plastic-laminate cabinets and countertops.
4. Show laminate direction and seaming patterns.
5. Show location and detail of all trim pieces and accessories.
6. Apply AWI quality Certification Program label to Shop Drawings.

C. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets demonstrating hardware design, quality and finish.

D. Samples for verification: Submit color chips of laminates and PVC edge molding representing manufacturer’s full range of available colors and patterns.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates for the following:

1. Composite wood products
2. High-pressure decorative laminates
3. Adhesives

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE AND HANDLING

A. Cabinets shall not be delivered to site until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinetry must be delivered and stored on site outside the installation areas, shall be stored in areas where environmental conditions comply with requirements specified within ‘Field Conditions’ article below.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is completed and HVAC system is operational, maintaining temperature and humidity at levels planned for occupancy during remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
1. Located concealed framing, blocking and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on shop drawings.

C. Establish Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

D. Coordinate sizes and locations of framing, blocking, furring, reinforcements and other related units of work specified in other sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL FABRICATORS:

A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Jeffrey Ellis Carl Cabinetmakers
2. Beaver Creek Industries, Inc.
3. Ridge Cabinet
4. BGI interiors, Inc.
5. Conley Casework

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

1. Reveal Dimension: As indicated.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.
b. Wilsonart LLC.
c. Nevamar

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.

4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
5. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Drawer sides and backs shall be Solid hardware lumber.
2. Join subfronts, backs, and sides with glued dovetail joints.
3. Drawer bottoms shall be Hardwood Plywood.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.
2. Match Architect's sample.
3. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors,
b. Wood grains,
c. Patterns.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural transparent finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of exposed treated woodwork.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."

1. Manufacturers: Subject to compliance with requirements and as stated in the Basis of Design on A604, provide products by one of the following:

a. Richelieu
b. Rakks
c. Mockett

B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening.

C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.

a. Type: Full extension.
b. Material: Zinc-plated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
6. For computer keyboard shelves, provide Grade 1.
7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.

G. Door Locks: ANSI/BHMA A156.11, E07121. All cabinet doors in project are to be lockable.

H. Drawer Locks: ANSI/BHMA A156.11, E07041.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: as selected from manufacturers full range.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Brushed Nickel, Clear Coated
2. Satin Stainless Steel: ANSI/BHMA 630.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: type recommended by fabricator to suit application.

2.7 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

B. Fabricate cabinets to dimensions, profiles, and details indicated. Bottom of doors and drawers to extend 1/8 inch below bottom of cabinets.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.2 ADJUSTING AND CLEANING

1. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, contractor shall replace casework. Adjust joinery for uniform appearance.

2. Clean, lubricate, and adjust hardware.

3. Clean cabinets and countertops on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064116

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.
3. High Density blown closed-cell polyurethane foam

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research reports.

PART 2 - PRODUCTS

A. Extruded Polystyrene Board, Type V Sub slab insulation: ASTM C578, Type V, 100-psi minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Chemical Company (The).
   b. Owens Corning.
   c. Architect / Engineer approved equal

2. Thermal Resistance: Minimum R-5 per inch.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced (Sound attenuation): ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Owens Corning.

2.3 HIGH DENSITY BLOWN CLOSED-CELL POLYURETHANE FOAM

A. High Density blown closed-cell polyurethane foam: ASTM D7425-13 for spray polyurethane foam used for roofing applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle; (Basis of Design: PremiSEAL)
    b. Or Architect Approved Equal.

2. Thermal Resistance: Minimum R-6.3.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of **36 inches** in from exterior walls.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100

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SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D4397, 6-mil- (0.15-mm-) thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 074113.13 - FORMED METAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam, metal roof panels.
2. Exposed-fastener, lap-seam metal wall panels.

B. Related Sections:

1. Section 074213.19 "Insulated Metal Wall Panels" for foamed-in-place, laminated and honeycomb insulated metal wall panels.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment, doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of purlins and rafters during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof area, eave, and wall as shown on Drawings; approximately 48 inches (1200 mm) square by full thickness, including corners, attachments, seams and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

C. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 EXPOSED-FASTENER, LAP-SEAM, METAL ROOF PANELS

A. Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Box-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.

1. Manufacturers: Basis of design product: MR3-36 by Centria. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ATAS.
   b. MBCI.
   c. Kingspan.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

   a. Nominal Thickness: 0.034 inch (0.86 mm).
   b. Exterior Finish: Mica fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.

3. Rib Spacing: 12.0 inches (304 mm) o.c.
4. Panel Coverage: 36 inches (914 mm).
5. Panel Height: 3 inches (76 mm).

2.3 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. Box-Rib-Profile, Exposed-Fastener Metal Wall Panels <**Insert drawing designation**>: Formed with raised, box-shaped ribs, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.

1. Manufacturers: Basis of design product: MR3-36 by Centria. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ATAS.
   b. MBCI.
   c. Kingspan.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Nominal Thickness: 0.034 inch (0.86 mm).
    b. Exterior Finish: Mica fluoropolymer.
    c. Color: As selected by Architect from manufacturer's full range.

3. Rib Spacing: 12.0 inches (304 mm) o.c.
4. Panel Coverage: 36 inches (914 mm).
5. Panel Height: 3.0 inches (76 mm).

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

    1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
    2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
    3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

G. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments. Apply finish to both sides of panel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that are concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.
6. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

G. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

H. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal panel installation, including accessories. Report results in writing.

B. Remove and replace applications where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.13

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SECTION 074213.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Foamed-insulation-core concealed fastener metal wall panels, with related metal trim and accessories.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E72:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
4. FM Approvals Listing: Comply with FM approval 4881. Provide metal wall panel assembly listed in FM approvals “Approval Guide.”

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Insulation Core: Polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622.
c. Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.
d. Shear Strength: 36 psi when tested according to ASTM C273/C273M.
e. Tensile Strength: As required to meet structural performance requirements and with a minimum of 41 psi ASTM D 1623.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CENTRIA Architectural Systems. (Basis of Design – Versawall V)
b. Metl-Span.
c. Kingspan Insulated Panels.

2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior face sheet: 22 Gauge thickness with stucco embossed surface.
b. Exterior Finish: Two-coat fluoropolymer.

1) Color: As selected by Architect from manufacturer's full range of premium I color selections.

c. Interior Face sheet: 24 gauge thickness, with smooth unembossed surface light mesa.

d. Interior Finish: Modified silicone-polyester two-coat system.

1) Color: As indicated by manufacturer's designations.

3. Panel Width: 36 inch nominal.
4. Panel Thickness: 2.75 inches.
5. Thermal-Resistance Value (R-Value): R-22 according to ASTM C1363.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fascia, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Clips: ASTM A653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, one-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

E. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by the manufacturer for direct to masonry installation, designed to withstand design loads. Where exposed fasteners cannot be avoided, provide corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Vertical Joint Gasket: Manufacturers standard EPDM gasket. Color: Black.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.2 INSULATED METAL WALL PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.

2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.19

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Substrate board.
3. Roof insulation.
4. Cover board.
5. Metal edging and membrane terminations
6. Walkways.

B. Related Requirements:
1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Section 077100 "Roof specialties" for roof-edge specialties, roof-edge drainage systems and Reglets and counterflashings.
4. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Extent of Work:
1. Metal Deck Areas: Mechanically fasten 1/2” manufacturer approved Substrate to meet the required uplift ratings but no less than 1 every 2 sq. ft. in the field and perimeter and 1 every 1 sq. ft. in the corners. Prime the substrate board with NYS VOC OTC compliant primer. Install manufacturer approved vapor retarder. Adhesively attach Manufacturer approved Polyisocyanurate insulation and manufacturer approved water resistant 1/2” gypsum cover board with adhesive 4” on center in the field, perimeter & corners. Fully adhere .060 reinforced EPDM in accordance with current specifications and details.
2. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of a .060 inch thick reinforced EPDM membrane Fully Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.
3. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
4. The roofing contractor shall confirm all given information and advise the building owner, prior to bid, of any conflicts that will affect their cost proposal.
5. Any contractor who intends to submit a bid using a roofing system other than the approved manufacturer must submit for pre-qualification in writing ten (10) days prior to the bid date. Any contractor who fails to submit all information as requested will be subject to rejection. Bids stating "as per plans and specs" will be unacceptable.

1.2 PREINSTALLATION MEETINGS

A. Preliminary Conference: Conduct conference at Project site 901 Fuhrmann Blvd., NY 14203.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness if insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Tie-in with air barrier.

C. Samples: For the following products:

1. Roof membrane and flashings of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Research reports.

D. Field Test Reports:

1. Concrete internal relative humidity test reports.

2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.

B. Comply with the manufacturer's written instructions for proper material storage.
1. Store materials, except membrane, between 60 degrees F and 80 degrees F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60 degrees F minimum temperature before using.
2. Store materials containing solvents in dry, well-ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.

C. Insulation must be on pallets, off the ground and tightly covered with waterproof materials.

D. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.

1.7 WORK SEQUENCE

A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.

B. Do not disrupt activities in occupied spaces.

1.8 EXISTING CONDITIONS

A. If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work.

1.9 JOB SITE PROTECTION

A. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion.

B. Do not overload any portion of the building, either by use of or placement of equipment, storage of debris, or storage of materials.

C. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.

D. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required.

E. Store moisture susceptible materials above ground and protect with waterproof coverings.

1.10 SAFETY

A. The roofing contractor shall be responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. Safety shall be the responsibility of the roofing contractor. All related personnel shall be instructed daily to be mindful of the full time requirement to maintain a safe environment for the facility's occupants including staff, visitors, customers and the occurrence of the general public on or near the site.

1.11 WORKMANSHIP

A. Applicators installing the new roof, flashing and related work shall be factory trained and approved by the membrane manufacturer.

B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the building owner's satisfaction.

C. There shall be a supervisor on the job site at all times while work is in progress.

1.12 QUALITY ASSURANCE

A. The EPDM membrane roofing system must achieve a UL Class A rating and be installed to Factory Mutual standards.

B. The specified roofing assembly must have been successfully tested by a qualified testing agency (ANSI/FM 44747) to resist the design uplift pressures calculated according to state adopted:

American Society of Civil Engineers (ASCE 7)
International Building Code (IBC)
Minimum accepted assembly uplift rating is 90-lbs/sqft

C. The manufacturer must have a minimum of 20 (twenty) years experience in the manufacturing of vulcanized thermal set sheeting and must be the primary manufacturer of the EPDM membrane, membrane adhesives and membrane accessories. Secondary “marketers” of roofing systems will not be acceptable. The manufacturer must have warranty reserve fund. Evidence of this requirement shall be submitted in accordance with section 1.03.

D. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least 10 (ten) years successful experience installing single-ply EPDM roofing systems and having installed at least 10 (ten) roofing applications of similar or equal scope. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.

E. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.

Provide weekly inspections and provide written documentation to architect by a full time non-sales technical representative of membrane manufacturer or by a Registered Roof Observer.

F. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the specifier's consideration.

G. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the building owner seventy-two (72) hours prior to the manufacturer's final inspection.

1.13 JOB CONDITIONS, CAUTIONS AND WARNINGS

A. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.

B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

C. When loading materials onto the roof, the Manufacturer Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

F. Provide protection, such as 3/4-inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

H. New roofing shall be complete and weathertight at the end of the workday.

I. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.14 WARRANTY

A. Provide manufacturer's 20 year Total System Warranty covering both labor and material with no dollar limitation. The maximum wind speed coverage shall be peak gusts of 90 mph measured at 10 meters above ground level. Certification is required with submittals indicating the manufacturer has reviewed and agreed to such wind coverage. All products including substrate boards, vapor retarders, insulation, fasteners, fastening plates and edgings must be manufactured and/or supplied by the roofing system manufacturer and covered by the warranty.

B. Pro- rated Warranties shall not be accepted.

C. Evidence of the manufacturer's warranty reserve shall be included as part of the project submittals for the specifier's approval.

D. Include puncture resistance in warranty.

E. Installer/Roofing Contractor Warranty: Submit roofing installer’s written warranty, signed by the installer, covering work of this section. The warranty shall guarantee material and workmanship for watertightness, weathertightness, and against all leaks for a period of two (2) years. During the two-year period, the contractor shall respond and fix all reported leaks within 24 hours from time of notification, and fix all leaks without any cost to the Owner.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1' (Roof Area Field): 36 psf.
2. Zone 1 (Roof Area Field): 64 psf.
3. Zone 2 (Roof Area Perimeter): 84 psf.
4. Zone 3 (Roof Area Corners): 115 psf.

D. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class B; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D4637/D4637M, Type II, scrim or fabric internally reinforced, EPDM sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle SynTec Incorporated. (Basis of Design)
b. Firestone Building Products.
c. Mule-Hide Products Co., Inc.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Black.

2.3 AUXILIARY ROOFING MATERIALS

A. General: All products including substrate boards, vapor retarders, insulation, fasteners, fastening plates and edgings must be manufactured and/or supplied by the roofing system manufacturer and covered by the warranty.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 60 to 75 mils thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

F. Bonding Adhesive: Manufacturer's standard.

G. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.

H. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

I. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

J. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 SUBSTRATE BOARDS

A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlisle SynTec Incorporated. (Basis of Design)
   b. Firestone Building Products.
   c. Mule-Hide Products Co., Inc.

2. Thickness:
   a. 1/2 inch underlayment board

3. Surface Finish: Factory primed.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

2.5 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, 20 PSI felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlisle SynTec Incorporated. (Basis of Design)
   b. Firestone Building Products.
   c. Mule-Hide Products Co., Inc.

2. Size: 48 by 96 inches.
3. Thickness:

   a. Base Layer: 1-1/2 inch.
   b. Upper Layers: (2) layers of 2 inch

B. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

   a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
   b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 VAPOR RETARDER / TEMPORARY ROOF

A. Vapor retarder is a minimum 40 mil composite sheet consisting of a self-adhering rubberized asphalt membrane. The underlayment board shall be primed with Low VOC adhesive, Carlisle Cav-Grip (Basis of Design) in accordance with manufacturer's specifications. Vapor retarder must have a perm rating of 0.05 or less as per ASTM E90. Vapor retarder must be rated by the manufacturer as a temporary roof with an allowable exposure to the elements for 90 days.

2.7 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
   1. HP Fasteners: a threaded, black epoxy electro-deposition coated fastener used with steel and wood roof decks.

2. InsulFast Fasteners: A threaded #12 fastener with #3 phillips head used for insulation and underlayment board attachment into steel or wood decks.
3. Hammer Screw: an expansion anchor with stainless steel drive pin used for fastening the Sure-Seal Termination Bar or Seam Fastening Plates to concrete, brick, or block walls.
4. HP 14-10 Fasteners: A #14 threaded fastener used for minimum 3,000 psi concrete decks.
5. Insulation Fastening Plates: a nominal 3 inch diameter plastic or metal plate used for insulation attachment in conjunction with HP Fasteners or Concrete Spikes.
6. Seam Fastening Plates: a 2 inch diameter steel, FM approved metal plate used in conjunction with RUSS or with EPDM membrane for membrane securement.
7. RUSS (Reinforced Universal Securement Strip): a 6 or 9 inch wide, 100 foot long strip of reinforced EPDM membrane.
   a. The 6 inch wide RUSS shall be utilized horizontally or vertically (in conjunction with Seam Fastening Plates) below the EPDM membrane for additional membrane securement.
   b. The 9 inch wide RUSS shall be utilized in conjunction with metal edgings to allow the continuation of the EPDM deck membrane as flashing at all corner areas (20 foot in each direction) in accordance with details.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
4. All primers and adhesives must comply with NYS VOC OTC regulations.

C. Cover Board: ASTM C1278/C1278M, fiber-reinforced gypsum board. Boards shall be an impact resistant, non-structural, fiber reinforced gypsum panel manufactured with a 95% certified recycle content, with moisture and mold resistance throughout the panel core and surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlisle SynTec Incorporated. (Basis of Design)
   b. Firestone Building Products.
   c. USG

2. Thickness: 1/2 inch.

D. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

2.8 METAL EDGING AND MEMBRANE TERMINATIONS

A. All metal edging shall be factory mutual approved. All metal edge boxes and wood blocking shall be installed as per FM 1-49.

B. METAL EDGE QUALITY ASSURANCE: High performance gravel stop shall be CERTIFIED by the gravel stop manufacturer to comply with ANSI/SPRI Standard ES-1-98. Roof edge/gravelstop shall meet performance design criteria according to the following test standards:

1. ANSI/SPRI ES-1-98Test Method RE-1 Test for Roof Edge Termination of Single-ply Roofing Membrane: The fascia system shall be tested to secure the membrane to minimum 100 lbs/ft in accord with the ANSI/SPRI ES-1-98 Test Method RE-1. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

2. ANSI/SPRI ES-1-98Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with the ANSI/SPRI ES-1-98 Test Method RE-2. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

3. FMRC Loss Prevention Data Sheet 1-49 “Perimeter Flashing.” The fascia product shall be listed in current Factory Mutual Research Corporation Approval Guide.

C. Fascia / Gravel Stop:
1. SecureEdge 3000XT (Carlisle: Basis of Design): A snap-on edge system consisting of an extruded aluminum base anchor and .050” aluminum fascia. Installed as per manufacturer detail (U-1E) similar with 6 inch seam tape. Color chosen by owner from standard color range.

D. Termination Bar:
1. A 1 inch wide and .098 inch thick extruded aluminum bar pre-punched 6 inches on center; incorporates a sealant ledge to support Lap Sealant and provide increased stability for membrane terminations. (Basis of Design - The required metal edge detail for this project shall be Carlisle Detail U-9A.)

2.9 WALKWAYS

A. Walkways are to be specified at all traffic concentration points and if regular maintenance is necessary to service rooftop equipment.

B. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured, pressure-sensitive walkway pads with factory applied tape adhesive and approximately 3/16 inch thick. Product submitted shall be acceptable to roofing system manufacturer.

1. Size: Approximately 30 by 30 inches
2. Color: match color of roof membrane.
3. Weight: 18 lb/sq. ft..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified elsewhere in specification.

3.3 INSTALLATION OF SUBSTRATE BOARD

A. Metal Deck Areas: Mechanically attach the 1/2” Carlisle Securock to meet the required uplift ratings but no less than one fastener per 2 square feet in the field and perimeter of the roof system and 1per 1 square foot in the corners. Mechanically fasten the underlayment board thru the top flutes only careful not to penetrate the low flutes. Contractor shall coordinate with other trades to ensure conduits and ductwork is at least 6 inches below the underside of metal deck.

B. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

3.4 INSTALLATION OF VAPOR BARRIER APPLICATION

A. Surfaces to receive Air and Vapor Barrier, basis of design Carlisle 725 TR, must be clean and dry. Blow off and broom off any loose debris. Prime all surfaces to receive the vapor retarder

with a NYS VOC OTC compliant primer, Low VOC CCW-702 Primer or Cav-Grip (Basis of Design). Apply the primer with a long nap roller at the applicable coverage rate noted above. At 75° F allow primer to dry 1 hour minimum. If the Cav-Grip is being used; spray apply in a thin even coat at a rate of 2,000 - 2,500 square feet per cylinder. Apply Cav-Grip in a thin, even coat to substrate. Avoid high thickness buildup. Keep spray gun perpendicular to surface during spray. Set time for the Cav-Grip should be approximately 5 minutes. Primers have a satisfactory cure when it will not transfer when touched. Prime only areas to be waterproofed the same day. Reprime if area becomes dirty. Apply Air and Vapor Barrier from low to high point, in a shingle fashion, so that laps will shed water. Overlap all edges at lease 2-1/2 inches. End laps shall be staggered. Place membrane carefully so as to avoid wrinkles and fishmouths. Immediately after installation, roll with a 100-150 pound weighted steel roller. There shall be no gaps in the vapor barrier application.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

1. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows.

a. Secure all insulation, staggering all joints, to the Vapor Retarder with the Flexible FAST Adhesive in accordance with the manufacturer's specifications and application procedures. Insulation adhesive must be a 2 part low rise foam adhesive with 100% adhesion. Apply the overlayment board with the same adhesive application requirements. (Ribbon method adhesives are acceptable. Bead spacing shall be 4 inches on center in the field, perimeters and corners.) Strict care must be taken to make sure that all insulation and cover boards lay flat and are in an even plane with adjacent boards. (Caution: Do not apply urethane adhesives to unweathered asphalt, new or residual.)

1) Allow Flexible FAST adhesive to rise approximately 1/8” and develop a string/body (approximately 1.5-2 min). String time will vary based on environmental conditions like temperature and humidity. String time is measured by touching the adhesive with a splice wipe and looking for development of “strings” of adhesive as you pull the splice wipe out of the adhesive. Do not allow the adhesive to over-cure prior to setting the roof boards.

2) When installing full spray or beads do not allow the foam installation pattern to exceed the width of the board being installed. Exceeding the width of the roof board will cause an uneven application of the adjacent board due to the rising foam. (See Carlisle Detail A-27G for 4” bead spacing.)

3) Walk the boards into the adhesive and roll using a 30” wide, 150 pound weighted steel roller to ensure full embedment. Optimal set up time should be approximately 5 to 7 minutes. Caution: walking on the boards immediately after placement in adhesive can cause slippage/movement until the adhesive has started to set. When walking the boards in, relief cuts may

be necessary to allow a lifted board to lay flat, constant weight may be required to achieve adequate adhesion.

b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch with insulation.
f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
a. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch with insulation.
f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows

a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
b. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place with a 150 pound weighted steel roller to ensure full embedment.

3.7 INSTALLATION OF ADHERED ROOFING

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll membrane roof membrane a ½ hour before bonding and allow to relax before installing. Fold the sheet back onto itself so half the underside of the membrane is exposed.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply the Bonding Adhesive in accordance with the manufacturer's published instructions, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
2. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.
3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

J. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 MEMBRANE SPLICING:

A. 6 inch pre-applied Splice Tape is required for this project: All details and splice procedures as per 25 Year Warranty specifications, no exceptions or deviations.
   1. Overlap adjacent sheets and mark a line 1/2 inch out from the top sheet.
   2. Fold the top sheet back and clean the dry splice area (minimum 6 inches wide) of membrane with Sure-Seal Primer as required by the membrane manufacturer.
   3. Apply Primer to the EPDM sheet. Press Membrane and tape onto the sheet using hand pressure.
   4. Remove the release film and press the top sheet onto the tape using hand pressure.
   5. Roll the seam toward the splice edge with a 2 inch wide steel roller.
   6. Splice intersections are to be overlaid with a layer of 6” X 6” and a 12” X 12” Pressure-Sensitive flashing.
   7. All field and flashing splices are to be sealed with Lap Sealant and installed per manufacturer detail (U-2A.1, option 2).

3.9 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.10 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.

   1. Install flexible walkways at the following locations:

      a. Perimeter of each rooftop unit.
      b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.

2. Provide 6-inchclearance between adjoining pads.
3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.11 DAILY SEAL

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Use manufacturer Pourable Sealer or other acceptable membrane seal in accordance with the manufacturer's requirements.

3.12 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 RELATED SECTIONS

A. Section 072500 – Weather barrier for connections to self-adhering flashing.
B. Section 075323 – Ethylene-Propylene-Diene-Monomer (EPDM) Roofing for flashing associated with installation of manufacturer standard edge metal.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Elastomeric sealant.
2. Butyl sealant.
3. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of roof-penetration flashing.
8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
9. Include details of special conditions.

10. Include details of connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

B. Evaluation Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.

C. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Special warranty.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. FM Approvals Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-60. Identify materials with name of fabricator and design approved by FM Approvals.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Embossed and with manufacturer's standard clear acrylic coating on both sides.
2. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

H. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Heckmann Building Products, Inc.
   b. Hohmann & Barnard, Inc.
   c. OMG, Inc.

2. Material: Galvanized steel, 0.022 inch thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Accessories:

   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

5. Finish: With manufacturer's standard color coating.

2.4 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 24 gauge.

B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Aluminum: 24 gauge.

C. Roof-Penetration Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.019 inch thick.

2.6 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
1. Aluminum: 24 gauge.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    d. Adjust setting proportionately for installation at higher ambient temperatures.

        1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.2 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.3 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

C. Reglets: Installation of reglets is specified in Section 042200 "Concrete Unit Masonry."

3.4 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

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SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof-edge specialties.
2. Roof-edge drainage systems.
3. Reglets and counterflashings.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for downspout guards and downspout boots.
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
4. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include copingsroof-edge drainage systems made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 075323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing.”

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075323 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing.”

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings, roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-75. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ROOF-EDGE SPECIALTIES

A. All metal edging shall be factory mutual approved. All metal edge boxes and wood blocking shall be installed as per FM 1-49.

B. Metal Edge Perimeter Blocking System: Two-piece Galvanized steel assembly with pre-punched fastener holes tested to comply with ANSI/SPRI/FM4435/ES-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. OMG, Inc.: EdgeBox-RI Perimeter Blocking System (Basis of Design)
b. Or Architect Approved Equal.

2. Height and Width: As indicated on drawings.
3. Length: Top and Bottom sections formed in 10’-0” lengths.
4. Material: 20 Ga galvanized box.
5. Insulation: Polyisocyanurate rigid insulation in core of perimeter blocking system.
6. Fasteners: #14 HD fastener spaced as per manufacturers installation instructions, minimum 1” penetration required.
7. Spines: 16 Ga. Spine required for face heights greater than 6”. Spines 1” wide at 24” O.C.
8. Blocking system accessories:

a. Closure Strip (Perpendicular to deck flutes)
b. Finish Strip (Parallel to deck flutes)
c. End Cap Insert: Installed in accordance with manufacturers installation instructions.

C. METAL EDGE QUALITY ASSURANCE: High performance Fascia / gravel stop shall be CERTIFIED by the manufacturer to comply with ANSI/SPRI Standard ES-1-98. Roof edge/gravel stop shall meet performance design criteria according to the following test standards:

1. ANSI/SPRI ES-1-98Test Method RE-1 Test for Roof Edge Termination of Single-ply Roofing Membrane: The fascia system shall be tested to secure the membrane to minimum 100 lbs/ft in accord with the ANSI/SPRI ES-1-98 Test Method RE-1. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

2. ANSI/SPRI ES-1-98Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with the ANSI/SPRI ES-1-98 Test Method RE-2. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

3. FMRC Loss Prevention Data Sheet 1-49 “Perimeter Flashing.” The fascia product shall be listed in current Factory Mutual Research Corporation Approval Guide.

D. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Syntec Systems: Secure Edge 3000XT (Basis of Design)
b. Firestone Building Products.
c. OMG, Inc.

2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick, installed as per manufacturer detail (U-1E) similar with 6 inch seam tape.

a. Surface: Smooth, flat finish.
b. Finish: Two-coat fluoropolymer.
c. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Receiver: Manufacturer's standard material and thickness based on exposed face without brakes.
6. Fascia Accessories: Fascia extenders with continuous hold-down cleats, Soffit trim, and Spillout scuppers where indicated in construction documents.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with roofing manufacturer’s requirements, provide products by one of the following:

1. Architectural Products Company.
2. ATAS International, Inc.
3. OMG, Inc.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Aluminum Sheet: 0.040 inch thick.
2. Gutter Profile: Style I according to SMACNA's "Architectural Sheet Metal Manual."
3. Gutter Supports: Gutter brackets with finish matching the gutters.

C. Downspouts: Plain rectangular complete with elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Formed Aluminum: 0.040 inch thick.

D. Aluminum Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.4 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fry Reglet Corporation.
2. Heckmann Building Products, Inc.
3. OMG, Inc.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
2. Corners: Factory mitered and mechanically clinched and sealed watertight.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

D. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Zinc-Coated Steel Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.3 ROOF-EDGE SPECIALITIES INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.5 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Section 033000 "Cast-in-Place Concrete" and Section 042200 "Veneer Masonry" for installation of reglets.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Preformed flashing sleeves.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 055213 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, [**integral metal cant,**] [**stepped integral metal cant raised the thickness of roof insulation,**] and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Basis of design product: Thermally Broken Roof Hatch NB50TB by Bilco, an Amesbury Truth company. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Babcock-Davis.
   b. CRS Supply.
   c. The Williams Bros. Company.

B. Type and Size: Single-leaf lid, 30 by 54 inches (750 by 1370 mm).

C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Two-coat fluoropolymer.
3. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Insulation: 2-inch- (50-mm-) thick, polyisocyanurate board.

   a. R-Value: 20 minimum according to ASTM C1363.

2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than 84 inches (2130 mm).
2. Provide remote-control operation.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches (1060 mm) above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized-steel tube, 1-5/8 inches (41 mm) in diameter.
3. Flat Bar: Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: Manufacturer's standard.

    a. Color: As selected by Architect from manufacturer's full range.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches (1060 mm) above finished roof deck.
3. Material: Steel tube.
4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.

    a. Color: Black.

2.3 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted metal collar.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
3. Diameter: As indicated on Drawings.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.
3. Height: 7 inches (175 mm).
4. Diameter: As indicated on Drawings.
5. Finish: Manufacturer's standard.

2.4 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

   a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.

4. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

C. Steel Tube: ASTM A500/A500M, round tube.

D. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

E. Steel Pipe: ASTM A53/A53M, galvanized.

2.5 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Underlayment:

1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D4397.
3. Slip Sheet: Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.
4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

D. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rail-type, flat-mounted snow guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

1. Include details of rail-type snow guards.

C. Samples:

1. Rail-Type Snow Guards: Bracket, 12-inch- (300-mm-) long rail, and installation hardware.

a. For units with factory-applied finishes, submit specified color.

D. Delegated-Design Submittal: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include calculation of number and location of snow guards.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the jurisdiction in which the Project is located.

B. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

1.5 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit adhesive-mounted snow guards to be installed, and adhesive cured, according to adhesive manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, as applicable for attachment method, based on the following:

1. Roof snow load.
2. Snow drifting
3. Roof slope.
4. Roof type.
5. Roof dimensions.
6. Roofing substrate type and thickness.
7. Snow guard type.
8. Snow guard fastening method and strength.
9. Snow guard spacing.
10. Coefficient of Friction Between Snow and Roof Surface: 0.
11. Factor of Safety: 2.

B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

A. Rail-Type, Flat-Mounted Snow Guards:

1. Manufacturers: Basis of design product: PP315 Two-or-Three Pipe Snow Guard for Narrow Spaces by Alpine Snowguards. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. VersaGard by S-5!.
b. Rocky Mountain Snow Guards, Inc..

2. Description: Units fabricated from metal baseplate anchored to fixedbracket and equipped with two or three bar(s), rail(s), or pipe(s).
3. Brackets and Baseplate: ASTM B209 (ASTM B209M) aluminum; clear anodized.
4. Bars: ASTM B221 (ASTM B221M) aluminum; clear anodized.

a. Profile: Round.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare substrates for bonding snow guards.

B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.

1. Space rows as indicated on Shop Drawings, as recommended by manufacturer.

B. Attachment for Exposed Fastened Metal Roofing:

1. Do not use fasteners that will void metal roofing finish warranty.

2. Rail-Type, Flat-Mounted Snow Guards:

a. Install brackets in straight rows.
b. Mechanically fasten to metal roofing, using sealant and mechanical fasteners identical to those used to secure metal roofing to substrate.
c. Install cross members to brackets.

END OF SECTION 077253

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Polysulfide joint sealants.
6. Joint sealant accessories

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction laboratory test reports.

C. Preconstruction field-adhesion-test reports.

D. Field-adhesion-test reports.

E. Sample warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry and EIFS substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. Dow Corning Corporation.

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Sika Corporation; Joint Sealants.
c. The Dow Chemical Company.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Bostik, Inc.
c. Sika Corporation; Joint Sealants.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Pecora Corporation.
c. Sherwin-Williams Company (The).

C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. LymTal International Inc.
    b. Or Architect Approved Equal.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Pecora Corporation.
    b. The Dow Chemical Company.
    c. Tremco Incorporated.

C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Pecora Corporation.
    b. Sherwin-Williams Company (The).
    c. Tremco Incorporated.

2.5 POLYSULFIDE JOINT SEALANTS

A. Polysulfide, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. W.R. Meadows, Inc.
    b. Or Architect Approved Equal.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bostik, Inc.
    b. Pecora Corporation.
    c. Or Architect Approved Equal.

2.7 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, Type O (open-cell material) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adfast.
    b. Alcot Plastics Ltd.
    c. BASF Corporation.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

   a. Isolation and contraction joints in cast-in-place concrete slabs.
   b. Tile control and expansion joints.
   c. Joints between different materials listed above.
   d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Construction joints in cast-in-place concrete.
   b. Joints between plant-precast architectural concrete units.
   c. Control and expansion joints in unit masonry.
   d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Tile control and expansion joints.
   c. Vertical joints on exposed surfaces of unit masonry concrete or walls and partitions.

d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Samples: For each kind and color of acoustical joint sealant required.

C. Acoustical-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation ; SHEETROCK Acoustical Sealant. or a comparable product by one of the following:

   a. Everkem Diversified Products, Inc.
   b. GE Construction Sealants; Momentive Performance Materials Inc.
   c. Hilti, Inc.
   d. Specified Technologies, Inc.
   e. Tremco Incorporated.

2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

B. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

C. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

END OF SECTION 079219

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SECTION 079513.19 - PARKING DECK EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Parking deck expansion joint covers.

B. Related Requirements:

1. Section 079100 "Preformed Joint Seals" for preformed foam and extruded-silicone joint seals.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches (150 mm) long in size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

E. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches (150 mm) long in size.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Expansion Joint Design Criteria:

1. Type of Movement: Thermal and Wind sway.

a. Nominal Joint Width: As indicated on Drawings.
b. Minimum Joint Width: As indicated on Drawings.
c. Maximum Joint Width: As indicated on Drawings.

2.3 PARKING DECK EXPANSION JOINT COVERS

A. Metal-Plate Parking Deck Joint Cover: Assembly consisting of metal cover plate in continuous contact with metal frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:

a. C-S Group.
b. EMSEAL.
c. Watson Bowman.

2. Application: Slab to slab.
3. Installation: No bump.
4. Load Capacity:

a. Uniform Load: 200 lb/sq. ft. (976 kg/sq. m).
b. Concentrated Load: 2000 lb (907 kg).
c. Maximum Deflection: 0.125 inch (3.2 mm).

5. Cover-Plate Design: Abrasive covered.
6. Exposed Metal:

a. Aluminum: Manufacturer's standard.

2.4 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), Alloy 6063-T5 for extrusions; ASTM B209 (ASTM B209M), Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.

C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Repair or grout block out as required for continuous frame support, using nonmetallic, shrinkage-resistant grout.
2. Install frames in continuous contact with adjacent surfaces.

    a. Shimming is not permitted.

3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.

E. Precompressed Foam Parking Deck Expansion Joint Seals:

1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

F. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

G. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals, and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 079513.19

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 081416 "Flush Wood Doors" for flush wood doors.
2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Curries Company; ASSA ABLOY.
2. Concept Frames, Inc.
3. DKS Steel Door & Frame Systems, Inc.
4. Steelcraft, Allegion Brand.
5. Or Architect approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard.
f. Fire-Rated Core: Manufacturer's standard core for fire-rated and temperature-rise-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyisocyanurate.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Face welded.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.7 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with plastic-laminate-faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.

4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.

5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.
10. Apply AWI Quality Certification Program label to Shop Drawings. C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.
3. Polymer edging, in manufacturer's standard colors.
4. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
5. Louver blade and frame sections, 6 inches long, for each material and finish specified.
6. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
2. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate. B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Minimum 20-years experience in manufacturing flush wood doors.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors indicated to be blueprint matched with paneling from single manufacturer.

2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors and frames comply with requirements of grades specified.
   a. Contractor shall register the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Masonite Architectural. (Basis of Design, see A604)
   b. Eggers Industries.
   c. Or Architect approved equal.

2. Performance Grade:

   a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated.
   b. ANSI/WDMA I.S. 1A Extra Heavy Duty: public toilets, janitor's closets, assembly spaces and exits.

3. Architectural Woodwork Standards Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.

   a. Species: Walnut (Basis of Design).
   b. Cut: Plain sliced (flat sliced).
   c. Match between Veneer Leaves: Book match.
   d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
   e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

5. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.

   a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-1 particleboard.

1) Blocking: Provide wood blocking in particleboard-core doors as follows:

a) 5-inch top-rail blocking, in doors indicated to have closers.
b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c) 5-inch midrail blocking, in doors indicated to have exit devices.

2) Provide doors with glued-wood-stave cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."

7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; factory primed for paint with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

C. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASSA ABLOY.
b. L & L Louvers, Inc.
c. Or Architect approved equal.

2. Blade Type: Vision-proof, inverted V.
3. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AAM12C22A31.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors. B. Factory

machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.

2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors that are indicated on Drawings to receive transparent finish.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. Finish: Architectural Woodwork Standards System-5, Varnish, Conversion.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect. B. Inspections:

1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of access door and frame and for each finish specified.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Exterior Access Doors with Lock:

1. Manufacturers: Basis of design product: Access Panel XTA by Activar Construction Products Group. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. The Williams Bros. Corporation of America.
   b. Best Access Doors.

2. Description: Face of insulated door flush with frame, with 1-inch exposed flange, concealed hinge, and lock.
3. Locations: Exterior wall of AV room.
4. Thickness: 2-inch
5. R-value: R-13 minimum.
6. Door Material: Nominal 0.040-inch aluminum panel with continuous stainless steel hinge or 16 gauge galvannealed steel, factory finished.
7. Frame Material: Nominal 0.060-inch, 16 gauge galvannealed steel, factory finished.
8. Finish: Black powder coat paint.

9. Gaskets: Adhesive-backed EPDM foamed silicone rubber seal on door and frame.
10. Latch and Lock: Lockable compression paddle latch with key.

B. Flush Access Doors with Exposed Flanges (interior):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Babcock-Davis
   b. JL Industries, Inc., a division of the Activar Construction Products Group
   c. Nystrom, Inc.

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Ceiling.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
5. Frame Material: Same material, thickness, and finish as door.
6. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.4 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

2. Factory Finished: Apply manufacturer's standard powder coated paint on primed metal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

END OF SECTION 083113

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SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Screen doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, and other accessories.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Guides.
3. Brackets.
4. Hood.
5. Locking device(s).
6. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: As indicated on Drawings.
2. Testing: According to ASTM E330/E330M.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.3 DOOR ASSEMBLY

A. Screen Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Basis of design product: Rolling Service Door 610 with C-275 Slat Profile by Overhead Door Company. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. C.H.I. Overhead Doors
b. Cookson.
c. Cornell.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Door Curtain Material: Galvanized steel.

D. Door Curtain Slats: Curved profile slats of 3-1/4-inch (83-mm) center-to-center height.

1. Fenestrated Slats: Approximately 3- by 5/8-inch (76- by 16-mm) openings spaced approximately 1-1/2 inches (38 mm) apart and beginning 12 inches (305 mm) from jamb guides.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

E. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel and finished to match door.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

G. Hood: Galvanized steel.

1. Shape: Square.
2. Mounting: Between jambs.

H. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.

I. Manual Door Operator: Manufacturer's standard crank operator.

1. Provide operator with manufacturer's standard removable operating arm.

J. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized-steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.
2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.6 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
   1. .

B. Chain Lock Keeper: Suitable for padlock.

2.7 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

   1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic-closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 30-lbf (133-N) force to turn crank. Fabricate gearbox to be oiltight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames.
2.
3. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
4. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.

1.2 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

C. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
e. Fastenings and other installation information.
f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
g. Mounting locations for door hardware.
h. List of related door devices specified in other Sections for each door and frame.

E. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of doors and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

   a. Exit Devices: Two years from date of Substantial Completion.
   b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

B. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:

a. Bommer Industries, Inc.
b. Hager Companies.
c. Stanley Commercial Hardware.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
2. Deadbolts: Minimum 1.25-inch (32-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

D. Lock Trim:

1. Description: 40H.
2. Levers: Wrought.

   a. 14.

3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: BHMA A156.13; Security Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Best.
   b. Allegion.
   c. Schlage.

2.

2.5 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. IVES.
   b. Hager.
   c. Trimco.

2.6 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Von Duprin.
b. Adams Rite.
c. Dorma.

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Interchangeable.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Master Key System: Change keys and a master key operate cylinders.

a. Provide three cylinder change keys and five master keys.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2.9 ACCESSORIES FOR PAIRS OF DOORS

A. Astragals: BHMA A156.22.

2.10 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. LCN.
   b. Hager.
   c. CRL.

2.11 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ASSA ABLOY.
   b. Rockwood.
   c. Ives.

2.12 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ASSA ABLOY.
   b. Ives.
   c. Glynn Johnson.

2.13 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:

   a. Hager Companies.
   b. Pemko; an ASSA ABLOY Group company.
   c. Sealeze.

B. Maximum Air Leakage: When tested in accordance with ASTM E283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. (0.000774 cu. m/s per m) of door opening.

2.14 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:

   a. Hager Companies.
   b. Pemko; an ASSA ABLOY Group company.
   c. Sealeze.

2.15 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:

   a. Rockwood, an ASSA ABLOY Group company.
   b. Trimco.
   c. Ives.

2.16 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
2. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.17 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.9 DOOR HARDWARE SCHEDULE

A. Per Drawings.

END OF SECTION 087100

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SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of mirror and mirror mastic.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. D & W Incorporated.
2. Guardian Glass.
3. Lenoir Mirror Company.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.

B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, low-iron (low-iron) float glass with a minimum 91 percent visible light transmission.

1. Nominal Thickness: 6.0 mm.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. C.R. Laurence Co, Inc.
b. Liquid Nails Adhesive.
c. Pecora Corporation.

2.4 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Install mastic as follows:

a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 088300

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation reports for firestop tracks, post-installed anchors and power-actuated fasteners.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. ClarkDietrich.
   b. Or Architect approved equal.

2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
3. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.

   a. Manufacturers: Subject to compliance with requirements, provide products by the following:

      1) ClarkDietrich.
      2) Or Architect approved equal.

2. Single Long-Leg Track System: ASTM C645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

   a. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1) ClarkDietrich.
      2) Or Architect approved equal.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. ClarkDietrich.

b. Or Architect approved equal.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ClarkDietrich.
b. Or Architect approved equal.

2. Minimum Base-Steel Thickness: 0.0329 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ClarkDietrich.
b. Or Architect approved equal.

2. Depth: As indicated on Drawings.
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ClarkDietrich.
b. Or Architect approved equal.

2. Minimum Base-Steel Thickness: 0.0329 inch.
3. Depth: As indicated on Drawings.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. ClarkDietrich.
b. Or Architect approved equal.
2. Depth: As indicated on Drawings.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

D. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

a. Minimum Base-Steel Thickness: 0.0329 inch.
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.

a. Minimum Base-Steel Thickness: 0.0329 inch.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. National Gypsum Company.
   b. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

B. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. National Gypsum Company.
   b. USG Corporation.
2. Core: 5/8 inch, Type X.
3. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. National Gypsum Company.
   b. USG Corporation.

2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. National Gypsum Company.
   b. USG Corporation.

2. Core: As indicated.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Georgia-Pacific Gypsum LLC.
    b. USG Corporation.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

2. Fill Coat: For second coat, use setting-type, sandable topping compound.
3. Finish Coat: For third coat, use setting-type, sandable topping compound.
4. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from slag wool or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Pecora Corporation.
    b. USG Corporation.

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

F. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

G. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

H. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

I. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Metal edge strips.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Tile Type PY-1: Unglazed pressed floor tile.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Daltile
b. Crossville (Basis of design)
c. Or Architect Approved Equal.

2. Composition: Porcelain.
3. Face Size: 12 inch x 24 inch
4. Face Size Variation: Non-rectified.
5. Thickness: 5/16 inch.
6. Face: Plain with square edges, Unpolished.
7. Dynamic Coefficient of Friction: Not less than 0.50.
8. Tile Color and Pattern: Retro Active 2.0 collection; Color to be Selected from Manufacturer's standard range of colors.
9. Grout Color: Laticrete, Color to be selected with tile, 3/8-inch joint.

A. Tile Type PY-2: Unglazed pressed floor tile.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Daltile
b. Crossville (Basis of design)
c. Or Architect Approved Equal.

2. Composition: Porcelain.
3. Face Size: 24 inch x 48 inch mosaic
4. Face Size Variation: Non-rectified.
5. Thickness: 5/16 inch.
6. Face: Plain with square edges, Unpolished.
7. Dynamic Coefficient of Friction: Not less than 0.50.
8. Tile Color and Pattern: Retro Active 2.0 collection; Color to be Selected from Manufacturer's standard range of colors.
9. Grout Color: Laticrete, Color to be selected with tile, 3/8-inch joint.

B. Ceramic Tile Type WT: Glazed.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Daltile (Basis of design)
b. Crossville
c. Or Architect Approved Equal.

2. Face Size: 3 by 6 inches (76 by 152 mm).
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Face: Polished with square edges.
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Tile Color, Glaze, and Pattern: Chalkboard 0180 (2), Semi-Gloss, Subway.
8. Grout Color: Polar White 01 by Ardex, 1/16 inch.

9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Cove Base: Surface cove base, module size same as adjoining flat tile.
    b. External Corners: Surface bullnose, module size same as adjoining flat tile.
    c. Internal Corners: Field-butted square corners.

C. Tile Type WT-2: Unglazed porcelain tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Daltile
    b. Crossville, Inc. (Basis of Design)
    c. Or Architect Approved Equal.

2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12 inch x 24 inch
4. Face Size Variation: Non-Rectified.
5. Thickness: 5/16 inch.
6. Face: Plain with square edges, Unpolished.
7. Dynamic Coefficient of Friction: Not less than 0.42.
8. Tile Color, Glaze, and Pattern: Retro Active 2.0 collection; Color to be Selected from Manufacturer’s standard range of colors.
9. Grout Color: Laticrete, Color to be selected with tile, 3/8-inch joint.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. External Corners: Surface bullnose, module size same as adjoining flat tile.
    b. Cove base: 6x12 Cove base with flat top, with 1x6 Inside and Outside Corners.

2.3 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Latex-Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cement-based mix and latex additive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ARDEX Americas.
    b. MAPEI Corporation.

2.4 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Latex-Portland Cement Crack-Resistant Mortar: Flexible mortar consisting of cement-based mix and latex additive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX Americas.
b. MAPEI Corporation.

2.5 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. LATICRETE SUPERCAP, LLC.
b. MAPEI Corporation.

2. For wall applications, provide nonsagging mortar.

2.6 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX Americas.
b. LATICRETE SUPERCAP, LLC.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring

applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Schluter Systems L.P.

C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Bonsal American, an Oldcastle company.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

   a. Exterior tile floors.
   b. Tile floors in wet areas.
   c. Tile swimming pool decks.
   d. Tile floors in laundries.
   e. Tile floors consisting of tiles 8 by 8 inches or larger.
   f. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Pressed Floor Tile: 1/8 inch.
2. Porcelain Tile: 3/32 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

K. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

M. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

N. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation PY-1, PY-2: TCNA F111 and ANSI A108.1C; cement mortar bed (thickset) with cleavage membrane.

   a. Tile Type: Porcelain / Porcelain Mosaic.
   b. Bond Coat for Cured-Bed Method: Standard dry-set mortar.
   c. Grout: Sand-portland cement grout.

B. Interior Wall Installations, Masonry or Concrete:

1. Ceramic Tile Installation WT-1, WT-2: TCNA W202; thinset mortar.

   a. Ceramic Tile Type: Porcelain.
   b. Thinset Mortar: Standard dry-set mortar.
   c. Grout: Sand-portland cement grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Product test reports.

C. Research reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class B according to ASTM E1264.
2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS (ACP1)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Ceiling & Wall Solutions. (Refer to A604 for Basis of Design)
2. USG Corporation.

B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E1264.

C. Classification: Type XII, Form 2, Pattern E, Fire Class A

D. Color: White.

E. Light Reflectance (LR): 0.90

F. Ceiling Attenuation Class (CAC): N/A

G. Noise Reduction Coefficient (NRC): 0.95

H. Articulation Class (AC): 190

I. Edge/Joint Detail: Tegular

J. Thickness: 1 inch

K. Modular Size: 24 inch x 24 inch

2.3 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Ceiling & Wall Solutions. (Refer to A604 for Basis of Design)
2. USG Corporation.

B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M.

C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; pre-painted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Hold-Down Clips: Manufacturer's standard hold-down.

C. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
3. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.

END OF SECTION 095113

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base.
   2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Johnsonite; a Tarkett company.
   2. Roppe Corporation, USA.

B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

   1. Group: I (solid).
   2. Style and Location:
      a. Style B, Cove: Provide in areas with resilient floor coverings

C. Thickness: 0.125 inch

D. Height: 4-inch

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As selected by Architect from Manufacturer’s standard colors.

2.2 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Roppe Corporation, USA.

B. Description: Rubber nosing for transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As indicated by manufacturer's designations.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 in length.

   a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6 in length.

   a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.

1. Apply coat(s) per manufacturers standards

C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 097720 –FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.

1. PVC trim.

B. Products Not Furnished or Installed under This Section:

1. Gypsum substrate board.
2. Resilient Base.

1.2 RELATED SECTIONS

A. Section 092900 – GYPSUM BOARD.

B. Section 092216 – NON-STRUCTURAL METAL FRAMING

C. Section 054000 – COLD-FORMED METAL FRAMING

D. Section 099123 – INTERIOR PAINTING

E. Section 096513 – RESILIENT BASE AND ACCESSORIES

1.3 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)

1. ASTM D 256 - Izod Impact Strengths (ft #/in)
2. ASTM D 570 - Water Absorption (%)
3. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
4. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
5. ASTM D 2583- Barcol Hardness
6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.

1. Submit complete with specified applied finish.
2. For selected patterns show complete pattern repeat.
3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.5 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:

1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)

a. Wall Required Rating – Class C.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.

1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with requirements, provide products by one of the following, or an approved equal:

1. Marlite.
2. Crane Composites
3. Fiber-Tech Industries.
4. Kal-lite.

B. Product:

1. Panel FRP.

2.2 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.

1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
2. Dimensions:
   a. Thickness – 0.090 “ (2.29mm) nominal
   b. Width - 4'-0” (1.22m) nominal
   c. Length –As indicated on the drawings
3. Tolerance:
   a. Length and Width: +/-1/8 “ (3.175mm)
   b. Square - Not to exceed 1/8 “ for 8 foot (2.4m) panels or 5/32 “ (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.

1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)

2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
5. Water Absorption - 0.72% per ASTM D 570.
6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Front Finish: As selected by the Architect from the Manufacturer's standard finishes.

2.3 MOLDINGS

A. Aluminum Trim: Heavy duty polyvinyl chloride (PVC) trim.

a. Inside Corner, 8' length
b. Outside Corner, 8' length
c. Division, 8' length
d. Edge, 8' length

B. Color: Factory Oven-Baked Finish to match specifiedd panel

2.4 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.

1. Match panel colors.
2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.

1. FRP Adhesive - Water- resistant, non-flammable adhesive.
2. Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant: .

1. Color Match Sealant .

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

B. Repair defects prior to installation.

1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 foot (2.4m) of panel.

1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
2. Pre-drill fastener holes 1/8” (3mm) oversize with high speed drill bit in pattern per manufacturer’s instructions.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.

1. Install panels with manufacturer's recommended gap for panel field and corner joints.

a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.

1. All moldings must provide for a minimum 1/8 “ (3mm) of panel expansion at joints and edges, to insure proper installation.
2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.3 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 097720

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SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

B. Related Requirements:

1. Section 033543 "Polished Concrete Finishing" for the exposed existing concrete slab.

2. Section 321723 "Pavement Markings" for the painted graphics on the exposed existing concrete slab.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of topcoat product.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel topcoat: Subject to compliance with requirements, provide products by one of the following:

1. Everbrite.
2. DiamondFinish, by KBS Coatings.
3. ProtectaClear.
4. POR-15.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates (Existing Exposed Steel):

1. Water-Based, Acrylic Coating System:

a. Intermediate Coat: Matching topcoat.
b. Topcoat: Exterior, water-based, Acrylic coating, low sheen.

B. Steel and Iron Substrates:

1. Alkyd System:

a. Prime Coat: Shop primer specified in Section in which substrate is specified.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Exterior alkyd enamel, semigloss.

END OF SECTION 099113

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and iron.
2. Gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sherwin-Williams Company (The)

2. Benjamin Moore
3. Or Architect Approved Equal.

B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

1. Fifteen (15) to Twenty (20) percent of surface area will be painted with deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. High Performance DTM Acrylic System:

   1) 1st coat: Sherwin Williams Pro Industrial DTM Acrylic Primer.

   2) 2nd & 3rd coats: Sherwin Williams Pro Industrial DTM Acrylic Coating.

2. Water-Based Dry-Fall System, P9
   a. 1st coats: Sherwin Williams, Pro Industrial Pro Cryl Primer
   b. 2nd and 3rd coats: Sherwin Williams, Pro Industrial WB Dryfall, Flat- 2 coats

B. Galvanized-Metal Substrates
   a. 1st coat: Matching topcoat.
   b. 2nd and 3rd coats: Sherwin Williams, Pro Industrial WB Dryfall, Flat- 2 coats

C. Gypsum Board Substrates:

1. Latex System:
   a. 1st coat: Sherwin-Williams; ProMar 200—Zero VOC primer, 4.0 mils wet, 1.0 mils dry.
   b. 2nd and 3rd coat: Sherwin-Williams; ProMar 200 – Zero VOC Eggshell Finish, 4.0 mils wet, 1.7 mils dry per coat.

2. High-Performance Architectural Latex System:

   a. 1st coat: Scuffmaster Primemaster Primer/Sealer
   b. 2nd and 3rd coat: Scuffmaster ScrubTough Performance Paint. 2 coats

END OF SECTION 099123

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SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Warm-air dryers.
4. Childcare accessories.
5. Underlavatory guards.
6. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full size, for each exposed product and for each finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser A401A:

1. Owner furnished contractor installed.
2. Mounting: Surface mounted.

B. Combination Towel (Folded) Dispenser/Waste Receptacle A401A:

1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
2. Mounting: Semirecessed.

    a. Designed for nominal 6-inch (150-mm) wall depth.

3. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
4. Minimum Waste-Receptacle Capacity: 12 gal. (45.4 L).
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
6. Liner: Reusable, vinyl waste-receptacle liner.

C. Liquid-Soap Dispenser A401A:

1. Owner furnished contractor installed.
2. Mounting: Vertically oriented, surface mounted.

D. Grab Bars A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin)on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

E. Clothing Hook A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Clothing Hook Strip A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch-thick stainless steel.
3. Mounting Flanges: Stainless steel flanges designed for exposed fasteners.
4. Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Shower Curtain A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
4. Color: As selected from manufacturer's full range.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

C. Folding Shower Seat A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Dimensions: 18” wide x 15” deep.

2.4 WARM-AIR DRYERS

A. High-Speed Warm-Air Dryer A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dyson Airblade V
    b. Architect Approved Equal

2. Description: High-speed, warm-air hand dryer for rapid hand drying.
3. Mounting: Surface mounted.
4. Operation: Electronic-sensor activated with operation time of 10 to 20 seconds.
5. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
6. Electrical Requirements: 200-240V, 15A, 1000W.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Buckaroos, Inc.
    b. Plumberex Specialty Products, Inc.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Utility Shelf with Mop and Broom Holder A401A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bobrick
    b. Architect Approved Equal

2. Description: Unit with shelf, hooks, and holders, suspended beneath shelf
3. Length: 36 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
    If the same paper towel dispensers and soap dispensers that are used in washrooms are also used in custodial areas, delete "Paper Towel (Folded) Dispenser," "Paper Towel (Roll) Dispenser," and "Liquid-Soap Dispenser" paragraphs below.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units' level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

END OF SECTION 102800

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SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Samples for Initial Selection: For each type of exposed finish required.

E. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

F. Product Schedule: For fire-protection cabinets. . Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Potter Roemer Fire Pro
      b. Architect Approved Equal

B. Cabinet Construction: One-hour fire rated.

   1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inchbackbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Stainless steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.
2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

J. Accessories:
1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Factory primed for field painting.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range.
2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated:

1. Fire-Protection Cabinets: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:
1. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Amerex
      b. Architect Approved Equal

   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type : UL-rated Class A – 5lb minimum and Class B – 5lb minimum nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
   1. Class B – 5lb to be installed in Flammable Liquid 069.
   2. Class A – 5lb to be installed in all other locations.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standardgalvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated red or black baked-enamel finish.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Amerex
      b. Architect Approved Equal

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

      a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

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SECTION 111200 - DOCK CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Miscellaneous loading dock control equipment.

B. Related Requirements:

1. Section 055213 "Pipe and Tube Railings" for pipe guardrails for fall protection not identified in this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for dock control equipment.

B. Shop Drawings: For dock control equipment.

1. Include plans, elevations, sections and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) square in size.

D. Samples for Initial Selection: For units with factory-applied finishes.

E. Samples for Verification: For each type of exposed finish 6 inches (150 mm) square in size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dock control equipment to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain dock control equipment from single source from single manufacturer.

2.2 MISCELLANEOUS DOCK CONTROL EQUIPMENT

A. Fixed Safety Barrier System at Loading Dock with Forklift: Steel post and fixed-guardrail barrier system.

1. Manufacturers: Basis of design product: Guardrite Steel by Rite Hite. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. FS Industries.
b. Steel King.
c. Rhino Rails.

2. Type: Double Level Rail.
3. Post Centerline: 120-inch.
4. Height: 42-inch-high.
5. Impact Resistance: 4 mile-per-hour impact from a 10,000-lb load.
6. Color: Safety Yellow
7. Rail: 11.8-inch high x 3-inch deep
8. Steel: 0.125-inch thickness.
9. Hardware: 0.50-inch diameter, grade 5.

B. Retractable Safety Barrier System at Loading Dock: Fixed post with barrier housing with fabric retractable barrier barrier system.

1. Manufacturers: Basis of design product: Dok-Guardian Safety Barrier by Rite Hite. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. AKON.
b. Northern Dock Systems.
c. Johnson Equipment Company.

2. Operation: Manual.
3. Posts: Fixed posts that house the retracted barrier.
4. Height: 44-inch-high.
5. Barrier material: PVC-coated fiberglass mesh.
6. Impact Resistance: 4 mile-per-hour impact from a 10,000-lb load.
7. Color: Safety Yellow

2.3 ANCHORAGES

A. Anchor Bolts: Stainless steel.

1. Stainless steel, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before parking control equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install dock control equipment as required for complete and integrated installation.

1. Rough-in electrical connections.

3.3 INSTALLATION OF ELECTRICAL

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Dock control equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust dock control equipment to function smoothly, and lubricate as recommended by manufacturer.

B. Confirm that locks engage accurately and securely without forcing or binding.

C. After completing installation of exposed, factory-finished dock control equipment, inspect exposed finishes and repair damaged finishes.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain parking control equipment.

END OF SECTION 111200

SECTION 111313 - LOADING DOCK BUMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes loading dock bumpers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of loading dock bumper.

B. Shop Drawings: For dock bumpers. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 LOADING DOCK BUMPERS

A. General: Surface-mounted bumpers; of type, size, and construction indicated; designed to absorb kinetic energy and minimize damage to loading dock structure.

1. Manufacturers: Basis of design product: Laminated Loading Dock Bumper by Rite Hite. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Hugger Dock Equipment Company.
   b. Pioneer Dock Equipment.
   c. Rotary Products Inc.

2. Source Limitations: Obtain from single source from single manufacturer.

B. Laminated-Tread Loading Dock Bumper: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles.

1. Thickness: 4-1/2 inches (114 mm).

2. Vertical Style: 8 inches (203 mm) wide by 24 inches (610 mm) high.

C. Anchorage Devices: Galvanized-steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanized according to ASTM A153/A153M or ASTM F2329/F2329M.

D. Materials: ASTM A36/A36M for steel plates, shapes, and bars. Hot-dip galvanize according to ASTM A123/A123M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Loading Dock Bumpers: Attach loading dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.3 ADJUSTING

A. After completing installation of exposed, factory-finished dock bumpers, inspect exposed finishes and repair damaged finishes.

END OF SECTION 111313

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cooking appliances.
2. Refrigeration appliances.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for kitchen sinks, dishwasher air-gap fittings, waste (garbage) disposers, and instant hot-water dispensers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of appliance.

B. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 100 miles (62 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Microwave Oven: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service.

1. Warranty Period: Five years from date of Substantial Completion.

C. Refrigerator/Freezer with Icemaker, Sealed System: Full warranty, including parts and labor, for on-site service on the product.

1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
2. Warranty Period for Other Components: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 MICROWAVE OVENS

A. Microwave Oven:

1. Manufacturers: Basis of design product: NN-SN965S Countertop Microwave by Panasonic. Subject to compliance with requirements, available manufacturers offering

products that may be incorporated into the Work include, but are not limited to the following:

a. Samsung.
b. General Electric.
c. Whirlpool.

2. Type: Conventional.
3. Dimensions:

a. Width: 24 inches (610 mm).
b. Depth: 19-1/2 inches (495 mm).
c. Height: 14 inches (356 mm).

4. Capacity: 2.20 cu. ft. (0.066 cu. m).
5. Oven Door: Door with observation window and pull handle or and pushbutton latch release.
6. Microwave Power Rating: 1250W.

7. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
8. Controls: Digital panel controls and timer display.
9. Other Features: Turntable.
10. Material: Stainless steel.

a. Color/Finish: Black.

2.4 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer: Three- or Four-door refrigerator/freezer with freezer on bottom with integral ice maker and complying with AHAM HRF-1.

1. Manufacturers: Basis of design product: 36-inch Wide Counter Depth 4 Door Refrigerator (19.4 cu.ft.) by Whirlpool. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Samsung.
b. General Electric.
c. LG.

2. Type: Freestanding.
3. Dimensions:

a. Width: 36 inches (914 mm).
b. Depth without doors: 24 inches (610 mm).
c. Height: 70 inches (1778 mm).

4. Storage Capacity:

a. Refrigeration Compartment Volume: 13.3 cu. ft. (0.37 cu. m).
b. Freezer Volume: 5.13 cu. ft. (0.15 cu. m).
c. Shelf Area: Three adjustable glass shelves.

5. General Features:

a. Door Configuration: Overlay.
b. Built-in water-filtration system.
c. Dual refrigeration systems.
d. Separate temperature controls for each compartment.

6. Refrigerator Features:

a. Interior light in refrigeration compartment.
b. Compartment Storage: vegetable crisper and meat compartment Insert requirement.
c. Door Storage: Modular compartments Gallon- (3.8-L) milk-container storage.
d. Temperature-controlled meat/deli bin.

7. Freezer Features: Two freezer compartment(s) with door(s).

a. Manual defrost.
b. Interior light in freezer compartment.
c. Automatic icemaker and storage bin.

8. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
9. Front Panel(s): Manufacturer's standard Stainless steel, Fingerprint resistant.

a.

10. Appliance Color/Finish: Stainless steel.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113013

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SECTION 122200 - CURTAINS AND DRAPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior industrial curtains and tracks.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Curtain Tracks: Include maximum weights of drapes that can be supported.

2. Fabrics.
3. Textile treatments.

B. Shop Drawings:

1. Curtain Tracks: Show installation and anchorage details and locations of controls.

2. Curtain: Show sizes, locations, graphics, and details of installation.

C. Samples for Verification: As follows:

1. Curtain Tracks: 18 inches (450 mm) long, with carriers, controls, and accessories.
2. Curtain Fabrics: For each color and pattern indicated, full width by 36 inches (1000 mm) long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.
3. Textile Trims: For each color and pattern indicated, 18 inches (450 mm) long.
4. Curtain Fabrication: For each heading, fabric, color, and pattern indicated, a complete full-size panel to verify details of fabrication and thread colors.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For curtain track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items, on which the following items are shown:

1. Structural members to which tracks are attached.

B. Product Certificates: For each curtain fabric treated with flame retardant, signed by fabric supplier and indicating treatment durability and cleaning procedures required to maintain treatment effectiveness.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For products installed to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Curtain Track Carriers: For each size indicated, equal to 5 percent of amount installed, but no fewer than [**10**] <**Insert number**> of each size.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: For curtains and curtain tracks, fabricator of curtains.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before curtain fabrication, and indicate measurements on Shop Drawings.

B. Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 CURTAIN TRACKS

A. Manually Operated Track:

1. Manufacturers: Basis of design product: SCH Sliding Curtain - Zoneworks by Rite-Hite. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Akon.
b. SteelGuard Safety Products

2. Construction: Galvanized Steel.

a. Size and thickness: ANSI/BHMA A 156.14 Grade 1, 16 gauge box rail.
b. Lengths and Configurations: As indicated on Drawings.
c. Support Capability: 450 lb (204kg) mounted on track length indicated.
d. Finish: Manufacturer's standard.

3. Mounting Brackets: Galvanized steel, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and curtain plus force applied to operate track.

a. Mounting Surface: Steel trusses and Unistrut supports.
b. Size: Adjustable.

4. Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
5. Operation: Curtain edge.

a. Draw: One way, stack as indicated on Drawings.

6. Carriers: Trolley.

a. Type: Zinc-plated single angle box rail hanger.
b. Support Capability: 150 lb (68 kg).

7. End Stops: Manufacturer's standard with track end cap.

2.2 CURTAINS

A. Manufacturers: Basis of design product: SCH Sliding Curtain - Zoneworks by Rite-Hite. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Akon.
2. SteelGuard Safety Products

B. Source Limitations: Obtain each color and pattern of curtain fabric and trim from one dye lot.

C. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. Curtain:

1. Curtain Fabric: Flame-Retardant vinyl.
2. Weight: 18 oz per square yard.
3. Width: As indicated on Drawings.
4. Textile Treatments: Flame retardant, polymer type.
5. Lining Fabric: Double fabric layer at panel top.
6. Grommets: #4 grommets spaced at 24” o.c. max. along top hem for trolley attachment.
7. Internal supports: Pipe staffs

    a. Size: 1-1/4 inch.
    b. Type: Schedule 40
    c. Finish: G-90 Galvanized
    d. Spacing: 48” min. to 66” max.

8. Locking: 1/2-inch locking pin in overhead track and 5/8-inch diameter drop pin assembly at floor connection.
9. Sweep: 6” high bottom sweep.
10. Color: Black
11. Graphic: Integral to material. Image as provided by Owner

2.3 CURTAIN FABRICATION

A. Fabricate curtains as indicated. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

B. Seams: Two-needle lock stitching at hems, splice joints, and attachments. All seam terminations shall be back-tacked.

PART 3 - EXECUTION

3.1 CURTAIN TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 CURTAIN INSTALLATION

A. Where curtains abut overhead construction, hang curtainss so that clearance between headings and overhead construction is 1/4 inch (6.4 mm).

B. Where curtains extend to floor, install so that bottom sweep extends to floor with not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) overlap.

3.3 ADJUSTING

A. After hanging curtains, test and adjust each curtain track to produce unencumbered, smooth operation.

B. Remove and replace curtains that are stained or soiled.

END OF SECTION 122200

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SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:

   a. Avonite Surfaces.
   b. Formica Corporation.
   c. Wilsonart, LLC (Basis of Design).

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top with separate apron, 6 inches (150 mm) high, recessed 1/4-inch (6.4-mm) behind front edge.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops without joints, if possible.

G. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.
2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

H. Cutouts and Holes:

1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

   1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
   2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to

finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings
3. Escutcheons for plumbing piping.
4. Grout.
5. Plumbing demolition.
6. Equipment installation requirements common to equipment sections.
7. Concrete Bases.
8. Supports and anchorages.

1.2 RELATED DOCUMENTS

A. All contract documents including drawings, alternates, addenda, and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specifications Sections apply to work of this section. All preceding and following sections of this specification Division are applicable to the Plumbing Contractor, all sub-contractors, and all material suppliers.

1.3 SCOPE OF WORK

A. This Division requires the furnishing and installing of complete functioning Plumbing systems, and each element thereof, as specified or indicated on Drawings, including every article, device, or accessory necessary to facilitate each system's function as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

B. Refer to Architectural, Structural, Electrical, Mechanical, and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams, and other structural members to facilitate concealing pipework in the manner anticipated in the design. Contractor shall become familiar with equipment provided by other Divisions that require plumbing connections and controls.

C. Electrical work required to install, and control plumbing equipment, which is not shown on plans or specified under Division 26, shall be included in this contractors base bid proposal.

1.4 DEFINITIONS

A. The ENGINEER indicated in these specifications is Watts Architecture and Engineering, PC. 95 Perry Street, Suite 300. Buffalo, NY 14203. Phone 716.206.5100.

B. The CONTRACTOR indicated in these specifications shall mean the company that enters into contract with the Owner to perform this section of work.

C. When the word “PROPER”, “SATISFACTORY”, “EQUIVALENT”, and “AS DIRECTED” is used, it requires the Architect/Engineers review.

D. “PROVIDE” means to supply, purchase, transport, place, erect, connect, test, and turn over to Owner, complete and ready for regular operation, the particular work referred to.

E. “INSTALL” means to join, unite, fasten, link, attach, set up, or otherwise connect, test, and turn over to Owner, complete and ready for regular operation, the particular work referred to.

F. “FURNISH” means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items required for the proper and complete application for the particular work referred to.

G. “AS DIRECTED” means as directed by the Architect/Engineer or their representative.

H. “CONCEALED” means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

I. “REMOVE” means to dismantle, disconnect, remove from the premises, and properly dispose of the particular work referred to.

J. “EXISTING” means any piping, equipment, components, and accessories that are presently installed and in the possession of the owner.

1.5 CODES, RULES, AND REGULATIONS

A. The Contractor shall provide all work in compliance with applicable codes, rules, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction. All work shall conform to latest edition and supplements of following codes, standards, or recommended practices.

B. The Contractor shall provide all work in compliance with the National Electrical Safety Code Handbook H30 published by the National Bureau of Standards, and the Occupational Safety and Health Standard (OSHA) published by the Department of Labor.

C. The Contractor shall provide all work in compliance with NFPA No. 54 – Gas Appliance & Gas Piping Installation, and NFPA No. 70 – National Electrical Code.

D. The Contractor shall provide all work in compliance with the Americans with Disabilities Act (ADA) and ANSI A117.1 – Handicapped Accessibility, as specified or indicated on drawings.

E. All materials, equipment, and components of equipment shall bear Underwriter's Laboratories (UL) labels whenever such devices are listed.

1.6 FIELD CONDITIONS

A. The Contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine the site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.7 CONTRACT CHANGES

A. Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of the Architect/Engineer. No verbal change orders will be recognized.

1.8 LOCATIONS AND INTERFERANCES

A. Locations of equipment, piping, and other plumbing work are indicated diagrammatically on the plumbing drawings. The Contractor shall determine the exact locations on site, subject to structural conditions, work of other contractors, and access requirements for installation and maintenance to approval of Architect/Engineer. Provide additional piping offsets as required at no additional cost.

B. Any piping, equipment, apparatus, or appliance interfering with proper placement of work of other Divisions as indicated on drawings, specified, or required, shall be removed, relocated, and reconnected without extra cost. Damage to work of other Divisions caused by the Contractor, sub-contractor, or workers shall be restored as specified for new work.

C. Do not scale plumbing drawings for dimensions. Contractor shall accurately layout work from the dimensions indicated on the architectural drawings unless they are found to be in error.

1.9 QUALITY ASSURANCE

A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, or appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification Division.

B. Steel support welding: Qualify processes and operators according to ASW D1.1, "Structural Welding Code – Steel".

C. Steel pipe welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications"

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Contractor shall certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical characteristics for plumbing equipment: Equipment of higher electrical characteristics may be furnished if the proposed equipment is approved by the Engineer in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. The Contractor shall refer to project commissioning requirements.

F. The Contractor shall be responsible to provide coordination drawings for the plumbing and fire protection construction, piping, and placement with respect to and in coordination with all other Divisions.

1.10 WARRANTY

A. The Contractor warrants to the owner and Architect/Engineer that upon notice from them within a one year warranty period following date of acceptance by owner, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at the Contractor's expense.

B. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.11 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS

A. The intent of these specifications is to allow ample opportunity for the Contractor to use their ingenuity and abilities to perform the work to his/her and the owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

B. Material and equipment installed under this contract shall be new, unused, and without damage.

C. Where materials or equipment are described but not named, provide items adequate in every respect for intended use. Such items shall be submitted in writing to the Architect/Engineer for review prior to procurement.

D. Materials and equipment proposed for substitutions shall be equal or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect/Engineer who's decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by written descriptive and technical data including manufacturers name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.

E. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in plumbing or electrical service requirements necessary to accommodate such substitution.

1.12 OPENINGS, ACCESS PANELS, AND SLEEVES

A. The Contractor shall include the installation of all boxes, access panels, and sleeves for openings required to install this work, except for structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

B. All penetrations through interior or exterior and rated or non-rated walls and floors shall be appropriately sealed to prevent entry and movement of rodents and insects. Contractor shall coordinate their work with the work of all other trades.

1.13 ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

A. Contractor shall consult all architectural drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as pipe sizes, height, location, and orientation. Shop drawings incorporating these requirements should be submitted to the Architect/Engineer for approval prior to installation of rough-in.

1.14 SUBMITTALS

A. Product Data: For all products listed in this section and for the final O&M Manuals.

B. Welding certificates for certified welders.

C. Operation and maintenance data for the final O&M Manuals to be provided to the Owner.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping specification sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping specification sections for special joining materials not listed below.

B. Pipe-flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8” maximum thickness unless thickness or specific material is indicated.

C. Solder Filler Materials: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Welding Filler Materials: Comply with AWS D10.12.

E. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC UNIONS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded solder-joint, plan, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, rated for 250 psi SWP at 180°F.

D. Dielectric Flanges: Factory-fabricated, companion flange assembly rated for 150- or 300- psi SWP as required to suite system pressures.

E. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive, thermoplastic lining, threaded ends, and rated for 300 psi SWP at 225°F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining, threaded ends, and rated for 300 psi SWP at 225°F.

2.4 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates with an inner diameter to closely fit around pipe, tube, and insulation and an outer diameter to completely cover openings in walls and floors.

B. Two-Piece, Deep-Pattern Type: Deep drawn, box shaped brass with polished chrome-plated finish.

C. Two-Piece, Cast Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast Brass Type: With concealing hinge and set screw

1. Finish: Polished chrome-plated.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. The Contractor shall dismantle, disconnect, and remove from the premises plumbing systems, equipment, and components as indicated on plumbing drawings. The Contractor shall dispose of all construction debris and removed materials in accordance with Local, State, and Federal regulations.

1. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug existing piping with compatible piping material.
2. Piping to be abandoned: Drain piping and cap or plug piping with compatible material.
3. Equipment to be removed: Disconnect and cap any existing piping connections and remove equipment.
4. Equipment to be removed and salvaged: Disconnect and cap any existing piping connections and deliver equipment to the owner.
5. Provide for the off-site disposal of construction demolition materials in accordance with all Local, State, and Federal codes and regulations.

C. If pipe insulation, or existing equipment as indicated on drawings, is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PLUMBING PIPING – COMMON REQUIREMENTS

A. Provide piping according to the previous and following requirements and in compliance with Division 22 sections specifying piping systems.

B. All contract documents including drawings, alternates, addenda, and modifications indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to calculate size and capacities of piping systems including friction loss, expansion, motor power requirements, and other design considerations. Install piping as indicated unless deviations to layout are approved by the Engineer.

C. Contractor shall provide all piping in concealed locations unless otherwise indicated, and except in mechanical rooms and service areas.

D. Contractor shall provide piping indicated to be exposed and piping in mechanical rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Contractor shall provide piping concealed above ceilings to allow sufficient space for ceiling panel removal.

F. Contractor shall provide piping to allow operation, servicing, or replacement of all valves, accessories, or appliances.

G. Contractor shall provide piping at indicated slopes.

H. Contractor shall provide piping free of sags and bends.

I. Contractor shall provide all required fittings for changes in direction and branch connections.

J. Contractor shall provide all piping to allow application of insulation as specified.

K. Contractor shall provide system components with pressure ratings equal to or greater than system operating pressure.

L. Contractor shall provide escutcheons for penetrations of walls, ceilings, and floors.

M. Contractor shall provide sleeves for piping passing through concrete and masonry walls, gypsum-board partitions, and concrete floors and roof slabs.

N. Contractor shall provide required sealing to maintain indicated fire ratings of walls, partitions, ceilings, and floors at all penetrations. Refer to Division 07 section “Firestopping” for materials.

O. Contractor shall verify final equipment and plumbing fixture locations prior to installing piping for rough-in.

P. Contractor shall refer to equipment specifications in other sections of these specifications, and to manufacturer’s written installation instructions, for rough-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 sections specifying piping systems.

B. Ream ends of pipe and tubes to remove burrs and restore piping to full inner diameter. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook" using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp die. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to PART 1 - 1.9 "QUALITY ASSURANCE".

G. Flanged Joints: Provide appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joint surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe handling practices of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe, and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Non-pressure Piping: Join according to ASTM D 2855.

I. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.4 PIPING CONNECTIONS

A. Contractor shall construct connections according to the following unless otherwise indicated:

1. Provide unions in piping NPS 2" and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Provide flanges in piping NPS 2 ½" and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT AND FIXTURE INSTALLATION – COMMON REQUIREMENTS

A. Contractor shall provide equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Contractor shall provide equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces unless otherwise indicated.

C. Contractor shall provide plumbing equipment and apparatus to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Contractor shall provide equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE EQUIPMENT BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes of project.

1. Construct concrete bases of dimensions indicated, but not less than 4" larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18" centers around full perimeter of the base.
3. Provide epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, written instructions, and directions furnished with items to be embedded.
5. Provide anchor bolts to elevations required for proper attachment of supported equipment.
6. Provide anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 4000-psi, 28-day compressive strength concrete and reinforcement.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Contractor shall refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Contractor shall cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for plumbing equipment base bearing surface, pump, and other equipment base plates, and anchors.

B. Contractor shall clean surfaces that will come into contact with grout.

C. Contractor shall provide forms as required for placement of grout.

D. Contractor shall avoid air entrapment during placement of grout.

E. Contractor shall place grout to completely fill equipment bases.

F. Contractor shall place grout on concrete bases and provide a convex surface capable of repelling fluid buildup on grout surface.

G. Contractor shall place grout around anchors.

END OF SECTION 220500

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SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Under deck Clamp: Clamping ring with set screws.

E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Galvanized-Steel-Sheet Sleeves: 24 Gauge (0.0239-inch) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.

2. Metraflex Company (The).
3. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Dial-type pressure gages.
3. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: To include operation and maintenance manuals, and manufacturer written warranties to be included in the final O & M Manuals.

1.3 QUALITY ASSURANCE

A. NSF Standard: Comply with NSF 61, NSF 62 Annex G and NSF 372 “Drinking Water System Components—Health Effects,” for fixture materials that will be in contact with potable water. The lead content of water system components shall not exceed 0.25 percent by weighted average.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Palmer Wahl Instrumentation Group.
   b. Tel-Tru Manufacturing Company.
   c. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Steel; 8-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F or deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Palmer Wahl Instrumentation Group.
    b. Tel-Tru Manufacturing Company.
    c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled and Sealed type; cast aluminum with 3-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi or psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.3 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

B. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

C. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

D. Install valve and snubber in piping for each pressure gage for fluids.

E. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlet of each domestic water circulation pump.

F. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Suction and discharge of each domestic water pump.

G. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

H. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Industrial-style, liquid-in-glass type.

B. Thermometers at inlet and outlet of each domestic water circulation pump shall be one of the following:

1. Industrial-style, liquid-in-glass type.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F, or 0 to 150 deg F and minus 20 to plus 70 deg C

B. Scale Range for Domestic Hot-Water and Hot-Water Recirculation Piping: 0 to 250 deg F, or 0 to 250 deg F and 0 to 150 deg C.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled and sealed, direct-mounted, metal case dial-type.

B. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Liquid-filled and sealed, direct-mounted, metal case dial-type.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi, or 0 to 160 psi and 0 to 1100 kPa.

B. Scale Range for Domestic Water Piping: 0 to 160 psi, or 0 to 160 psi and 0 to 1100 kPa.

END OF SECTION 220519

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Balance valves.
3. Check valves.

1.2 SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.
5. ASME B16.1 for flanges on iron valves.
6. ASME B16.5 for steel flanges.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BALL VALVES

A. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Red-White Valve Corp.
   f. WATTS.

2. Description:

   a. Two-piece full port forged brass ball valve. Seats and stem packing shall be PTFE. Valve shall have a separate handle nut and packing nut, and chrome plated brass ball and stem. Quarter-turn operation. Valve sizes ¼” to 2” shall be pressure rated to 600 psi WOG and 150 psi SWP. Valve sizes 2 ½” to 3” shall be pressure rated to 400 psi WOG and 125 psi SWP.

B. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. WATTS.
   f. Zurn Industries, LLC.

2. Description:

a. Two-piece full port bronze ball valve. Seats and stem packing shall be PTFE. Valve shall have a separate handle nut and packing nut, and chrome plated brass ball and stem. Quarter-turn operation. Valve sizes ¼" to 2" shall be pressure rated to 600 psi WOG and 150 psi SWP. Valve sizes 2 ½" to 3" shall be pressure rated to 400 psi WOG and 125 psi SWP.

2.3 FLOW MEASUREMENT VALVES

A. Calibrated Balancing Valves with Memory Stop Device

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Apollo Flow Controls.
   b. Conbraco Industries, Inc.
   c. Bell and Gossett
   d. WATTS.

2. Description:

   a. Bi-directional ball-type bronze balancing valve. Valve shall be equipped with a pre-calibrated indicator plate. Seat shall be carbon/glass filled PTFE. Valve shall be equipped with memory stop device and NPT ¼" threaded and capped metering ports. Valves ¼" to 3" shall be pressure rated to 300 psi and 125 psi SWP.
   b. Balance valves shall be calibrated to individual flow rates as indicated on the contract documents.

2.4 CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disk

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. WATTS.

2. Description:

   a. Wye-pattern bronze swing check valve. Valve shall conform to MSS SP-80. Seat and disk shall be lead-free bronze. Hanger and pin shall be stainless steel. Valves ¼" to 2" shall be pressure rated to 200 psi and 125 psi SWP.

B. Bronze Spring Check Valves with Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. WATTS.

2. Description:

   a. In-line pattern bronze spring check valve. Valve shall conform to MSS SP-80. Disk shall be lead-free bronze. Seat shall be PTFE. Spring and guide pin shall be stainless steel. Valves ¼” to 2” shall be pressure rated to 400 psi and 125 psi SWP.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: May be provided with Threaded, press-connect, or solder-joint ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates for certified welders.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 section "Exterior Painting." and Division 09 section "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve Tags

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Craftmark Pipe Markers.
   c. Kolbi Pipe Marker Co.
   d. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Craftmark Pipe Markers.
   c. Kolbi Pipe Marker Co.
   d. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   1. Brady Corporation.
   2. Craftmark Pipe Markers.
   3. National Marker Company.
   4. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Kolbi Pipe Marker Co.
4. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: 1-1/2 inch.

2.4 VALVE TAGS

A. Metal Tags for Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Craftmark Pipe Markers.
   c. Kolbi Pipe Marker Co.
   d. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Minimum Label Size: 1-1/2 inch round.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Beaded chain or “S” hooks, same material as valve tag.

PART 3 - EXECUTION

3.1 PREPERATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices; including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulates.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Division 09 section Interior Painting.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 30 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background: Safety green.
   b. Letter Colors: White.

2. Sanitary Waste, Vent, and Storm Drainage Piping:

   a. Background: Safety green.
   b. Letter Colors: White.

3.4 VALVE TAG INSTALLATION

A. Install or permanently fasten labels on each valve and control device.

B. Locate valve tags where accessible and visible.

END OF SECTION 220553

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SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Sanitary waste piping exposed to freezing conditions.
4. Storm-water piping exposed to freezing conditions.
5. Roof drains and rainwater leaders.
6. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. K-Flex USA.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Insulco, Division of MFS, Inc.
   b. P.K. Insulation Mfg. Co., Inc.
   c. Rock Wool Manufacturing Company.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Aeroflex USA, Inc.
   b. Armacell LLC.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. K-Flex USA.

2. Adhesive: As recommended by flexible elastomeric and polyolefin manufacturer and with a VOC content of 80 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.

2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
d. Mon-Eco Industries, Inc.

2. Adhesives shall have a VOC content of 80 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.
c. Speedline Corporation.
d. The Dow Chemical Company.

2. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
2. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Knauf Insulation.
   d. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Knauf Insulation.
   e. Mon-Eco Industries, Inc.
   f. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. Sealant shall have a VOC content of 250 g/L or less.

7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) Dow Chemical Company (The).

5. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) Dow Chemical Company (The).

6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) Dow Chemical Company (The).

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Foster Brand; H. B. Fuller Construction Products.
b. Vimasco Corporation.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.
c. Proto Corporation.
d. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. 3M Industrial Adhesives and Tapes Division.

b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 3 inches.
3. Film Thickness: 4 mils 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. McGuire Manufacturing.

b. Truebro.
c. Zurn Industries, LLC.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot-and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Truebro.
b. Zurn Industries, LLC.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.

D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

E. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

F. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

G. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

H. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

I. Install insulation with longitudinal seams at top and bottom of horizontal runs.

J. Install multiple layers of insulation with longitudinal and end seams staggered.

K. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

L. Keep insulation materials dry during application and finishing.

M. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

N. Install insulation with least number of joints practical.

O. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

P. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

Q. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

R. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

S. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

T. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

U. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.4 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where PVDC jackets are indicated, install as follows:

1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one locations for each type of valve, equipment, or water service entrance and as defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment that is not factory insulated.

C. Heat-Exchanger Insulation shall be one of the following:

1. Mineral-Fiber Pipe and Tank: 2 inches thick.

D. Domestic water, and domestic hot-water hydro-pneumatic tank insulation shall be one of the following:

1. Mineral-Fiber Pipe and Tank: 1 inch thick.

E. Domestic Hot-Water Storage Tank Insulation shall be one of the following:

1. Mineral-Fiber Pipe and Tank: Of thickness to provide an R-value of 12.5.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I:
   a. NPS 1-1/4 and Smaller: 1 inch thick.
   b. NPS 1-1/2 and Larger: 1-1/2 inch thick.

C. Stormwater and Overflow: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. Insulate entire drain body tight to roof deck.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. PVC, Preformed Pipe Insulation, Type I: 1/2 inch thick fitting covers.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

1. PVC: 20 mils thick.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. PVC: 20 mils thick.

E. Piping, Concealed:

1. PVC: 20 mils thick.

F. Piping, Exposed:

1. PVC: 20 mils thick.

END OF SECTION 220700

SECTION 221112 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:
   1. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

   1. Notify Architect, Construction Manager, and Owner no fewer than **two** days in advance of proposed interruption of service.
   2. Do not proceed with interruption of water-distribution service without Construction Manager'sand Owner's written permission.

1.7 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Soft Copper Tube: ASTM B88, Type K (ASTM B88M, Type A), water tube, annealed temper.

   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B88, Type K (ASTM B88M, Type A), water tube, drawn temper.

   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

E. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Anvil International/Smith-Cooper International.
2) Star Pipe Products.
3) Victaulic Company.

2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

B. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

a. Standard: AWWA C219.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves:

   a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

      1) Standard: AWWA C500.
      2) Minimum Pressure Rating: 200 psig (1380 kPa).
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

2. Nonrising-Stem, Resilient-Seated Gate Valves:

   a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig (1380 kPa).
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

   a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 250 psig (1725 kPa).
      3) End Connections: Push on or mechanical joint.
      4) Interior Coating: Complying with AWWA C550.

4. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

   a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

      1) Standard: AWWA C500.
      2) Minimum Pressure Rating: 200 psig (1380 kPa).
      3) End Connections: Flanged.

5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

   a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig (1380 kPa).
      3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:
1. UL/FMG, Nonrising-Stem Gate Valves:

a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

2. OS&Y, Rising-Stem Gate Valves:

a. Description: Iron body and bonnet and bronze seating material.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

C. Bronze Gate Valves:
1. OS&Y, Rising-Stem Gate Valves:

a. Description: Bronze body and bonnet and bronze stem.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Threaded.

2. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering

"WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.7 WATER METERS

A. Water meters will be furnished by utility company.

2.8 WATER METER BOXES

A. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 by 254 mm) square.

2.9 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C857 and made according to ASTM C858.

1. Ladder: ASTM A36/A36M, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A48/A48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.

    a. Dimension: 24-inch (610-mm) minimum diameter, unless otherwise indicated.

3. Manhole: ASTM A536, Grade 60-40-18, ductile-iron traffic frame and cover.

    a. Dimension: 24-inch- (610-mm-) minimum diameter, unless otherwise indicated.

4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 24 (DN 50) shall be soft copper tube, ASTM B88, Type K (ASTM B88M, Type A)] [ASTM B88; wrought-copper, solder-joint fittings; and brazed joints.

F. Underground water-service piping NPS 4 and NPS 10 (DN 100 and DN 250) shall be the following:
    1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed [mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

G. Water Meter Box Water-Service Piping shall be same as underground water-service piping.

    1. Hard copper tube, ASTM B88, Type K (ASTM B88M, Type A)); wrought-copper, solder-joint fittings; and brazed joints.
    2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 4 (DN 100) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, [metal] [resilient] [high-pressure, resilient]-seated gate valves with valve box.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

F. Bury piping with depth of cover over top at least 60 inches , with top at least 12 inches below level of maximum frost penetration.

G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

H. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

I. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.6 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
4. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. MSS Valves: Install as component of connected piping system.

D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C891.

3.12 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.13 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.14 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.15 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.16 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221112

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Piping joining materials.
4. Transition fittings.
5. Dielectric fittings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Provide all building plumbing systems in compliance with applicable codes, rules, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction. All work shall conform to latest edition and supplements of following codes, standards, or recommended practices.

B. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installations shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Potable-water piping: 125 psig.

2.2 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

C. Comply with NSF Standard 372 for low head.

D. Piping shall bear label, stamp, or other markings of specified testing agency.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type K (ASTM B88M, Type A).

B. Annealed-Temper Copper Tube: ASTM B88, Type K (ASTM B88M, Type A).

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. Wrought Copper Unions: ASME B16.22.

H. Copper Tube, Pressure-Seal-Joint Fittings:
1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
2. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).

I. Copper Tube, Push-on-Joint Fittings:
1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
2. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

J. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Anvil International.
    b. Shurjoint Piping Products USA, Inc.
    c. Victaulic Company.

2. Fittings for Grooved-End, Copper tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End, Copper Tubing:

    a. AWWA C606 for copper-tube dimensions.
    b. Ferrous housing sections.
    c. Bolts and nuts.
    d. EPDM-rubber gaskets suitable for hot and cold water.
    e. Minimum Pressure Rating: 300 psig.

2.4 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Unshielded, Non-pressure Transition Couplings:

1. Standard: ASTM C 1173.
2. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
3. End Connections: Same size as and compatible with pipes to be joined.
4. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

D. Shielded, Non-pressure Transition Couplings:

1. Standard: ASTM C 1460.
2. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
3. End Connections: Same size as and compatible with pipes to be joined.

E. Copper-to-Steel Pipe: Cast bronze copper to iron female or male adapter.

F. Plastic-to-Metal Transition Unions:

1. Description:

a. Brass threaded end.
b. Solvent-cement-joint or threaded plastic end.
c. Rubber O-ring.
d. Union nut.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following::

   a. HART Industrial Unions, LLC.
   b. WATTS.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Pressure Rating: 150 psig (1035 kPa)] [250 psig (1725 kPa).
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following::

   a. Capitol Manufacturing Company.
   b. WATTS.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 150 psig (1035 kPa).
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following::

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig (1035 kPa).
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following::

   a. Elster Perfection Corporation.
   b. Precision Plumbing Products.
   c. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F1545.
4. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller , shall be one of the following:

1. Soft copper tube, ASTM B88, Type K (ASTM B88M, Type A); wrought-copper, solder-joint fittings; and brazed copper pressure-seal fittings; and pressure-sealed joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger, shall be one of the following:

1. Soft copper tube, ASTM B88, Type K (ASTM B88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

E. Under-building-slab, domestic water piping, **NPS 2 (DN 50) and smaller**, shall be one of the following:

1. Hard or soft copper tube, ASTM B88M, Type B; wrought-copper, solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install valves according to the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."
2. Section 220523.13 "Butterfly Valves for Plumbing Piping."
3. Section 220523.14 "Check Valves for Plumbing Piping."
4. Section 220523.15 "Gate Valves for Plumbing Piping."
5. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
6. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on[**inlet and**] outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
3. PVC Piping: Join according to ASTM D2855.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings couplings or nipples nipples unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges flange kits nipples.

D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod..

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.9 IDENTIFICATION

A. Identify exposed domestic water piping.

B. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

C. Label pressure piping with system operating pressure.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

      1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

   c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Strainers.
5. Hose bibbs.
6. Wall hydrants.
7. Drain valves.
8. Water-hammer arresters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
6. Section 224719 "Water Station Water Coolers" for water filters for water coolers.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

B. Operation and maintenance data: To include operation and maintenance manuals, and manufacturer written warranties to be included in the final O & M Manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. NSF Standard: Comply with NSF 61, NSF 62 Annex G and NSF 372 “Drinking Water System Components—Health Effects,” for fixture materials that will be in contact with potable water.

The lead content of water system components shall not exceed 0.25 percent by weighted average.

B. Provide all building plumbing systems in compliance with applicable codes, rules, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction. All work shall conform to latest edition and supplements of following codes, standards, or recommended practices.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers **(RPZ-1)**:

1. Manufacturers: Subject to compliance with requirements, provide Watts Series LF909 or approved equal, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Size: 1-1/4 NPS.
6. Design Flow Rate: 35 gpm.
7. Body: Bronze for NPS 2 and smaller.

8. End Connections: Threaded for NPS 2 and smaller.
9. Configuration: Designed for vertical upward flow.
10. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Strainer: Bronze with removable basket.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral**,** nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze, or chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle or operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, Provide Watts HY-420; available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Acorn Engineering Company.
   b. MiFab.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

2.8 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.9 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters **(WHA)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. MIFAB, Inc.
   b. WATTS.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

   1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve and pump.

F. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

G. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

H. Install water-hammer arresters in water piping according to PDI-WH 201.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly, and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Domestic Water Circulator Pumps.

1.2 DEFINITIONS

A. “HI” means Hydraulics Institute

B. “NEMA” means National Electrical Manufacturers Association

C. “UL” means Underwriters Laboratories, Inc.

D. “VFD” means Variable Frequency Drive.

1.3 SUBMITTALS

A. Product Data: For each type of pump indicated in this section and for the final O & M Manuals. Include rated capacities, operating characteristics, accessories, materials of construction, and manufacturer written warranties to be included in the final O & M Manuals.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

C. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER CIRCULATOR PUMPS **(CP-1)**:

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Armstrong Pumps, Inc.
2. Bell & Gossett; A Xylem Brand.
3. Grundfos Pumps Corp.
4. TACO Comfort Solutions, Inc.

B. Description: Factory-assembled and -tested, wet rotor, inline centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal. Pump internals shall be capable of being serviced without disturbing piping connections.
2. Casing: Stainless Steel, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Variable speed, permanent magnet motor tested with the pump as one unit by manufacturer.

D. Capacities and Characteristics:

1. Capacity: 10 gpm.
2. Total Dynamic Head: 35 feet W.C.
3. Minimum Working Pressure: 125 psig.
4. Maximum Continuous Operating Temperature: 205 deg F.
5. Inlet and Outlet Size: 3/4 NPS.
6. Pump Speed: 3250 RPM.
7. Motor Horsepower: 1/8.
8. Electrical Characteristics:

a. Volts: 115.
b. Phases: Single.
c. Hertz: 60.
d. Amperes: 1.4 A.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 50 to 125 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 24 V, ac or 120 V, ac.
7. Settings: Start pump at 110 deg F and stop pump at 115 deg F.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft horizontal.

D. Install continuous-thread hanger rods or uni-strut framing of size required to support pump weight.

1. Install booster pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03 Section "Cast-in-Place Concrete."
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

E. Support connected domestic-water piping so weight of piping is not supported by pumps.

F. Install thermostats in hot-water return piping.

G. Provide full port ball valves on inlet and outlet connections of pumps.

H. Engage a factory-authorized service representative to perform booster pump startup service.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

2. Provide shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523 "General Duty Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
3. Install union, flanged, or grooved-joint connections on suction and discharge piping at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Section 221116 "Domestic Water Piping."
4. Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge piping. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
5. Install flexible connectors, same size as piping, on piping connections to booster-pump suction and discharge piping. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
6. Install piping adjacent to booster pumps to allow service and maintenance.
7. Provide pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

D. Connect thermostats and timers to pumps that they control.

E. Equipment Nameplates and Signs: Provide engraved metal equipment nameplate or sign on or near each of the following:

1. Domestic Water Circulator Pump.

F. Provide all nameplates or signs according to requirements specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual and mechanical inspection.
2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 DEMONSTRATION

A. Provide for a manufacturer-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain domestic water circulation pumps, and domestic water pressure booster pumps.

END OF SECTION 221123

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SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless cast-iron soil pipe and fittings.
3. Nonpressure-type transition couplings.
4. Pressure-type pipe couplings.
5. Expansion joints and deflection fittings.
6. Backwater valves.
7. Cleanouts.
8. Encasement for piping.
9. Manholes.
10. Concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

B. Product Certificates: For each type of pipe and fitting.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A74, Service class.

B. Gaskets: ASTM C564, rubber.

C. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

1. Description: ASTM C1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Shielded Couplings:

1. Description: ASTM C1277 and ASTM C1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, SDR 21, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

E. Nonpressure-Type, Rigid Couplings:

1. Description: ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

2. Top-Loading Classification(s): Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

2.6 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (100-mm) minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP ; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm) .
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser, with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile, ASTM A48/A48M, Class 35 gray iron unless otherwise indicated.

2.7 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350 (ACI 350M), and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420-MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a. Invert Slope: 2 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

   a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420-MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 48-inch (1220-mm)minimum cover.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install PVC corrugated sewer piping according to ASTM D2321 and ASTM F1668.
7. Install PVC Type PSM sewer piping according to ASTM D2321 and ASTM F1668.

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A674 or AWWA C105/A21.5:

1. Hub-and-spigot, cast-iron soil pipe.
2. Hubless cast-iron soil pipe and fittings.
3. Expansion joints and deflection fittings.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join PVC corrugated sewer piping according to ASTM D2321.
5. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
6. Join dissimilar pipe materials with nonpressure-type, flexible[**or rigid**] couplings.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

   a. Unshielded flexible or rigid couplings for pipes of same or slightly different OD.
   b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic serviceareas.

B. Set cleanout frames and covers in earth (non paved areas) in cast-in-place-concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
   3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

      a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

   4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs. Fill abandoned pipe with flowable fill.

B. Backfill to grade according to Section 312000 "Earth Moving."

3.9 IDENTIFICATION

A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

   1. Usedetectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:

      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.

   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Manholes: Perform hydraulic test according to ASTM C969 (ASTM C969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 221313

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SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-Spigot, Cast-iron Soil Pipe and fittings.
2. Hubless, Cast-iron Soil Pipe and fittings.
3. Copper tube and fittings.
4. Specialty pipe fittings.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

C. Welding Certificates.

1.3 QUALITY ASSURANCE

A. Provide all building plumbing systems in compliance with applicable codes, rules, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction. All work shall conform to latest edition and supplements of following codes, standards, or recommended practices.

B. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class, asphalt coated.

B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service weight class, asphalt coated ASTM A 888 or CISPI 310 couplings.

B. Heavy-Duty, Shielded Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. Dallas Specialty & Mfg. Co.
   d. MIFAB, Inc.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Stant.
   g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shielded with double 301 stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Fernco Inc.
2) Froet Industries LLC.
3) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 1/4 inch per foot slope downward in direction of flow for piping NPS 2 and smaller; 1/8 inch per foot slope downward in direction of flow for piping NPS 3 and larger.
2. Vent Piping: 1/8 inch per foot slope down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523 "General Duty Valves for Plumbing Piping," for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment.”

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.

6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acceptable Manufacturers.
2. Cleanouts.
3. Floor Drains.
4. Shower Drains.
5. Roof flashing assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing Materials.
8. Trap Guard Device.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated in this section and for the final O & M Manuals. Include rated capacities, operating characteristics, and accessories.

B. Operation and Maintenance Data: For each type of fixture to include operation and maintenance manuals, and manufacturers written warranties to be included in the final O & M Manuals.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Provide sanitary waste piping specialties in compliance with Chapters 7, 8, 9 and 10 the International Plumbing Code of New York State (2015).

C. Provide all building plumbing systems in compliance with the International Plumbing Code of New York State (2015) and all New York State Amendments.

D. Comply with NSF 14 for plastic sanitary waste piping specialty components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The components listed in this section are basis-of-design products. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

1. Cleanouts: Charlotte, Mueller, Watts, Nibco, or Zurn.
2. Floor Cleanouts: Watts, Sioux Chief, Oatey, or Zurn.
3. Access Housing: Watts, Zurn, or MiFab.
4. Floor Drains: Watts, Sioux Chief, Oatey, or Zurn.
5. Floor Sinks: MiFab, Watts, or Zurn.
6. Roof Flashing Assemblies: Acorn Engineering, Custom Solutions Roof and Metal Products, Milcor, or Thaler.
7. Trap Guard Devices: MiFab, Provent, Proset, and Rectorseal.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

A. Cast-Iron Exposed Floor Cleanouts **(FCO)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.

5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, stainless-steel cover plate with screw.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains **(FD)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Anchor Flange: Not required.
6. Clamping Device: Flashing clamp.
7. Outlet: As indicated on plans.
8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
9. Sediment Bucket: Not required.
10. Top or Strainer Material: 7 inch diameter Stainless Steel.
11. Top of Body and Strainer Finish: Stainless Steel.

12. Top Shape: Round.
13. Dimensions of Top or Strainer: 7 inch diameter.
14. Top Loading Classification: Heavy Duty.
15. Funnel: Not required.
16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet.
17. Trap Material: Cast iron.
18. Trap Features: Trap-guard device.

2.4 SHOWER DRAINS **(TD-1):**

A. Linear floor drain consisting of a formed stainless steel channel body and grate assembly that can be seamlessly adjusted. Channel body is 2-1/2 inch wide trough, a 2 inch no-hub outlet, and a 7/8 inch wide bonding flange. Provide drain lengths as detailed in the Architectural drawings.

1. Basis of Design Product: Subject to compliance with requirements, provide Schluter Kerdi-Line Drain or a comparable product by one of the following:

   a. Quickdrain.

2. Drain Length: As detailed in the Architectural drawings.
3. Grate Frame Height: 3/4 inch.
4. Body Material: Type 304 stainless steel.
5. Grate Material: Type 304 stainless steel.
6. Outlet Location: To suit job conditioins.
7. Provide strainer for outlet.
8. Grate pattern to be selected by Architect.

2.5 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Acorn Engineering Company; Elmdor/Stoneman Div.
   b. Thaler Metal Industries Ltd.
   c. Milcor Inc.; Commercial Products Group of Hart and Cooley Inc.

2. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

   a. Open-Top Vent Cap: Without cap.
   b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
   c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.6 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch-minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Air Admittance Valves:

1. Standard: ANSI/ASSE 1051, for fitting designed to allow air to enter sanitary vent piping to prevent siphonage of water trap seals.
2. Body: ABS or PVC with silicone gasket. Screening inside and outside to protect sealing membrane from vermin and debris.
3. End Connections: Matching connected piping.
4. Size: Same as connected vent piping.

I. Trap Guard Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. RectorSeal
   b. Mifab
   c. Provent.
   d. Zurn.

2. Standard: ASSE 1072, for barrier type drain trap seal protection devices.
3. Body: UV resistant ABS frame with silicone sealing gasket.
4. Size: Same as drain outlet piping.

J. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.7 FLASHING MATERIALS

A. Copper Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Provide floor drains and trench drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Provide floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Provide individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
5. Provide a trap guard device inside floor drain bodies below strainer.
6. Provide vandal resistant tools to owner.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Division 07 section “Sheet Metal Flashing and Trim”.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Division 07 section “Sheet Metal Flashing and Trim”.

G. Assemble open drain fittings and install with top of hub 2 inches above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

N. Install wood-blocking reinforcement for wall-mounting-type specialties.

O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Division 26 section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Comply with requirements in Division 07 section "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 section "Sheet Metal Flashing and Trim."

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-Spigot, Cast-iron Soil Pipe and fittings.
2. Hubless, Cast-iron Soil Pipe and fittings.
3. Specialty pipe fittings.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

C. Welding Certificates.

1.3 QUALITY ASSURANCE

A. Provide all building plumbing systems in compliance with applicable codes, rules, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction. All work shall conform to latest edition and supplements of following codes, standards, or recommended practices.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drain Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class, asphalt coated.

B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service weight class, asphalt coated ASTM A 888 or CISPI 310 couplings.

B. Heavy-Duty, Shielded Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. Dallas Specialty & Mfg. Co.
   d. MIFAB, Inc.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Stant.
   g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shielded with double 301 stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Fernco Inc.
2) Froet Industries LLC.
3) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1/4 inch per foot slope downward in direction of flow for piping NPS 2 and smaller; 1/8 inch per foot slope downward in direction of flow for piping NPS 3 and larger.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

L. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.

a. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

2. Install drains in storm drainage gravity-flow piping.

a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Maximum spans in remaining paragraphs were taken from MSS SP-58 for water service and from model plumbing codes. The most restrictive piping and spacing dimensions allowed are shown.

G. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

H. Install supports for vertical cast-iron soil piping every 15 feet.

I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PAINTING

A. Comply with requirements for painting piping specified in Division 09 "Painting."

B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.

C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting. Reinstall removed items after painting.

D. Clean surfaces before applying paint. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.

E. Moisture Content: Do not paint over surfaces where moisture content exceeds manufacturer's instructions.

F. Apply paint in accordance with manufacturer's instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.
   2. Ensure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
   3. Sand lightly between each succeeding enamel or varnish coat.
   4. Paint aboveground, exterior exposed storm piping with one (1) coat of primer, and two (2) coats of black, alkyd enamel.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:

   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
   3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Underground storm drainage piping NPS 6 and smaller shall be any of the following:

   1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
   2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acceptable Manufacturers.
2. Cleanouts.
3. Roof Drains.
4. Wall Downspouts.
5. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated in this section and for the final O & M Manuals. Include rated capacities, operating characteristics, and accessories.

B. Operation and Maintenance Data: For each type of fixture to include operation and maintenance manuals, and manufacturers written warranties to be included in the final O & M Manuals.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Provide all building plumbing systems in compliance with the International Plumbing Code of New York State (2015) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The components listed in this section are basis-of-design products. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

1. Cleanouts: Charlotte, Mueller, Watts, Nibco, or Zurn.
2. Floor Cleanouts: Watts, Sioux Chief, Oatey, or Zurn.
3. Access Housing: Watts, Zurn, or MiFab.
4. Roof Drains: Watts, Sioux Chief, Josam, MiFab, Oatey, or Zurn.

5. Roof Flashing Assemblies: Acorn Engineering, Custom Solutions Roof and Metal Products, Milcor, or Thaler.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

A. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. MIFAB, Inc.
c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, stainless-steel cover plate with screw.

2.3 METAL ROOF DRAINS

A. Cast-Iron, Dual-Outlet Roof Drains **(RD-1)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Zurn Industries, LLC.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: Nominal 14-inch diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Flow-Control Weirs: Not required.
7. Outlet: Dual, 45-degree primary and bottom secondary.
8. Extension Collars: Not required.
9. Underdeck Clamp: Required.
10. Expansion Joint: Not required.
11. Sump Receiver Plate: Not required.
12. Dome Material: Cast iron.
13. Perforated Gravel Guard: Not required.
14. Vandal-Proof Dome: Required.
15. Overflow height: 6-1/4 inches high.

2.4 WALL DOWNSPOUTS

A. Hinged Downspout Cover:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts Series RD-950 Downspout Cover or a comparable product by one of the following:

a. Josam Company; Josam Div.

b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.

2. Description: Manufactured, stainless-steel downspout cover with securing flange, and secured perforated hinged strainer, for attaching to horizontal-outlet downspout.
3. Size: Same as connected drainage piping.
4. Vandal-Proof Grate: Required.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz. /sq. ft.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots at grade with top 18 inches above grade. Secure to building wall.

D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Install horizontal backwater valves in floor with cover flush with floor.

I. Install test tees in vertical conductors and near floor.

J. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

K. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

L. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electric, storage, water heaters.
2. Water heater accessories.

1.2 SUBMITTALS

A. Product Data: For each type of water heater indicated. Include accessories, appurtenances, equipment, and equipment supports. Include all materials and finishes, dimensions, and construction installation details.

B. Operation and Maintenance Data: For water heaters to include operation and maintenance manuals, certifications by testing agencies, and manufacturer written warranties to be included in the final O & M Manuals.

C. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

D. Coordination Drawings: Water heaters, drawn to scale, and coordinated with each other, using input from installers of the items involved:

1. Piping connections. Include size, location, and elevation of each.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance:
1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Domestic-Water Booster Heaters:

1) Controls and Other Components: Five years.

b. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Five years.

c. Electric, Tankless, Domestic-Water Heaters: Five year(s).
d. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 ELECTRIC, STORAGE WATER HEATERS **(EWH-1)**:

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Rheem Manufacturing Co.
2. A. O. Smith Corp.
3. Laars Heating Systems, Inc.
4. Lochinvar, LLC.

B. Standard: UL 1453.

C. Storage-Tank Construction: ASME-code, steel, vertical arrangement.

1. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

a. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
b. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

2. Pressure Rating: 150 psig.
3. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending lining material into tappings.

D. Factory-Installed Storage-Tank Appurtenances:

1. Anode Rod: Replaceable.
2. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
3. Insulation: Comply with ASHRAE/IESNA 90.1.
4. Jacket: Steel with enameled finish.
5. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
6. Temperature Control: Adjustable thermostat.
7. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
8. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

E. Special Requirements: NSF 5 construction

F. Capacity and Characteristics:

1. Capacity: 55 gal.
2. Recovery: 21 GPH at 90 deg F temperature rise.
3. Temperature Setting: 115 deg F.
4. Power Demand: 6.0 kW.
5. Heating Elements:

   a. Number of Elements: Two.
   b. Kilowatts Each Element: 4.5 kW.

6. Electrical Characteristics:

   a. Volts: 240.
   b. Phases: Single.
   c. Hertz: 60.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. A. O. Smith Corporation.
   b. Honeywell.
   c. TACO Comfort Solutions, Inc.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: 2.1 gal minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.

F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 section "Quality Requirements" for retesting and re-inspecting requirements and Division 01 section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Storage Water Heater Mounting: Install electric, storage water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03 section "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Electric, Tankless, Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General Duty Valves for Plumbing Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater

relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

I. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill electric, domestic-water heaters with water.

K. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Contractor shall verify and adjust delivery water temperatures at water heater to building mixing valve and plumbing fixtures. Supply temperature to the building mixing valve shall not exceed 140 °F. Supply temperatures to fixtures shall not exceed 115 °F. Provide test and inspection reports for final O & M manual.
6. Contractor shall field verify all system thermometers and temperature settings. Replace thermometers that are damaged or not working.
7. Contractor shall field verify and adjust all hot water circulation return balance valves in the building to provide uniform flow throughout out the system and minimize delivery time of hot water to fixtures.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 section "Quality Requirements" for retesting and re-inspecting requirements and Division 01 section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION 223300

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SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acceptable Manufacturers.
2. Protective shielding guards.
3. Fixture supports.
4. Water Closets.
5. Lavatories.
6. Showers.
7. Sinks.
8. Mop Service Sink.
9. Brass Products

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. “ADA ACCESSIBLE” means any plumbing fixture that can be approached, entered, and used in accordance with requirements of the 1990 American with Disabilities Act and the 2008 American with Disabilities Act Amendments Act.

B. “SOLID SURFACE” means nonporous, homogeneous, cast-polymer-plastic material with heat, impact, scratch, and stain resistant qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include each fixture and trim, fittings, accessories, appurtenances, equipment, and fixture supports. Indicate all materials and finishes, dimensions, construction installation details, and flow-control rates.

B. Operation and Maintenance Data: For plumbing fixtures to include operation and maintenance manuals, and manufacturer written warranties to be included in the final O & M Manuals.

C. Submit cut out template data for counter-mounted plumbing fixtures to General Contractor.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in ICC A117.1, “Accessible and Usable Buildings and Facilities”; Public Law 90-480, “Architectural Barriers Act”; and Public Law 101-336, “Americans with Disabilities Act”; for plumbing fixtures for people with disabilities.

B. Regulatory Requirements: Comply with requirements in Public Law 102-486, “Energy Policy Act”, about water flow and consumption rates for plumbing fixtures.

C. NSF Standard: Comply with NSF 61, NSF 62 Annex G and NSF 372 “Drinking Water System Components—Health Effects,” for fixture materials that will be in contact with potable water. The lead content of water system components shall not exceed 0.25 percent by weighted average.

D. Provide all building plumbing systems in compliance with the 2015 International Plumbing Code, all amendments adopted by New York State.

E. Select combinations of fixture and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following acceptable standards and other requirements specified for plumbing fixtures:
   1. Plastic Mop-Service Basins: ANSI Z124.6.
   2. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
   3. Stainless-Steel Sinks: ASME A112.19.3.
   4. Vitreous-China Fixtures: ASME A112.19.2M.
   5. Water-Closet, Flush Valve: ASME A112.19.5.
   6. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
   7. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
   8. Faucets: ASME A112.18.1.
   9. Hose-Connection Vacuum Breakers: ASSE 1011.
   10. Hose-Coupling Threads: ASME B1.20.7.
   11. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
   12. NSF Potable-Water Materials: NSF 61, NSF 62 Annex G and NSF 372.
   13. Pipe Threads: ASME B1.20.1.
   14. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
   15. Supply Fittings: ASME A112.18.1.
   16. Brass Waste Fittings: ASME A112.18.2.
   17. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
   18. Faucets: ASME A112.18.1.
   19. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
   20. Manual-Control Antiscald Faucets: ASTM F 444.
   21. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
   22. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
   23. Atmospheric Vacuum Breakers: ASSE 1001.
   24. Brass and Copper Supplies: ASME A112.18.1.
   25. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
   26. Flexible Water Connectors: ASME A112.18.6.

27. Floor Drains: ASME A112.6.3.
28. Off-Floor Fixture Supports: ASME A112.6.1M.
29. Plastic Toilet Seats: ANSI Z124.5.
30. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
   1. Faucet Washers and O-Rings: Equal to 2 of each type and size installed.
   2. Faucet Cartridges and O-Rings: Equal to 2 of each type and size installed.
   3. Flushometer Valve, Repair Kits: Equal to 2 of each type installed, but no fewer than 12 of each type.
   4. Toilet Seats: Equal to 2 of each type installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The Fixtures and trim listed in this section are basis-of-design products. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

   1. Water Closets, and Lavatories: American Standard, Crane, Kohler, Orsonite, or Zurn.
   2. Water Closet Seats: American Standard, Bemis, Church, Kohler, Orsonite, or Zurn.
   3. Showers: Asker, Lasco, Universal, or Swan.
   4. Bathtubs: American Standard, Eljer, or Kohler.
   5. Faucets: Chicago, Delta, Moen, Symmons, Sloan, or Zurn.
   6. Shower Valves: Acorn, Bradley, Delta, Moen, Powers, Symmons, or Speakman.
   7. Fixture Traps, Stops, and Supplies: Central, Cambridge, Dearborn, McGuire, Wolverine, or T&S Brass.
   8. Mop Basins: Fait, Kohler, Mustee, or Stern-Williams.

2.2 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

   1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:

      a. <u>Engineered Brass Co.</u>
      b. <u>Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.</u>
      c. <u>McGuire Manufacturing Co., Inc.</u>
      d. <u>Plumberex Specialty Products Inc.</u>
      e. <u>TCI Products.</u>
      f. <u>TRUEBRO, Inc.</u>

g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.3 WATER CLOSETS

A. Wall-mounted, Top Spud Water Closet, ADA Accessible **(WC-2)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. American Standard.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC.

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: ADA Accessibility Compliant.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.6 gal. per flush.
   h. Spud Size and Location: NPS 1-1/4; top.
   i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045.
4. Flush Valve: Manual, Dual-Flush Valve for Water Closets.

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) American Standard.
      2) Sloan Valve Company.
      3) Zurn Industries, LLC.

   b. Standard: ASSE 1037.
   c. Minimum Pressure Rating: 125 psig.
   d. Features: Include integral check stop and backflow-prevention device. Manual lever operated with 1.1/1.6 gpf cycle.
   e. Material: Brass body with corrosion-resistant components.
   f. Exposed Flushometer-Valve Finish: Chrome plated.
   g. Housing Finish: Chrome plated.
   h. Style: Exposed.

i. Consumption: 1.1/1.6 gal. per flush.
j. Minimum Inlet: NPS 1.
k. Minimum Outlet: NPS 1-1/4.

5. Toilet Seat: White, heavy-duty, solid plastic toilet seat with non-corrosive 300 series stainless steel posts, and anti-microbial built-in seat protection.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) American Standard.
2) Centoco Manufacturing Group.
3) Church Seats; Bemis Manufacturing Company.
4) Olsonite Seat Co.

b. Standard: IAPMO/ANSI Z124.5.
c. Material: Molded, solid plastic with anti-microbial agent.
d. Type: Commercial (Heavy-duty).
e. Shape: Elongated rim, open front.
f. Hinge: Self-sustaining, check.
g. Hinge Material: Stainless Steel.
h. Seat Cover: Not required.
i. Color: White.

6. Fixture Support: Water Closet Carrier.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Josam Company.
2) MIFAB Manufacturing Inc.
3) Smith, Jay R. Mfg. Co.
4) Tyler Pipe; Wade Div.
5) Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6) Zurn Plumbing Products Group; Specification Drainage Operation.

b. Standard: ASME A112.6.1M.
c. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

2.4 LAVATORIES

A. Lavatory, vitreous china, under-counter mounted, ADA Accessible **(LAV-2)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Standard.
    b. Gerber Plumbing Fixtures LLC.
    c. Kohler Co.
    d. TOTO USA, INC.
    e. Zurn Industries, LLC.

2. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Material: Vitreous china.
    c. Type: For under-counter mounting.
    d. Height: ADA Accessibility Compliant.
    e. Nominal Size: Oval, 19 by 17 inches.
    f. Faucet-Hole Punching: Three holes, 4-inch centers.
    g. Faucet-Hole Location: Top.
    h. Color: White.
    i. Mounting Material: Sealant.

3. Faucet: Manual Faucet for Lavatory

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) American Standard.
        2) Chicago Faucets; Geberit Company.
        3) Moen Incorporated.
        4) Sloan Valve Company.
        5) Zurn Industries, LLC.

    b. Standard: ASME A112.18.1/CSA B125.1.
    c. Features: ADA compliant, Vandal-proof 4-inch wrist blade handles. Pressure compensating spray nozzle.
    d. Body Type: Centerset on 4-inch centers.
    e. Body Material: Commercial, solid brass.
    f. Finish: Chrome Plated.
    g. Maximum Flow Rate: 0.5 gpm.
    h. Mounting Type: Deck, exposed.
    i. Valve Handle(s): None.
    j. Spout: Rigid type.
    k. Spout Outlet: Vandal proof, laminar flow.

4. Drain: Grid, near back of bowl.
5. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated, cast-brass P-trap; NPS 1-1/2, 0.045-inch- thick tubular brass waste with off-set tailpiece to wall; and wall escutcheon.
6. Supplies: NPS 3/8 chrome-plated brass quarter turn stop valves with loose key stops.

2.5 SHOWERS

A. Shower, ADA Accessible **(SHR-1)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Symmons Industries, Inc.
   b. Moen, Inc.
   c. Delta Faucet Company.

2. Fixture:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Body Material: Solid brass.
   c. Finish: Chrome plated
   d. Features: ADA compliant. Integral check valves with service stops and adjustable stop screw to limit handle turn. Flexible 5-foot stainless-steel hose with in-line vacuum breaker. 30” slide/grab bar with chrome plated ADA hand shower wand.
   e. Anti-scale Device: Integral with mixing valve.
   f. Mixing Valve: Thermostatic/pressure balancing
   g. Maximum Flow Rate: 2.0 gpm.
   h. Valve Handle(s): Single, manual lever.
   i. Spout: Hand-wand with adjustable spray pattern.

3. Drain: 2 inch drain as specified in 221319.

2.6 SINKS

A. Sink, stainless steel, under-counter mount, ADA Accessible **(SK-1)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Elkay Manufacturing Company.
   b. Kohler Co.
   c. Moen, Inc.

2. Fixture:

   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Material: 18 gauge 304 stainless steel.
   c. Type: Under-counter mounted.
   d. Nominal Size: 23 by 18 inches.
   e. Height: 5 inches.
   f. Faucet-Hole Punching: Four holes, 8-inch centers + right side water chiller spout.
   g. Drain Location: Rear Center.

3. Faucet: Manual faucet for sink.

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) American Standard.
      2) Chicago Faucets; Geberit Company.
      3) Moen Incorporated.
      4) Sloan Valve Company.
      5) Zurn Industries, LLC.

   b. Standard: ASME A112.18.1/CSA B125.1.
   c. Features: ADA Compliant.
   d. Body Type: Centerset on 8-inch centers.
   e. Body Material: Commercial, solid brass.
   f. Finish: Chrome Plated.
   g. Maximum Flow Rate: 1.5 gpm.
   h. Mounting Type: Deck.
   i. Valve Handle(s): 4-inch wristblade.
   j. Spout: Swing type, restricted to 120-degrees.
   k. Spout Outlet: Vandal proof, laminar flow.

4. Drain: 3-1/2 inch removable basket strainer and rubber stopper, near back of bowl.
5. Drain Piping: NPS 1-1/2 by NPS 1-1/2 chrome-plated, cast-brass P-trap; NPS 1-1/2, 0.045-inch- thick tubular brass waste with off-set tailpiece to wall; and wall escutcheon.
6. Supplies: NPS 3/8 chrome-plated brass quarter turn stop valves with loose key stops.

2.7 Mop Service Sink, **(MB)**:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane/Fiat MSB-3624 or a comparable product by one of the following:

   a. Florestone Products Co., Inc.
   b. Stern-Williams Co., Inc.
   c. Mustee, E. L. & Sons, Inc.
   d. Zurn Plumbing Products Group; Light Commercial Operation.

2. Description: Flush-to-wall, floor mount, cast-polymer fixture with rim guard.

   a. Shape: Rectangular.
   b. Size: 36 inches x 24 inches.
   c. Height: 10 inches.
   d. Tiling Flange: On three sides.
   e. Rim Guard: On front top surfaces.
   f. Wall protection: Stainless steel wall guards for three sides.
   g. Accessories: Mop hanger, and hose and hose bracket.
   h. Color: White or bone.

3. Faucet: Manual faucet for mop basins.

a. Manufacturers: Subject to compliance with requirements, provide Chicago Faucets model 897-RCF or approved equal, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) American Standard.
2) Moen Incorporated.
3) Sloan Valve Company.
4) Zurn Industries, LLC.

b. Standard: ASME A112.18.1/CSA B125.1.
c. Features: Vandal proof, adjustable supply arms, integral check and stop valves for servicing, atmospheric vacuum breaker spout with 3/4 inch male hose thread, pail hook, and wall brace.
d. Body Type: Wall mounted, 8-inch body.
e. Body Material: Commercial, solid brass.
f. Finish: Chrome Plated.
g. Mounting Type: Wall, exposed.
h. Valve Handle(s): Lever.
i. Spout: Rigid type.

4. Drain: Grid, with NPS 3 center outlet.

2.8 BRASS PRODUCTS

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Central Brass.
b. Delta Faucet Company.
c. McGuire Brass.
d. Wolverine Brass
e. T & S Brass and Bronze Works, Inc.
f. Zurn Industries, LLC.

2. Description: Commercial grade, heavy duty, low lead content chrome plated brass products with vandal resistant hardware.

a. Traps: 17 gage cast brass chrome plated with brass slip-nut and deep steel flange, New York State compliant, with brass cleanout plug. Zurn Z-8730-PC to Z-8731-PC series or approved equal.
b. Supplies: Stainless steel hose flexible connectors with brass quarter turn stop valves and loose removable tee keys. Zurn Z-8800LRQ-8860-12-PC to Z8809LRKQ-8860-12-PC series or approved equal.
c. Offset lavatory strainers: Chrome plated brass open grid drain strainer and chrome plated cast brass elbow. 17 gage chrome plated tubular brass offset tailpiece for sink depth to 2-1/2 inches. Zurn Z-8746-PC or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide plumbing fixtures, trim, fittings, and other components according to manufacturer's written instructions.

B. Provide off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Provide carrier supports with waste fitting and seal for back-outlet fixtures.
2. Provide carrier supports without waste fittings for fixtures with tubular waste piping.
3. Provide chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Provide back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Provide wall-mounting fixtures with tubular waste piping attached to supports.

E. Provide fixtures level and plumb according to roughing-in drawings.

F. Provide floor-mounted water closets on closet flange attachments to drainage piping.

G. Provide counter-mounting fixtures in and attached to casework.

H. Provide water-supply piping with quarter turn brass stop valve on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Provide stops in locations where they can be easily reached for operation.

I. Provide trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Provide tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system. Omit trap on indirect waste piping unless otherwise indicated.

K. Provide flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

M. Provide toilet seats on water closets.

N. Provide faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Provide shower flow-control fittings with specified maximum flow rates in shower arms.

P. Provide traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

Q. Provide traps on all ADA accessible lavatories and sinks with trap offset adjacent to wall.

R. Provide protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

S. Provide wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

T. Provide washing machine outlet box in finished wall. Provide flange flush and tight with finished wall surface.

U. Set showers in leveling bed of cement grout. Comply with grout requirements specified in Section 220500 “Common Work Results for Plumbing.”

V. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

W. Ground equipment according to Division 26 Section “Grounding and Bonding for Electrical Systems.”

3.2 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Verify that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

D. Provide for verification of flow rates and outlet temperature at all hot water faucets and showers upon completion of project. Provide a written table of flows and temperature results for the final O&M manuals.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 224719 – WATER STATION WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Remote Water Chiller.

1.2 DEFINITIONS

A. “ADA ACCESSIBLE” means any plumbing fixture that can be approached, entered, and used in accordance with requirements of the 1990 American with Disabilities Act and the 2008 American with Disabilities Act Amendments Act.

1.3 SUBMITTALS

A. Product Data: For each type of drinking fountain indicated. Include each fixture and fittings, accessories, appurtenances, equipment, and fixture supports. Indicate all materials and finishes, dimensions, construction installation details, and flow-control rates.

B. Operation and Maintenance Data: For drinking fountains to include operation and maintenance manuals, and manufacturer written warranties to be included in the final O & M Manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.

C. NSF Standard: Comply with ANSI / NSF 61, NSF 62 – Annex G and NSF 372, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water. Components shall not have a lead content exceeding 0.25 percent by weighted volume.

D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

E. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated. UL 399 and CA/CSA 22.2 No. 120 certified.

F. Provide all building plumbing systems in compliance with the International Plumbing Code of New York State (2015) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 REMOTE WATER CHILLERS

A. Water Chiller Unit **(EWC-1)**:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Elkay Manufacturing Co.
   b. Oasis International, Inc.
   c. Hasley Taylor Company.

2. Material: Finish: 14 gage 304 type stainless steel polished stainless steel.
3. Chilling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat. R-134a refrigerant.

   a. Capacity: 1.5 gph at 50 deg F.
   b. Electrical Characteristics:

      1) Volts: 120.
      2) Phases: Single.
      3) Hertz: 60.
      4) Rated Power: 140 W.

4. Features: Field adjustable thermostat.
5. Faucet: Manual Glass Filler Spout

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) Elkay.
      2) Chicago Faucets; Geberit Company.
      3) T&S Brass, Inc.

   b. Standard: ASME A112.18.1/CSA B125.1.
   c. Body Material: Commercial, stainless-steel.
   d. Finish: Chrome Plated.

e. Mounting Type: Deck, exposed.
f. Valve Handle(s): Manual lever.
g. Spout: Integral rigid.
h. Spout Outlet: Vandal proof, laminar flow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General Duty Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 section "Joint Sealants."

H. Adjust fixture flow regulators for proper flow and stream height.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 CLEANING

A. After installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

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SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Elastomeric hangers.
9. Spring hangers.
10. Post-installed concrete anchors.
11. Concrete inserts.
12. Vibration isolation equipment bases.
13. Restrained isolation roof-curb rails.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. OSHPD: Office of Statewide Health Planning and Development (for the State of California owned and regulated medical facilities).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Include load rating for each wind-force-restraint fitting and assembly.
3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and wind-force-restraint component.
4. Annotate to indicate application of each product submitted and compliance with requirements.

5. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal:

1. For each wind-load protection device that is required by this Section or is indicated on Drawings, submit the following:

    a. Vibration Isolator and Wind-Load-Restraint Selection: Select vibration isolators, wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
    b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
    c. Concrete Anchors and Inserts: Include calculations showing anticipated wind loads.
    d. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
    e. Qualified Professional Engineer: All designated-design submittals for wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
2. Wind-Restraint Detail Drawing:

    a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during wind events. Indicate association with vibration isolation devices.
    c. Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

3. All delegated-design submittals for wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
4. Product Listing, Preapproval, and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.

6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints.

B. Qualification Data: For testing agency.

C. Welding certificates.

D. Air-Spring Mounting System Performance Certification: Include natural frequency, load, and damping test data.

E. Field quality-control reports.

F. Wind-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-force performance certification.

1. Provide equipment manufacturer's written certification for each designated HVAC device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.
2. Provide manufacturer's written certification for each designated louver, damper, or similar device, stating that it will remain in place and protect opening from penetration of windborne debris and comply with all requirements of authorities having jurisdiction.
3. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7 and be acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: an agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design system.
   1. Wind-Load Performance: Equipment shall withstand the effects of high wind events determined in accordance with ASCE/SEI 7-05.

B. Wind-Load Design Calculations:

   1. Perform calculations to obtain force information necessary to properly select wind-load-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-05. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise noted.

      a. Factors indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.
      b. Coordinate design wind-load calculations with vibration isolation requirements. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.

C. Consequential Damage: Provide additional restraints for suspended HVAC components or anchorage of floor-, roof-, or wall-mounted HVAC components as indicated in ASCE/SEI 7-05 so that failure of a non-essential or essential HVAC component will not cause the failure of any other essential architectural, mechanical, or electrical building component.

D. Fire/Smoke Resistance: All components that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

E. Component Supports:

   1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

      a. Kinetics Noise Control, Inc.
      b. Korfund.
      c. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Minimum deflection as indicated on Drawings.
5. Pad Material: Oil- and water-resistant rubber.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.
    a. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CADDY; brand of nVent Electrical plc.
    b. Kinetics Noise Control, Inc.
    c. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.
4. Minimum deflection as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-load control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF VIBRATION AND WIND-LOAD CONTROL DEVICES

A. Provide vibration and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

C. Installation of vibration isolators and wind-load restraints must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

D. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

E. Equipment Restraints:

1. Install snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install wind-load-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.3 ADJUSTING

A. Adjust isolators after system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

END OF SECTION 230548.13

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SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Kolbi Pipe Marker Co.
e. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.3 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Black.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.4 STENCILS

A. Stencils for Piping:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brimar Industries, Inc.
   b. Kolbi Pipe Marker Co.

2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

B. Stencils for Ducts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brimar Industries, Inc.
   b. Kolbi Pipe Marker Co.

2. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brimar Industries, Inc.
   b. Kolbi Pipe Marker Co.

2. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:
1. Refrigerant Piping: Black letters on a safety-white background.

3.5 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
    a. Refrigerant: 1-1/2 inches, round.

END OF SECTION 230553

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

   a. Constant-volume air systems.
   b. Variable-air-volume systems.
   c. Multizone systems.

2. Testing, Adjusting, and Balancing Equipment:

   a. Heat exchangers.
   b. Motors.
   c. Condensing units.

3. Testing, adjusting, and balancing existing systems and equipment.
4. Sound tests.
5. Vibration tests.
6. Duct leakage tests.
7. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.6 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.8 SOUND TESTS

A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at 5 locations as designated by the Architect.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
2. Equipment should be operating at design values.
3. Calibrate the sound-testing meter prior to taking measurements.
4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
5. Record a set of background measurements in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
6. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
7. Take readings no closer than 36 inches from a wall or from the operating equipment and approximately 60 inches from the floor, with the meter held or mounted on a tripod.

8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:

   a. Location.
   b. System tested.
   c. dBA reading.
   d. Sound pressure level in each octave band with equipment on and off.

2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.9 VIBRATION TESTS

A. After systems are balanced and construction is Substantially Complete, measure and record vibration levels on equipment having motor horsepower equal to or greater than 10.

B. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
4. Verify calibration date is current for vibration meter before taking readings.

C. Test Procedures:

1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
4. Record CPM or RPM.
5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:

1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.

3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."
4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.10 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.11 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Equipment with Fans: Plus or minus 10 percent.
2. Exhaust Fans: Plus 10 percent.
3. Air Outlets and Inlets: Plus or minus 10 percent.
   a. Exhaust Air Inlets: Plus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

C. Exhaust air quantities shown on plans are code required airflow and are considered the minimum required.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.

i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.

c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager and commissioning authority.

B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Corning Corporation.
   b. Johns Manville; a Berkshire Hathaway company.
   c. P.I.C. Plastics, Inc.
   d. Speedline Corporation.

2.3 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Childers Brand; H. B. Fuller Construction Products.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.4 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.5 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Avery Dennison Corporation, Specialty Tapes Division.
   b. Compac Corporation.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.
   e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.6 SECUREMENTS

A. Insulation Pins and Hangers:

1. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.
5) Nelson Stud Welding.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. C & F Wire.

2.7 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface.

Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior or first 15 feet from building exterior, whichever is greater.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.6 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.0-lb/cu. ft. nominal density. Installed R-6.1 and K-0.25.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.0-lb/cu. ft. nominal density. Installed R-6.1 and K-0.25.

C. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.0-lb/cu. ft. nominal density. Installed R-6.1 and K-0.25.

END OF SECTION 230713

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.

11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Ductmate Industries, Inc.
   b. McGill AirFlow LLC.
   c. SEMCO, LLC; part of FlaktGroup.

d. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. Sealant shall have a VOC content of 420 g/L or less.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods: Galvanized-steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. For round ducts in finished spaces use O-ring type joints.

D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

E. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure; A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: 45-degree entry high efficiency.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Control dampers.
3. Fire dampers.
4. Flange connectors.
5. Turning vanes.
6. Remote damper operators.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Duct accessory hardware.

B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
2. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.
4. Section 284621.13 "Conventional Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, or BIM model, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed or a minimum of six (6).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Air Balance; a division of MESTEK, Inc.
    b. American Warming and Ventilating; a Mestek Architectural Group company.
    c. Greenheck Fan Corporation.
    d. McGill AirFlow LLC.
    e. Nailor Industries Inc.
    f. Ruskin Company.
    g. United Enertech.

2. Performance:

    a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

3. Construction:

    a. Linkage out of airstream.
    b. Suitable for horizontal or vertical airflow applications.

4. Frames:

    a. Hat-shaped, 16-gauge-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized steel; 16 gauge thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.

8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.3 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Carnes Company.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff.
7. Ruskin Company.
8. Safe Air - Dowco Products.
9. United Enertech.
10. Young Regulator Company.

B. General Requirements:

1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:
   a. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.

3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:

    a. Hat, U, or angle shaped.
    b. 16-gauge-thick, galvanized sheet steel.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple blade with maximum blade width of 6 inches.
    b. Parallel-blade design.
    c. Galvanized steel.
    d. 16-gauge-thick single skin or 14-gauge-thick air foil dual skin.

5. Blade Edging Seals:

    a. Replaceable Closed-cell neoprene.

6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; galvanized steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
9. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.

E. Damper Actuator - Electric:

1. Electric - 24 V ac.
2. UL 873, plenum rated.
3. Two position.

    a. Sufficient motor torqueto drive damper fully open and fully closed with adequate force to achieve required damper seal.
    b. Minimum 90-degree drive rotation.

4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:

    a. Temperature: Minus 40 to plus 130 deg F.
    b. Humidity: 5 to 95 percent relative humidity noncondensing.

6. Environmental enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection.

F. Controllers, Electrical Devices, and Wiring:
1. Electrical Connection: 24 V, 60 Hz.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Air Balance; a division of MESTEK, Inc.
2. Greenheck Fan Corporation.
3. Ruskin Company.
4. United Enertech.

B. Type: dynamic; rated and labeled in accordance with UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed galvanized sheet steel, interlocking full-length steel blade connectors. Material gauge is to be in accordance with UL listing.

I. Horizontal Dampers: Include blade lock and stainless steel closure spring.

J. Heat-Responsive Device:

1. Replaceable, 165 deg F rated, fusible links.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.
2. DynAir; a Carlisle Company.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Aero-Dyne Sound Control Co.
2. Ductmate Industries, Inc.
3. Duro Dyne Inc.
4. DynAir; a Carlisle Company.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

D. Vane Construction:

1. Double wall.

2.7 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Aluminum.

D. Cable: Steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Steel.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.

3. McGill AirFlow LLC.
4. Ruskin Company.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. 24-gauge-thick galvanized steel door panel.
d. Vision panel.
e. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
f. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

a. 24-gauge-thick galvanized steel or 0.032-inch-thick aluminum frame.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Materials: Flame-retardant or noncombustible fabrics.

E. Coatings and Adhesives: Comply with UL 181, Class 1.

F. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

G. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.10 DUCT ACCESSORY HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Hardcast; a Carlisle Company.
4. United Enertech.
5. Ward Industries; a brand of Hart & Cooley, Inc.

B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

H. Install fire dampers in accordance with UL listing.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. Control devices requiring inspection.
8. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Operate fire dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

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SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Louver face diffusers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 ROUND CEILING DIFFUSERS (Type 2)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek company.
2. Carnes Company.
3. Price Industries.
4. Titus, a division of Air System Components; Johnson Controls, Inc.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, white.

E. Face Style: Plaque face.

F. Mounting: Duct connection.

G. Pattern: Fully adjustable.

H. Dampers: Radial opposed blade.

I. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.2 RECTANGULAR AND SQUARE CEILING DIFFUSERS (Type 1)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek company.
2. Carnes Company.
3. Price Industries.
4. Titus, a division of Air System Components; Johnson Controls, Inc.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, white.

E. Face Size: 24 by 24 inches.

F. Face Style: Plaque.

G. Mounting: T-bar.

H. Pattern: Adjustable.

I. Dampers: Radial opposed blade.

J. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

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SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adjustable blade face registers.
2. Fixed face registers and grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register (Type 3):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anemostat Products; a Mestek company.
b. Carnes Company.
c. Price Industries.
d. Titus, a division of Air System Components; Johnson Controls, Inc.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw.
9. Damper Type: Multishutter.

B. Fixed Face Register (Type A):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anemostat Products; a Mestek company.
   b. Carnes Company.
   c. Price Industries.
   d. Titus, a division of Air System Components; Johnson Controls, Inc.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw.
8. Damper Type: Multishutter.

2.2 GRILLES

A. Fixed Face Grille (Type A):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anemostat Products; a Mestek company.
   b. Carnes Company.
   c. Price Industries.
   d. Titus, a division of Air System Components; Johnson Controls, Inc.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

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SECTION 237219 - FIXED PLATE AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed-plate total heat exchangers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For air-to-air energy recovery equipment.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For air-to-air energy recovery equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of air-to-air energy recovery equipment.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

B. Seismic Qualification Data: Certificates, for air-to-air energy recovery equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean, dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breakage, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
3. Replace installed products damaged during construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE Compliance:

1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat/Energy Exchangers."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Comply with ASTM E84 or UL 723.

F. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to detail fabrication and assembly of air-to-air energy recovery equipment.

2.2 CAPACITIES AND CHARACTERISTICS See Schedules

2.3 FIXED-PLATE TOTAL HEAT EXCHANGERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CORE Energy Recovery Solutions.
2. Mitsubishi Electric Sales Canada Inc.
3. RenewAire.

B. Casing: Galvanized steel.

C. Core: Sealed, and arranged for counter airflow.

1. Plate Material and Coating: Chemically treated paper, or polymer, with selective hydroscopicity, moisture permeability, and gas barrier properties.

D. Maximum Differential Pressure: Suitable for maximum 6-inch wg.

E. Maximum Temperature: Suitable for maximum 194 deg F.

2.4 SOURCE QUALITY CONTROL

A. AHRI 1060 Certification: Certified according to AHRI 1060.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.

1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

B. Install units with clearances for service and maintenance.

C. Comply with requirements for ductwork specified in Section 233113 "Metal Ducts."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260529 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 250526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper water wash control and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

B. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed.
4. Verify water wash mechanism operation.

B. Starting procedures for air-handling units include the following:

1. Energize water wash motor and verify proper operation of motor and water wash system.
2. Measure and record motor electrical values for voltage and amperage.

3.7 ADJUSTING

A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.8 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-to-air heat recovery unit, and after completing startup service, clean unit to remove foreign material and construction dirt and dust.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fixed-plate air-to-air energy recovery units.

END OF SECTION 237219

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Daikin AC.
2. Lennox Industries, Inc.; Lennox International.
3. Mitsubishi Electric & Electronics USA, Inc.
4. Samsung HVAC.
5. Trane.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. Fan Motors:

   a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
   c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: Permanent, cleanable.
8. Condensate Drain Pans:

   a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

      1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      2) Depth: A minimum of 2 inches deep.

   b. Single-wall, stainless-steel sheet.
   c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

1) Minimum Connection Size: NPS 1.

d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

   a. Compressor Type: Scroll.
   b. Variable speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
   c. Refrigerant: R-410A.
   d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

D. Drain Hose: For condensate.

E. Wall mounting bracket for outdoor unit.

F. Filter housing and return air inlet.

2.5 CAPACITIES AND CHARACTERISTICS: See Schedules

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:
   1. Mount outdoor unit to wall using wall mounting brackets
   2. Mount indoor unit using elastomeric vibration isolators.
   3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238239.16 - PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Airtherm; a Mestek company.
2. CCI Thermal Technologies, Inc.
3. Engineered Air.
4. Rosemex Products.
5. Trane.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.7 CONTROLS

A. Control Devices:

1. Wall-mounted,fan-speed switch.
2. Wall-mounted thermostat.

2.8 CAPACITIES AND CHARACTERISTICS: See Schedule

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in forelectrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with wall mounting bracket and all-thread hanger rods and elastomeric hangers.

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

END OF SECTION 238239.16

SECTION 238323 - RADIANT-HEATING ELECTRIC PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes prefabricated radiant-heating electric panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For electric heating panels.

1. Include plans, sections, details, and attachments to other work.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating panels to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating panels that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR RADIANT-HEATING ELECTRIC PANELS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PREFABRICATED RADIANT-HEATING ELECTRIC PANELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Markel.
2. QMark; Marley Engineered Products.
3. SSHC, Inc.

B. Description: Sheet-metal-enclosed panel with heating element suitable for recessed mounting. Comply with UL 2021.

1. Panel: Minimum 0.0276-inch-thick, galvanized sheet steel back panel riveted to minimum 0.0396-inch-thick, galvanized sheet steel front panel with fused-on crystalline surface.
2. Heating Element: Powdered graphite sandwiched between sheets of electric insulation.
3. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
4. Exposed-Side Panel Finish: Baked-enamel finish in manufacturer's custom paint color as selected by Architect.
5. Surface-Mounted Trim: Sheet metal with baked-enamel finish in manufacturer's custom paint color as selected by Architect.

C. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F; with contacts suitable for low-voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.

D. Capacities and Characteristics: See Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating panels for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces in contact with electric heating panels are free of burrs and sharp protrusions.
2. Ensure surfaces and substrates are level and plumb.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install radiant-heating panels level and plumb.

B. Support for Radiant-Heating Panels in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling-support-system rods or wires for each panel. Locate not more than 6 inches from panel corners.
2. Support Clips: Fasten to panel and to ceiling grid members at or near each panel corner with clips designed for the application.
3. Panels of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support panels independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

C. Verify locations of thermostats with Drawings and room details before installation. Install devices 60 inches above finished floor.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operate electric-heating elements through each stage to verify proper operation and electrical connections.
2. Test and adjust controls and safeties.

B. Radiant-heating electric panels will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed radiant-heating electric panels from damage during construction.

B. Remove and replace damaged radiant-heating electric panels.

END OF SECTION 238323

SECTION 260100 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Summary of Work:

1. Provide all materials, equipment, labor, wiring, connections, and all accessories for the complete installation of the following basic systems. All systems to be fully functional and operational, and installed in a neat and first-class workmanship like manner:

   a. Raceways, wiring, boxes, enclosures, supports.
   b. Panelboards (reference only)
   c. Branch circuits, wiring devices, equipment connections
   d. Circuit breakers, overload devices, disconnects
   e. Luminaires, ballasts, lamps, switches, controls, occupancy sensors
   f. Special systems: Telecommunications, fire alarm, nurse call, security, access control, cable television

B. Drawings and Specifications:

1. The drawings are schematic in intent, and indicate the approximate location and general arrangement of systems to be installed as part of this contract. The specifications include a description of products and materials to be used, as well as general installation requirements. Equipment furnished by owner (RPCI).
2. Install all equipment in complete compliance with manufacturer's instructions, applicable codes and ordinances, and in a neat, workmanlike manner. For existing core and shell conditions, field inspect all existing conditions, and identify any obstacles or interference which may obstruct the execution of the work. Notify Engineer prior to execution of the work, for appropriate resolution.
3. Refer to Drawings G-011 and G-012 for fire rated construction information.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply in the fullest extent with NFPA 70, National Electrical Code.

1.3 CODES, STANDARDS, REGULATORY AGENCIES

A. Perform all work in complete accordance with the latest edition of each of the following:

1. International Building Code 2018 (IBC 2018)

2. N.Y.S. Uniform Fire Prevention and Building Code 2010
3. National Fire Protection Association Standards

   a. National Electrical Code NFPA 70 2017
   b. National Fire Alarm and Signalling Code NFPA 72 2016

4. All applicable Federal, State, and local codes and ordinances

B. All electrical equipment and materials shall be U.L. (Underwriter's Laboratories) listed.

C. Requirements of other standards agencies apply, including IEEE, ANSI, NEMA, and are referred in specification sections.

1.4 INSPECTIONS

A. Obtain an electrical inspection by the City of Buffalo, Correct any deficiencies cited by the inspecting authority or authority having jurisdiction. Deliver a certificate of inspection to the Owner at the completion of the work.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Submittals

1. Submit manufacturer's product information, performance data, sizes, capacities, for all equipment to the Engineer for approval, prior to ordering equipment, or beginning the work, for the following equipment and materials:

   a. Luminaires and lamps
   b. Circuit breakers, controllers, panelboards (if any)
   c. Conduit, fittings, raceways, boxes, enclosures
   d. Wire, connectors
   e. Hangers and supports

2. Equipment Specified:
   1. Upon receipt of a Contract, the Contractor must prepare submittals, and upon approval, must order the equipment and materials on a timely basis, and without undue delay. Substitutions are subject to owners approval and furnished equipment by owner to be coordinated.

B. Provide coordination shop drawings for review and approval by the Engineer prior to installing the work. Shop drawings shall include wiring diagrams, riser diagrams, and scale floor plans showing exact sizes, device and equipment locations, arrangements, zone and circuit numbers, and interferences for the following systems:

1. Lighting, photometric calculations, refer to luminaire specification section.

1.6 MAINTENANCE MANUALS AND RECORD DOCUMENTS

A. At the completion of the work, provide complete maintenance manuals, bound in three ring binders to the Owner. Include all maintenance information for all equipment furnished under this Contract.

B. Record the location of all equipment, fixtures, outlets, and feeders. Record the arrangement of branch circuits and circuit numbers as actually installed, if different from that shown on the Contract Drawings. Provide sets to Engineer at the completion of the work. Photocopied sets of neat and legible red marked sets are acceptable.

1.7 COORDINATION

A. Coordinate the work with the other contractors working on this project; adjust the location of the work to accommodate obstacles encountered; relocate obstacles where required, or as directed by the Architect.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

1.8 MANUFACTURER’S INSTALLATION INSTRUCTIONS

A. Install all equipment in complete compliance with manufacturer's installation instructions. Where these differ from the requirements of applicable codes and ordinances, or the Contract Documents, bring to the attention of the Engineer for resolution.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEMPORARY POWER

A. Coordinate requirements with local power utility provider to provide metered temporary power and lighting to include NEMA 3 distribution equipment on site.

3.2 ELECTRICAL EQUIPMENT INSTALLATION

A. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

B. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

B. Dry Locations: Steel materials.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lbminimum design load for each support element.

D. Refer to Division 26 Section "Hangers and Supports for Electrical Systems" for additional information.

3.4 SUPPORT INSTALLATION

A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.

C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.

D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:

1. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.
2. Existing Concrete: Expansion bolts .
3. Structural Steel: Welded threaded studs or Spring-tension clamps.

    a. Comply with AWS D1.1 for field welding.

4. Light Steel Framing: Sheet metal screws.
5. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.
6. Light Steel: Sheet-metal screws.
7. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

F. Refer to Division 26 Section "Hangers and Supports for Electrical Systems" for additional information.

3.5 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Refer to Division 26 Section "Identification for Electrical Systems" for additional information.

3.6 DEMOLITION (Core and Shell)

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.7 CUTTING AND PATCHING (Existing)

A. Cut, channel, chase, rout, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION 260100

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Aluminum building wire.
3. Metal-clad cable, Type MC.
4. Fire-alarm wire and cable.
5. Connectors and splices.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
2. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
3. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.3 DEFINITIONS

A. PV: Photovoltaic.

B. RoHS: Restriction of Hazardous Substances.

C. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpha Wire Company.
2. Belden Inc.
3. General Cable; Prysmian Group North America.
4. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems; Atkore International.
2. Belden Inc.
3. General Cable; Prysmian Group North America.
4. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

H. Armor: Aluminum, interlocked.

I. Jacket: PVC applied over armor.

2.3 FIRE-ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Allied Wire & Cable Inc.
2. CommScope, Inc.
3. Genesis Cable Products; Honeywell International, Inc.
4. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG or size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. 3M Electrical Products.
2. Hubbell Incorporated, Power Systems.
3. Ideal Industries, Inc.
4. Service Wire Co.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway Type USE, single conductor in raceway Mineral-insulated, metal-sheathed cable, Type MI Multiconductor cable, Type SE.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, or Metal-clad cable, Type MC.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system.

    a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

D. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Owner will engage qualified testing agency to administer and perform tests and inspections.
2. Engage qualified testing agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
b. Test bolted connections for high resistance using one of the following:

1) A low-resistance ohmmeter.
2) Calibrated torque wrench.
3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.
d. Inspect for correct identification.
e. Inspect cable jacket and condition.
f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test Wells
2. Ground rods.
3. Ground rings.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

   1) Ground rods.
   2) Ground rings.

b. Instructions for periodic testing and inspection of grounding features at ground rings based on NFPA 70B.

   1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
   2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   1. ABB, Electrification Products Division.
   2. Burndy; Hubbell Incorporated, Construction and Energy.
   3. Galvan Industries, Inc.; Electrical Products Division, LLC.
   4. Siemens Industry, Inc., Energy Management Division.

2.3 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper, copper lugs. Rated for 600 A.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

   a. Material: Tin-plated aluminum.
   b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

C. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 10 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.

6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

F. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 FENCE GROUNDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.
3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service

entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

F. Grounding system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

I. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

    a. Slotted support systems, hardware, and accessories.
    b. Clamps.
    c. Hangers.
    d. Sockets.
    e. Fasteners.

2. Include rated capacities and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. B-line; Eaton, Electrical Sector.
b. CADDY; nVent.
c. G-Strut.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel or Stainless steel, Type 316.
4. Channel Width: Selected for applicable load criteria.
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel and malleable-iron or Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Hilti, Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Hilti, Inc.
        2) B-line; Eaton, Electrical Sector.
        3) CADDY; nVent.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Provide stainless steel slotted support systems in areas that will be exposed to the environment.

E. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

F. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

G. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

a. Coordinate additional bracing requirements with Architect prior to construction start.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.
2. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
3. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit; Atkore International.
b. NEC, Inc.
c. Southwire Company.
d. Wheatland Tube; Zekelman Industries.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.

4. EMT: Comply with ANSI C80.3 and UL 797.
5. FMC: Comply with UL 1; zinc-coated steel.
6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit; Atkore International.
b. NEC, Inc.
c. Southwire Company.
d. Wheatland Tube; Zekelman Industries.

2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.

5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: Setscrew or compression.

7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AFC Cable Systems; Atkore International.
    b. Condux International, Inc.
    c. Topaz Lighting & Electric.

2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. ENT: Comply with NEMA TC 13 and UL 1653.
4. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
5. LFNC: Comply with UL 1660.
6. Rigid HDPE: Comply with UL 651A.
7. Continuous HDPE: Comply with UL 651A.
8. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D3485.
9. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AFC Cable Systems; Atkore International.
    b. Condux International, Inc.

c. Topaz Lighting & Electric.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

a. Fittings for LFNC: Comply with UL 514B.

4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Crouse-Hinds; Eaton, Electrical Sector.
2. Hubbell Incorporated.
3. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

M. Gangable boxes are prohibited.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 Type 3R Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Armorcast Products Company.
b. NewBasis.
c. Oldcastle Infrastructure Inc.; CRH Americas.
d. Quazite; Hubbell Incorporated, Power Systems.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." or “COMMUNICATIONS” per drawing notes.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
9. Tier Rating: All handholes shall be certified Tier 15 unless otherwise noted.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC IMC RNC, Type EPC-40-PVC RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: IMC EMT RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

C. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

D. Minimum Raceway Size: 3/4-inch trade size.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection

1. Outdoors:

    a. Type 3R unless otherwise indicated.
    b. Locations Exposed to Hosedown: Type 4.
    c. Locations Subject to Potential Flooding: Type 6P.
    d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.

e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.

2. Indoors:

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: Type 12.
c. Locations Exposed to Hosedown: Type 4.
d. Locations Exposed to Brief Submersion: Type 6.

C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:

1. Provide cast-metal boxes.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 102 for installation of aluminum raceways.
6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts.[**Install insulated throat metal grounding bushings on service conduits**].
9. Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.[**Install insulated throat metal grounding bushings on service conduits**].

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.

3. Install no more than equivalent of three 90-degree bends in conduit run[**except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted**]. Support within 12 inch of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Conduit extending from interior to exterior of building.
    d. Conduit extending into pressurized duct and equipment.
    e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    f. Where otherwise required by NFPA 70.

9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
10. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
11. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
12. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Requirements for Installation of Specific Raceway Types:

1. Types FMC, LFMC, and LFNC:

    a. Comply with NEMA RV 3. Provide a maximum of 36 inch of flexible conduit for recessed and semi recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

    b. .

D. Raceways Embedded in Slabs:

1. Run raceways larger than metric designator 27 (trade size 1) below concrete slab..
2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
3. Arrange raceways to ensure that each is surrounded by a minimum of 2 inch of concrete without voids.
4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
5. Change EMT (indoors) or RMC (outdoors) before rising above floor.

E. Stub-ups to Above Recessed Ceilings:

1. Provide EMT, IMC, or ERMC for raceways.
2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
2. EMT: Provide compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

G. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

3.4 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
2. Provide gaskets for wallplates and covers.

3.5 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, 36” below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

B. Comply with requirements in Section 260544 “Sleeves and Sleeve Seals for Electrical Raceways and Cabling.”

3.7 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.8 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

2.2 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.4 FOAM SEALANTS

A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:

1. Install cast-iron pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
2. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with expanding foam without leaving voids.

D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes.
5. Signs.
6. Cable ties.
7. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible labels with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Brady Corporation.
   b. Emedco.
   c. Panduit Corp.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

   a. 1-1/2 by 6 inches for raceway and conductors.
   b. 3-1/2 by 5 inches for equipment.
   c. As required by authorities having jurisdiction.

2.4 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated-Acrylic or Melamine-Plastic Signs:
   1. Engraved legend.
   2. Thickness:

      a. For signs up to 20 sq. in., minimum 1/16 inch thick.
      b. For signs larger than 20 sq. in., 1/8 inch thick.
      c. Engraved legend with white letters on a dark gray background.
      d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
      e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   1. HellermannTyton.
   2. Ideal Industries, Inc.
   3. Marking Services, Inc.
   4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F according to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F according to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches from cable end.

I. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

J. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows:

a. Local Area Network.
b. Fire Alarm
c. Area of Rescue Assistance
d. Public Address System

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.
3. Faceplate number.

E. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels.
2. Patch Panels: Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.
3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:

a. Room number being served.
b. Colon.
c. Faceplate number.

F. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

G. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:

1. Room number.
2. Colon.
3. Faceplate number.

H. Instructional Signs: Self-adhesive labels.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

J. Equipment Identification Labels:

1. Indoor Equipment: Laminated-acrylic or melamine-plastic sign.
2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
3. Equipment to Be Labeled:

a. Communications cabinets.
b. Uninterruptible power supplies.
c. Fire-alarm and suppression equipment.
d. Egress points.
e. Power distribution components.
f. Area of Rescue Assistance components.

END OF SECTION 270553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electronic time switches.
2. Outdoor photoelectric switches, low voltage.
3. Indoor occupancy and vacancy sensors.
4. Switchbox-mounted occupancy sensors.
5. Lighting contactors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

   a. Occupancy sensors.
   b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which equipment will be attached.
3. Items penetrating finished ceiling, including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Control modules.
    g. Fire alarm devices.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Faulty operation of lighting control software.
    b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ELECTRONIC TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
2. Contact Configuration: DPDT.
3. Contact Rating: 30-A inductive or resistive, 240-V ac.
4. Programs:

    a. Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.

5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: All channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, FLEXIBLE MOUNTING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.

B. Description: Solid state, with DPDT dry contacts rated for 1000 W incandescent, to operate 2 separately connected relay, contactor coils, or microprocessor input circuits; complying with UL 773A, and compatible with ballasts and LED lamps.

1. Listed and labeled as defined in NFPA 70, by NRTL, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with ANSI C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure from same source and manufacturer as switch.
6. Failure Mode: Luminaire stays ON.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, LUMINAIRE-MOUNTED

A. Where indicated on drawings or schedules provide luminaire manufacturer’s integral photoelectric control device.

2.4 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Hubbell Control Solutions; Hubbell Incorporated, Lighting.
3. Leviton Manufacturing Co., Inc.
4. WattStopper; Legrand North America, LLC.

B. General Requirements for Sensors:

1. Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
2. Dual technology.
3. Integrated or Separate power pack.
4. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. Operation:

    a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

6. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A.
7. Power: Line voltage.
8. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
9. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

10. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
11. Bypass Switch: Override the "on" function in case of sensor failure.
12. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Hubbell Control Solutions; Hubbell Incorporated, Lighting.
3. Leviton Manufacturing Co., Inc.
4. WattStopper; Legrand North America, LLC.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.
5. Faceplate: Color as selected by Architect.

2.6 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Leviton Manufacturing Co., Inc.
3. Square D; Schneider Electric USA.

B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SENSORS

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 INSTALLATION OF CONTACTORS

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 INSTALLATION OF WIRING

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.

D. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 260936 - MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall-box multiscene dimming controls.
2. Multipreset modular dimming controls.
3. Conductors and cables.

1.3 DEFINITIONS

A. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.

B. Low Voltage: As defined in NFPA 70, the term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.

C. RFI: Radio-frequency interference.

D. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.

E. SCR: Silicon-controlled rectifier.

F. Zone: A luminaire or group of luminaires controlled simultaneously as a single entity. Also known as a "channel."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
2. Device plates and plate color and material.
3. Ballast and lamp combinations compatible with dimmers.
4. Sound data including results of operational tests of central dimming controls.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.

1. Include elevation views of front panels of control and indicating devices and control stations.
2. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For standalone multipreset modular dimming controls to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of standalone multipreset modular dimming controls that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Damage from transient voltage surges.

2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Douglas Lighting Controls.
2. Leviton Manufacturing Co., Inc.
3. Lutron Electronics Co., Inc.
4. Signify North America Corporation (formerly Philips Lighting).

2.2 SYSTEM DESCRIPTION

A. Compatibility:

1. Dimming control components shall be compatible with luminaires.
2. Dimming control devices shall be compatible with lighting control system components specified in Section 260923 "Lighting Control Devices."

B. Dimmers and Dimmer Modules: Comply with UL 508.

1. Audible Noise and RFI Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or RFI. Modules shall include integral or external filters to suppress audible noise and RFI.
2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

C. Capacities: Unit shall be rated for 2400 W at 240-V ac and 2000 W at 120-V ac for up to 100 devices or zones.

D. Surge Protection: Withstand supply power surges without impairment to performance.

1. System Devices: 6000 V, 3000 A, complying with IEEE C62.41.1 and IEEE C62.41.2.

E. Off Control Position: User-selected off position of any control point shall disconnect the load from line supply.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CONDUCTORS AND CABLES

A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than [**No. 18**] [**No. 22**] [**No. 24**] AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING

A. Comply with NECA 1.

B. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.

D. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Label each dimmer module with a unique designation.

C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

    a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

C. Dimming control components will be considered defective if they do not pass tests and inspections.

D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls.

B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

END OF SECTION 260936

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Source quality-control reports.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings except for taps.

1. Coil Material: Copper.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Bolted.

D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

E. Enclosure: Ventilated.

1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.

a. Finish Color: Gray weather-resistant enamel.

F. Enclosure: Totally enclosed, nonventilated.

1. NEMA 250, Type 4X, Stainless Steel: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

G. Taps for Transformers 3 kVA and Smaller: One 5 percent tap above normal full capacity.

H. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.

I. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

J. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

K. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

L. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

M. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding the indicated insulation class in a 40 deg C maximum ambient and a 24-hour average ambient of 30 deg C.
2. Indicate value of K-factor on transformer nameplate.
3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with a K-factor equal to one.

N. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.

O. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.

P. Wall Brackets: Manufacturer's standard brackets.

Q. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

1. 9.00 kVA and Less: 40 dBA.
2. 9.01 to 30.00 kVA: 45 dBA.
3. 30.01 to 50.00 kVA: 45 dBA for K-factors of 1, 4, and 9.
4. 50.01 to 150.00 kVA: 50 dBA for K-factors of 1, 4, and 9.
5. 150.01 to 300.00 kVA: 55 dBA for K-factors of 1, 4, and 9.
6. 300.01 to 500.00 kVA: 60 dBA for K-factors of 1, 4, and 9.
7. 500.01 to 700.00: 62 dBA for K-factors of 1, 4, and 9.
8. 700.01 to 1000.00: 64 dBA for K-factors of 1, 4, and 9.

2.4 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
2. Ratio tests at rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:

    a. High-voltage to ground.
    b. Low-voltage to ground.
    c. High-voltage to low-voltage.

9. Temperature tests.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
2. Brace wall-mounted transformers as specified in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, and grounding.
c. Verify that resilient mounts are free and that any shipping brackets have been removed.
d. Verify the unit is clean.
e. Perform specific inspections and mechanical tests recommended by manufacturer.
f. Verify that as-left tap connections are as specified.
g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.
b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

F. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, and grounding.

c. Verify that resilient mounts are free and that any shipping brackets have been removed.
d. Verify the unit is clean.
e. Perform specific inspections and mechanical tests recommended by manufacturer.
f. Verify that as-left tap connections are as specified.
g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.
b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
c. Perform power-factor or dissipation-factor tests on all windings.
d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
e. Perform an excitation-current test on each phase.
f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

G. Remove and replace units that do not pass tests or inspections and retest as specified above.

H. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

I. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.

2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

QUALITY ASSURANCE

B. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.9 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

F. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

   a. Plating shall run entire length of bus.
   b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
7. Split Bus: Vertical buses divided into individual vertical sections.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Compression type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

G. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

G. Mount top of trim 90 inches above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box.

I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box, provide trim ring.

J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

P. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. Lighting switches, 120/277 V, 20 A.
5. Occupancy sensors.
6. Digital timer light switches.
7. Wall-box dimmers.
8. Wall plates.
9. Floor service fittings.
10. Poke-through assemblies.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with requirements in this Section.

F. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

G. Device Color:

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.

H. Wall Plate Color: For plastic covers, match device color.

I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
   d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

2.3 USB RECEPTACLES

A. USB Charging Receptacles:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
   d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 1310 and USB 3.0 devices.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
   d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.

5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.5 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
   d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Configuration: NEMA WD 6, Configuration L5-20R or as indicated on drawings.
3. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 120 V, 50 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour; Legrand North America, LLC.

2. Configuration: NEMA WD 6, Configuration L5-50R.
3. Standards: Comply with UL 498.

2.6 LIGHTING SWITCHES, 120/277 V, 20 A

A. General Requirements: Provide push button lighting control devices to function with control modules as indicated in drawings and details.

1. Provide push button control devices as indicated in drawing details.

   a. Two button: On/Off
   b. Four button: On/Off with dimming control

B. Single-Pole Toggle Switches, 120/277 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
b. Leviton Manufacturing Co., Inc.
c. Pass & Seymour; Legrand North America, LLC.
d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Description: Factory-supplied key in lieu of switch handle.

3. Standards: Comply with UL 20 and FS W-S-896.

2.7 TIMER LIGHT SWITCH

A. Digital Timer Light Switch: (‘T’ designation)

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
b. Leviton Manufacturing Co., Inc.
c. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

2. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10-minute increments.
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. Integral relay for connection to BAS.

2.8 DIMMERS

A. General Requirements: Provide dimming control modules per drawings and details to function with lighting control devices indicated.

2.9 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.10 FLOOR SERVICE FITTINGS

A. Flush-Type Floor Service Fittings:

1. Manufacturers: As indicated on drawings.

2. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
3. Compartments: Barrier separates power from voice and data communication cabling.
4. Service Plate and Cover: Rectangular, die-cast aluminum with satin finish.
5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

    a. Provide GFCI protection in wet or damp locations.

6. Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for twisted pair cable, complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Coordinate with Architect to select device and plate colors.
2. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
3. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
4. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
5. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262733 - POWER DISTRIBUTION UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes prepackaged power distribution units for distributing electrical power.

B. Pedestal Mounted Unit

C. Surface Mounted Unit for RV Parking areas

1.3 DEFINITIONS

A. SPD: Surge protection device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for power distribution units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power distribution units to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.

B. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

1.7 FIELD CONDITIONS

A. Environmental Conditions: Units shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability.

1. Storage Temperature Range: Minus 67 to plus 185 deg F.
2. Operating Temperature Range: 32 to 104 deg F.
3. Relative Humidity Range: 0 to 95 percent, noncondensing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design Basis: Milbank Manufacturing
4801 Deramus Ave.
Kansas City, MO 64120

B. Source Limitations: Obtain power distribution unit and associated components specified in this Section from a single manufacturer with responsibility for entire power distribution unit installation.

2.2 MANUFACTURED UNITS

A. Description: Integrated and coordinated assembly of power-line-conditioning and distribution components packaged in a single pad mounted NEMA 3R rated pedestal mounted cabinet or modular assembly of cabinets. Include the following components:
1. Branch circuit-breaker section.
2. Branch circuit receptacles

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. Wiring Access: Bottom wiring access.

E. Unit Capacity Rating: Carry indicated rms kilovolt-ampere load continuously without affecting the normal operation of the circuit breakers, monitoring system, or unit controls and without exceeding rated insulation temperature for the following input voltage and load current:

1. Input Voltage: Within rated input-voltage tolerance band of unit.
2. Load Current: Minimum of 3.0 crest factor and 85 percent total harmonic distortion.

2.3 BRANCH CIRCUIT BREAKER SECTION

A. Description: Circuit breaker section complying with Section 262416 "Panelboards" except for mounting provisions.

1. Construction: 6 pole, 120/208, single phase; capable of accepting branch circuit breakers rated to 50 A.
2. Panelboard Rating: 125A, with main circuit breaker.
3. Panelboard Phase, Neutral, and Ground Buses: Copper, with neutral bus at least 1.732 times the nominal phase bus rating.
4. Isolated Ground Bus: Copper, adequate for branch-circuit equipment ground conductors; insulated from supports.
5. Branch Circuit Breakers: Plug on.
6. Cable Racks: Removable and arranged for supporting and routing cables for section entrance.
7. Access Panels: Arranged so additional branch-circuit wiring can be installed and connected in the future.
8. All provided circuit breakers to be GFCI type.

2.4 BRANCH CIRCUIT RECEPTACLES

A. Comply with provisions of Section 262726 – “Wiring Devices”.

B. Provide the following:

1. VIP Area pedestals:
   a. One L14-50
   b. Three L5-20
2. RV Surface Mount:
   a. One L14-50
   b. One TT30R
   c. One 20A GFCI
3. Refer to drawings for configuration

2.5 PEDESTAL ENCLOSURE REQUIREMENTS

A. A single, pad-mounted NEMA Type 3 enclosure. Opening of an exterior door shall not provide access to any live parts. Panels and covers that expose hazardous voltages shall require tools to remove.

B. Access from front, top, and side only for all installation, operations, and normal maintenance, including infrared scanning of bus and breakers. All normal operating controls and instrumentation shall be located on the front of the enclosure.

2.6 SURFACE MOUNT RV ENCLOSURE REQUIREMENTS

A.

2.7 FINISHES

A. Manufacturer's standard finish over corrosion-resistant pretreatment and primer.

2.8 SOURCE QUALITY CONTROL

A. Factory Tests: Design and routine tests shall comply with referenced standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Arrange power distribution units to provide adequate access to equipment and circulation of cooling air. Locate transformers away from corners and not parallel to adjacent wall surface.

B. Coordinate size and location of concrete bases with actual power distribution unit provided.

C. Equipment Mounting:

1. Install power distribution units on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

D. Identify equipment and install warning signs according to Section 260553 "Identification for Electrical Systems."

E. Coordinate layout and installation of power distribution units with Owner's equipment.

1. Meet jointly with electronic equipment representatives and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute record to other participants.
3. Adjust arrangements and locations of power distribution units to accommodate and optimize arrangement and space requirements of equipment.

3.2 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Separately Derived Systems: Make grounding connections to grounding electrodes as indicated; comply with NFPA 70.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Install flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification for circuit breakers, molded case; and for transformers, dry type, air cooled, low voltage. Certify compliance with test parameters.
2. Perform functional tests of power distribution units throughout their operating ranges. Test each monitoring, status, and alarm function.

D. Remove malfunctioning units, replace with new units, and retest as specified above.

E. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of conductor and bus connections.

1. Use an infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform two follow-up infrared scans of main breaker, transformer, and panelboards, one at 4 months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying connections checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

G. Power distribution unit will be considered defective if it does not pass tests and inspections.

H. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Verify that power distribution units are installed and connected according to the Contract Documents.
2. Verify that electrical wiring installation complies with manufacturer's submittal and with written installation requirements in other electrical Sections.
3. Complete installation and startup checks according to manufacturer's written instructions.

3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain power distribution units.

END OF SECTION 262733

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection system for ordinary structures.

B. Section includes lightning protection system for the following:

1. Open structural steel framing

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
2. Include raceway locations needed for the installation of conductors.
3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
4. Include roof attachment details, coordinated with roof installation.
5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lightning protection cabling attachments to roofing systems and accessories.
2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:

1. UL Master Label Certificate.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: UL-listed installer, category OWAY or LPI Master Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. East Coast Lightning Equipment Inc.
2. ERICO; brand of nVent Electrical plc.
3. Harger Lightning & Grounding; business of Harger, Inc.
4. Heary Bros. Lightning Protection Co. Inc.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class I buildings.

2.3 MATERIALS

A. Air Terminals:

1. Copper or Aluminum unless otherwise indicated.
2. 3/8-inch diameter by 24 inches long.

3. Pointed tip.
4. Integral base support.

B. Class 1 Main Conductors:

1. Stranded Copper: 57,400 circular mils in diameter.

C. Secondary Conductors:

1. Stranded Copper: 26,240 circular mils in diameter.

D. Ground Rods:

1. Material: Copper-clad steel.
2. Diameter: 5/8 inch.
3. Rods shall be not less than 120 inches long.

E. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet of building. Comply with requirements for concealed systems in NFPA 780.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

3.2 CONNECTIONS

A. Above ground concealed connections, and connections in earth or concrete, shall be done by exothermic welds.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: exothermic weld.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Perform inspections as required to obtain a UL Master Label for system.

B. Prepare test and inspection reports and certificates.

END OF SECTION 264113

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixture types as indicated in drawings and defined in schedules.
2. Materials.
3. Luminaire support.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260926 "Lighting Control Panelboards" for panelboards used for lighting control.
3. Section 260936 "Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
4. Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.

1. Include Samples of luminaires and accessories involving color and finish selection.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Globes and Guards: 5 of each type and rating installed.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 5 to 104 deg F.

1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. Refer to the Lighting Fixture Schedule for additional certification requirements.

2.3 FIXTURE REQUIREMENTS.

A. Comply with Lighting Fixture Schedule for fixture types.

B. Nominal Operating Voltage: 277 V ac unless noted otherwise in the drawings and schedules.

C. Lamp:

1. Initial delivered lumens per Lighting Fixture Schedule.
2. Minimum allowable efficacy of 80 lm/W.
3. CRI of minimum 80. CCT per fixture schedule.
4. Rated lamp life of minimum 50,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.

D. Housings per Lighting Fixture Schedule.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes per Lighting Fixture Schedule.

G. With integral mounting provisions.

H. Standards per Lighting Fixture Schedule.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.5 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls or as indicated on drawings.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

   a. Two 5/32-inch- diameter aircraft cable supports to height AFF as indicated on drawings.
   b. Pendant mount with per manufacturer’s recommended diameter aircraft cable supports to height AFF as indicated on drawings.
   c. Hook mount.

2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Luminaire Lighting Controls."

B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 265213 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Comply with the requirements of Sections 265119 - LED Interior Lighting and 265619 - LED Exterior Lighting.

1.2 SUMMARY

A. Section Includes:

1. Exit signs.
2. Inverter Systems.
3. Materials.
4. Luminaire support components.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each product and for each color and texture specified.

D. Samples for Initial Selection: For each type of luminaire with factory-applied finishes.

E. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

F. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each luminaire for tests performed by a qualified testing agency.

E. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70 and UL 924, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Comply with NFPA 101.

C. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.

1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

3. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Comply with requirements on Lighting Fixture Schedule.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Housings: Per lighting fixture schedule.

2.4 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

   a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265213

SECTION 265556 - SPECIAL LIGHTING AND CONTROL SYSTEMS

PART 1 - GENERAL

1.1 PROJECT INFORMATION:

A. Owner: Erie Canal Harbor Development Corporation
B. Architect: Bergmann Associates
C. Consultant: AVL Designs, Incorporated

1788 Penfield Rd, Suite 1
Penfield, New York 14526
Phone (585) 586-1100

D. Engineer: Watts Architecture & Engineering
E. Contractor: The successful bidder for the work described herein. Also referred to as the Sound Contractor or the bidder.
F. Others: Various companies doing construction work under the general contract.

1.2 Professional Standards:

A. The contractor is expected to install all work to the appropriate industry professional standards, manufacturer recommendations, and current applicable codes. If any work required exceeds the skills of the contractor, they will employ appropriate subcontractors for the scope required.
B. The acceptability of materials and workmanship will be determined by the Architect, Consultant, and CM.
C. Any work that might be damaged, be inadvertently painted, or become dirty during construction will be protected by the contractor. All responsibility for protection shall be by the contractor. The contractor will provide final cleaning and or repair of all equipment in their scope to like new condition.
D. The contractor will attend and/or arrange meetings as required to make sure their scope is coordinated with all other trades. The contractor is responsible to make known to all other trades critically dimensioned items and locations to avoid conflicts. Where conflicts occur follow required procedures in the project manual to seek resolution.
E. The contractor will comply with the AHJ (Authority Having Jurisdiction) as it relates to programming any and all emergency interfaces.
F. The contractor is expected to possess knowledge of the equipment of their industry and to provide all small items required to install the specified equipment. Provide small items such as rack rails, DIN rails, rack panels, power cords, connectors, wall-wart power supplies, crimps, Nicopress and other items that may not be called out on drawings or in specs but are required to support primary equipment.
G. When in doubt about any aspect of the work the contractor should not proceed until they obtain clarification from the appropriate entity following procedures detailed in the project manual.

1.3 Definitions:

Code Requirements	Minimum requirements as specified by all applicable and published codes.

Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Equal or Equivalent	Equally acceptable as determined by Owner's Representative.
Extend	To increase the length(s) of any indicated conduit/wiring so as to reach a particular specified or implied point – including the provision of any misc. additional equipment as required for proper extension and to maintain full system functionality.
Final Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
Furnish	Supply and deliver to installation location to the appropriate trade responsible for installation.
Furnished by Others	Receive delivery at job site or where called for and install.
Inspection	Visual observations by Owner's site Representative
Install	Mount and connect equipment and associated items and make ready for use.
Labeled	Refers to classification by a standards agency.
Or Approved Equal	Approved equal or equivalent as determined by Owner's Representative.
Owner's Representative	The Prime Professional, Construction Management or Clerk of the Works.
Patching	Repair of holes, marks, and damage left from removals. Consult project manual for requirements.
Provide	Furnish, install and connect ready for use.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.

Replace	Remove and provide new item.
Remove	Safely Disconnect including any and all wiring, hardware, conduit (except concealed), anchors, suspension hardware etc. Legally dispose of items not called out to be offered to or returned to owner.
Review	A general contractual conformance check of specified products.
Satisfactory	As specified in contract documents.

Refer to General Conditions of the Contract for additional definitions.

1.4 SECTION INCLUDES BUT IS NOT LIMITED TO:

A. Provision of lighting Control system and related work scope as indicated on drawings including controls for lighting fixtures.
B. Wiring, setup, focus and commissioning.
C. Training and closeout documents.

1.5 RELATED SECTIONS & DOCUMENTS:

A. The contractor(s) shall examine the full set of construction drawings and specifications and ascertain all aspects of the scope of work described within this specification. general requirements:
B. Provide all equipment outlined and described within this specification and assemble it into a complete, properly functioning system for use by the owner as described within this specification.
C. It is the contractor's responsibility to clarify any misunderstandings or drawing-to-drawing/drawing-to-spec discrepancies prior to bid. In cases of a difference between stated quantities in drawings, specs or electrical drawings, the higher quantity will prevail.
D. Check each component before installation as well as each portion of the project during installation to ensure that the intent of this specification is achieved.

1.6 BIDDER QUALIFICATIONS – SUBMITTALS:

A. The bidder and all persons performing theatrical lighting system related work on this project must be certified (those performing low voltage terminations, system commissioning, programing, , DMX/RDM/Network addressing and other related areas). This will require the installer to either be a current ETCP (Entertainment Technician Certification Program) certified entertainment electrician or an equivalent factory trained and certified installer (from the equipment supplier) or a crew working under the direct supervision of a certified foreman (of either certification described above). This applies to all theatrical lighting equipment installation and any other assemblies indicated as being provided or installed by the contractor. Proof of current certification MUST be provided in the submittals package (this is typically in the form of a pdf copy of the current and active certification certificates from PLASA). Out of date or expired certifications shall not be recognized as meeting the requirements of ETCP certification.

1.7 INQUIRIES AND COmmunications:

A. All questions should be posed in writing as called for in the project manual.
B. Where discrepancies occur, and pre-bid instructions have not been obtained by written request, the contractor will abide by the owner's decision at no additional cost to the owner.

1.8 standards REFERENCES:

A. The contractor is responsible for the provision of material and methods installation of equipment conforming to the currently applicable standards of:
   1. ADA - Americans with Disabilities Act
   2. AISC - American Institute of Steel Construction
   3. AISI - American Iron and Steel Institute
   4. ANSI - American National Standards Institute

5. ASME - American Society of Mechanical Engineers
6. ASTM - American Society for Testing Materials
7. AWS - American Welding Society
8. EIA - Electronic Industries Association
9. ESTA - Entertainment Services and Technology Association
10. FCC - Federal Communications Commission
11. IEC - International Electronics Commission
12. IEEE - Institute of Electrical and Electronics Engineers
13. IFI - Industrial Fasteners Institute
14. ISO - International Organization for Standardization
15. NACM - National Association of Chain Manufacturers
16. NEC - The National Electric Code
17. NEMA - National Electrical Manufacturers Association
18. NFPA - National Fire Protection Association
19. OSHA - Occupational Safety and Health Association
20. SAE - Society of Automotive Engineers
21. SMPTE - Society of Motion Picture and Television Engineers
22. TIA - Telecommunications Industry Association
23. UL - Underwriters Laboratories (Electrical components, devices and accessories shall bear a UL label where applicable. UL listed and labeled as defined by NFPA70, article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.)
24. USITT - United States Institute for Theater Technology "Recommended Guidelines for stage rigging and stage machinery-specifications and practices".

B. Provide certification and labels where applicable. Comply with federal, state and local regulations and applicable union regulations where required. Provide all equipment with proper labels for sale and use within New York State.

C. Provide only equipment that is standard, new equipment, the latest model of regular stock product and is supplied with all parts regularly used with the equipment offered for the purpose intended. The contractor guarantees that no modification of the equipment has been made contrary to the manufacturer's regular practice.

D. Review all materials and equipment prior to installation and notify owner as to any changes or discrepancies between published specifications and the actual material and equipment to be installed, including discontinued product updates, etc.

1.9 Equivalents:

A. The successful bidder shall submit any product equivalents prior to award of the contract. When requested, the successful bidder shall also submit information, describing in specific detail, how the equivalent bid material differs from the appearance, quality and performance required by the base specification. Submittal of the manufacturer's advertising cut sheets alone is not acceptable for proof of equivalency.

B. Proof of equivalency may require the bidder to provide physical samples, a full-sized mockup or specific manufacturer information detailing technical equivalency. Proof of equivalency shall be the burden of the submitting contractor/bidder and not that of the consultant. Proof of equivalency relates to all pertinent functions of the specified equipment, regardless of if that information is reflected on any manufacturer’s issued cut sheets.

C. If proposing equivalents that affect the system design as shown on the drawings, the bidder must submit flow charts, and any other drawings necessary to show differences in the system operation from the primary referenced system.
D. The bidder will pay for any and all changes to related work scope required by the equivalent products.

    1. This includes electrical, architectural, structural and other changes that might be needed to implement an equivalent product.
        a. Some products with virtual identical functions have varying power requirements, physical dimensions, etc.

E. The risk of whether bid equivalents will be accepted is borne by the contractor. See section 2.1 “Performance Requirements” for more information.
F. No equivalents will be considered after the Contract award unless specifically provided in the Contract Documents.
G. Final judgment as to equality will be solely that of the consultant, architect, construction manager and owner.

1.10 Submittals:

A. Equipment: After bid award but before ordering any equipment or starting any work submit to the owner for approval a list of all equipment to be furnished showing types, models, quantities and manufacturer. Attach catalog sheets for all items submitted.
B. The quantity and form (paper and/or electronic copies) of all submittal material required shall be provided by the contractor to the appropriate parties as is indicated in the contract front end documents.
C. Submit each of the following as each pertains to this project. Provide a copy for each related person performing indicated work who holds these certifications:
    1. Current training certifications.
    2. Current ETCP certification.
    3. Current manufacturer certifications.

D. Submit material schedules and shop drawings for approval by the architect, consultant and owner prior to any fabrication or installation as follows:
    1. Drawings of proposed mounting methods for all equipment.
    2. Samples of proposed marking systems for wire and equipment labeling.
    3. Rack layouts, panel layouts and proposed labeling.
    4. Schedule for submission of drawings for fabrication and site work.

E. Quality Assurance
    1. The Basis of design for the company switch power, relay and control systems equipment as well as most of the theatrical fixtures shall be manufactured by Electronic Theater Controls, Inc., 3030 Laura Lane, Middleton, Wisconsin. The equipment is described in complete technical data available from the manufacturer.
    2. Fabrication shall begin only after approved drawings and a written notice to proceed have been delivered to the manufacturer at the manufacturer's place of business.
    3. A qualified engineering representative employed by the manufacturer shall visit the job site after installation is complete and prior to the energization of the system to inspect, test and adjust the system.

4. This representative shall terminate & connect all control wiring, verify all load and line wiring, and energize the system. The factory representative will also program architectural control presets.

1.11 GENERAL system description:

A. Lighting System:
1. Architectural Lighting Controls
2. Relay panels
3. Integrally dimmed LED house lighting
4. Emergency Lighting Interfaces
5. Integration of house lighting into overall system architecture
6. Commissioning, Training and closeout documentation

PART 2 - PRODUCTS

2.1 Performance requirements:

A. The requirements of the referenced equipment are not generic in nature. Specific performance, control and routing capabilities are necessary for any alternate or substituted equipment. The details set forth herein and within the functional descriptions of each system are the critical criteria for the selection of each piece of equipment.
B. If substituting equipment from manufacturers other than those referenced be aware that all functional information included in this specification as well as the manufacturer's specifications, physical size, serviceability, acoustic output, warranty terms, product availability and other non-technical issues may be determining factors in product equivalency. Final judgment as to equality will be solely that of the owner, architect and consultant.
C. If the contractor substitutes a piece of equipment that does not meet with all of the critical device functionality of the specified equipment (functionality and feature set as detailed below, inherent in the specified equipment, available as provided option and/or required based upon the intents of the contract documents), then he will have to replace all substandard equipment or substituted equipment that does not meet, match or exceed the specified equipment with either the specified equipment or an alternate piece(s) of equipment that meets/exceeds the specified equipment’s feature set and shall provide all reprogramming, installation, conduit, wire, etc. as is required.
D. Equivalents Criteria:
1. Relay rack substitutions require proof that the substituted product meets all performance requirements including but not limited to:
a. Product warranty period
b. Physical rack size
c. Relay density
d. dB noise output of rack
e. Rack noise frequency response curve
f. 0-10 Volt control capabilities
g. DMX routing and control capabilities
h. Relay rack’s acoustic output and tonality
i. No field modifying the rack itself by the contractor in order to meet spec.
j. No operational capabilities limitations in order to meet spec.
k. No operational capabilities limitations in order to meet spec.

2. Lighting control system device substitutions require proof that the substituted product meets all performance requirements including but not limited to:
   a. Product warranty period
   b. Physical device size
   c. Device installation options (rack mount, DIN rail mount, etc.)
   d. Physical quantity of inputs, outputs, sourcing & sinking
   e. Output modes (0-10V, 0-15V, 0-2.5V, 0-5V, etc.)
   f. Current rating per channel
   g. RDM discoverability and remote manipulation capabilities
   h. Selectable starting addresses
   i. Signal isolation and fault protection limits
   j. Voltage step selections (.05V, .1V, etc.)
   k. Quantity of DMX universe control
   l. Protocol conversion and compatibility with alternate control schemes (sACN, DMX, RDM, 0-10V, DALI, etc.)
   m. Display, programming buttons & configuration limitations
   n. Panic controls interface
3. DMX/0-10V Data Emergency Bypass device substitutions require proof that the substituted product meets all performance requirements including but not limited to:
   a. Physical device size
   b. Device installation options (rack mount, DIN rail mount, etc.)
   c. Physical quantity of inputs, outputs, sourcing & sinking
   d. Physical quantity of emergency, UL924, contact, panic or other inputs
   e. Output modes (DMX, 0-10V, 0-15V, 0-2.5V, 0-5V, etc.)
   f. Current rating per channel
   g. Snapshot ability of a DMX “look” into the device’s non-volatile memory
   h. Signal isolation and fault protection limits
   i. Quantity of DMX universe control
   j. Protocol conversion and compatibility with alternate control schemes (sACN, DMX, RDM, 0-10V, DALI, etc.)
   k. DIP switches, programming buttons & configuration limitations
   l. Panic controls interface
   m. UL924 controls interface
   n. UL924 capabilities
   o. No operational capabilities limitations in order to meet spec.
   p. Required (or not required) device backbox quantities & sizes
   q. Emergency control system topology
   r. Device quantity, lack of need for additional power/control conduits, wiring, etc.
   s. LED indicator light for device emergency status, etc.
   t. Form factor
   u. No required, additional or “buried” accessories or devices in order to obtain system performance requirements.
4. Architectural control system substitutions require proof that the substituted product meets all performance requirements including but not limited to:
   a. Product warranty period
   b. Physical device size
   c. Required device backbox sizes

d. Architectural control system topology
e. Preset recall by button stations and LCD displays.
f. LCD display size, color & programming options
g. LED indicator light on individual control station devices
h. Form factor
i. No required, additional or "buried" accessories or devices in order to obtain system performance requirements.
j. No spare wire requirements
k. Ability for each pushbutton station button to trigger the unique preset desired and not simply manufacturer determined or hardware/software restrictive preset order recalls.
l. Ability for architectural control system to read console snapshots and recall them via presets.
m. No "room" restrictions in system topology or functionality.
n. Proximity detector on LCD stations
o. For all 0-10V, DMX, network or RDM devices the equipment provided must meet or exceed all programmatic, voltage options, etc. of the specified equipment.

5. LED lighting fixture substitutions require proof that the substituted product meets all performance requirements including but not limited to:
   a. Product warranty period and advanced replacements policies
   b. Physical LED strip size, flexibility & durability
   c. PF (power factor)
   d. Available light output patterns
   e. Lumen package options
   f. Efficacy (lumens per watt)
   g. CRI
   h. PWM frequency adjustability (to high rates)
   i. Light output intensity in FC distribution
   j. Form factor
   k. Wattage of LED's
   l. Expected and average LED & related drive electronics lifespan
   m. LED driver/power supply(ies) and their ability to dim the LED's smoothly and down to <1% is critical (dim to black capabilities). Some general house/work lighting fixtures need only dim down to approx. 10%, based upon specified manufacturer's product.
   n. Ability of LED fixtures/strips to fit in intended locations and with all physical limitations of surrounding structure.
   o. Binning tolerances & LED quality control must match or exceed specified product.
   p. LED drivers, interfaces, mounting options, etc. shall meet or exceed specified product.
   q. No rope lighting or similar products (not even LED rope lighting) shall be considered as an equal to the specified LED strip lighting products nor shall any rope lighting equivalents be approved.
   r. Visual representation of white light output of fixture - color temperature variants.
   s. Absence of visual anomalies during static and/or dimmed states (i.e. no flickering, ghosting, jitters, popcorning, etc.)

t. Overall acoustic output of fixture during static and/or dimmed states (i.e. fixtures must not create any discernable acoustic output or tonality of acoustic output while in use)
u. Absence of RF interference during use/standby state
v. Power draw requirements.
w. Beam spread characteristics
x. Critical accessories and mounting options.
y. Cooling requirements – convection cooled vs. fan cooled and including fan noise, tonality of fans, etc.
z. Fixture installation requirements (installable from below, retrofittable into existing ceiling and holes, etc.)

6. Wire substitutions require proof that the substituted product meets all performance requirements including but not limited to:
   a. Jacket Type
   b. Number of Conductors
   c. Jacket Shape – i.e. round, twisted, etc.
   d. Number of strands and gauge
   e. Flexibility
   f. Overall physical size of wire
   g. Weather condition/direct burial ratings
   h. Capacitance and resistance conductor-to-conductor as well as single conductor.

E. The current manufacturer's data sheet, user’s manual and actual technical specifications/capabilities/feature set for each referenced piece of equipment in force at the date of printing of this specification shall be the basis for the specifications of the referenced equipment.
F. Specification details are provided only for the features required for current and intended future uses of the products.
G. Quantities:
   1. Where no quantity is indicated in the written specifications, the contractor shall supply quantities as indicated on drawings.

2. Items not indicated on drawings but necessary for project completion shall be provided as required for project execution at no additional cost.

2.2 architectural control system rack enclosure: referenced product etc unison erN SERIES CONTROL ENCLOSURES

A. Control Enclosures
1. The control Enclosure shall be the Unison ERn Series Control Enclosure as manufactured by Electronic Theatre Controls, Inc., or equal.

B. Mechanical
1. The ERn Control Enclosure shall be a surface mounted panel constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.
   a. The Enclosure door shall have an opening to allow limited access to the control module face panel.
   b. Enclosures shall be convection cooled without the use of fans.
2. Control Enclosures shall be sized to accept one or two Control Processors and one or two Station Power Modules, including various options and accessories.
   a. The two-space Control Enclosure (ERn2) shall support a single Station Power Supply module
   b. The four-space Control Enclosure (ERn4) shall support two Control Processors, and two Station Power Supply modules, or, one Control Processor, one Station Power Supply Module and one Station Bus Repeaters module, or one control processor and one dual Station Bus Dual Repeater module.
3. All Enclosure components shall be properly treated and finished.
   a. Exterior surfaces shall be finished in fine textured, scratch resistant, powder-based epoxy paint.
4. Enclosure(s) shall also be available in a 19” rack mounted (RM) version.
   a. Rack-mounted version shall have an independent Enclosure suspension kit, with a full height, locking door/cover attached to the kit.
   b. Rack-mounted version shall have an opening to access the control module face panel, and openings to view indicators on option modules.
5. Enclosure dimensions and weights (without modules) shall not exceed:
   a. ERn2 - 15" W x 9" H, 10" D, 15 lb.
   b. ERn2-RM - 19" W 11"H 10" D, 20 lb.
   c. ERn4 - 15" W x 14" H x 10" D, 20 lb.
   d. ERn4-RM - 19" W x 16" H x 10" D, 25 lb.
6. Top, bottom, and side knockouts shall facilitate conduit entry.
7. Enclosures shall be designed to allow easy insertion and removal of all control and option modules without the use of tools.
   a. Supports shall be provided for precise alignment of modules into power and signal connector blocks.
   b. With modules removed, Enclosures shall provide clear front access to all power and control wire terminations.
8. Option Modules
   a. Ethernet Switch (ENET - Surface Mount ERn only)

1) The Control Enclosure shall support an optional 5-port Ethernet Switch, with at least 4 ports supplying Power over Ethernet (PoE).
2) The Ethernet Switch module shall be 10/100BaseTX, auto MDI/MDIX, 802.3af PSE compliant.
3) The Ethernet Switch module shall contain power, status, and activity indicators. All indicators shall be visible when the Enclosure door is open for wall mounted ERn.

b. Redundant Power Supply (RRPS)
1) The Control Enclosure shall support an optional redundant power supply which shall automatically provide power to the control electronics upon failure or removal of the primary power supply.
2) The redundant power supply shall assert itself seamlessly without a loss of power to the control electronics.
3) The redundant power supply shall seamlessly remove itself when the primary power supply is reengaged.
4) The redundant power supply shall provide visible indication that it is active.

c. Station Bus Repeaters (ERn4 only)
1) The Control Enclosure shall support an optional module to expand the station bus length an additional 400 meters, and the station count an additional 30 stations (62 maximum per processor/Enclosure)
2) Wall-mount and 19" Rack-Mount versions of the Station Bus Repeaters shall also be available to support mid-span insertion away from the Control Enclosure.

d. Station Bus Dual Repeaters (ERn4 only)
1) The Control Enclosure shall support an optional module to expand the station bus length to two additional 400-meter segments (a total of 1200 meters from a single Enclosure, and the station count to 62 stations (62 maximum per processor/Enclosure).
2) Wall-mount and 19" Rack-Mount versions of the Station Bus Dual Repeaters shall also be available to support mid-span insertion away from the Control Enclosure.

9. Provide the following accessories

a. RideThru Option (RTO)
1) The Control Enclosure shall support an optional, short-term back-up power source for the control electronics installed inside the Enclosure.
2) RideThru Option (RTO) provides power for control electronics during brief power outages or drop outs.
3) The short-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
4) The short-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.

5) The short-term back-up power source shall support the control electronics for at least 10 seconds.

b. BatteryPack Option (BPO – Surface Mount ERn Only)

1) The Control Enclosure shall support an optional, long-term back-up power source for the control electronics installed outside the Enclosure.

2) The long-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.

3) The long-term back-up power source shall supply power to the control electronics for at least 90 minutes.

4) The long-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.

5) A test switch/indicator shall be available without opening the rack door or removal of any modules/components.

C. Electrical

1. Control Enclosures shall be available in 100, 120, 230 and 240 volt, single-phase configurations.
2. Control Enclosures shall be completely pre-wired by the manufacturer. The contractor shall provide input and control wiring.
3. Control Enclosures shall be designed to support the following wire terminations:
   a. AC (single phase)
   b. Echelon link power (Belden 8471 or equivalent)
   c. 24Vdc (2- 16AWG Wire)
   d. DMX512A Port A (In or Out) (Belden 9729 or equivalent)
   e. DMX512A Port B (In or Out) (Belden 9729 or equivalent)
   f. RS232 Serial In/Out (Belden 9729 or equivalent)
   g. Unshielded Twisted Pair (UTP) Category 5 Ethernet
   h. Contact Closure In (14AWG to 26AWG Wire)
   i. Contact Closure Out (14AWG to 26AWG Wire)
      1) Contact Closure Out shall provide 1A @ 30vDC
4. Station Power Modules
   a. Station power supply modules shall provide LinkPower for at 32 stations and 1.5A@24VDC of Auxiliary (AUX) power.
   b. Station power repeater modules shall provide LinkPower for 30 stations and1.5A@24VDC of Auxiliary (AUX) power.
   c. Station power module shall support over-current/short protection for LinkPower and Aux. LinkPower shall support fault detection on each leg of the balanced data bus.
5. All control wire connections shall be terminated via factory provided connectors.

D. Thermal

1. Ambient room temperature: 0-40°C / 32-104°F
2. Ambient humidity: 30-90% non-condensing.

2.3 architectural control processor: REFERENCED PRODUCT ETC unison paradigm control processor modules

A. The Architectural Control Processor shall be the Unison Paradigm P-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc.

B. Mechanical
   1. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures and ERn Series Control Enclosures.
   2. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.
   3. ACP module electronics shall be contained in a plug-in assembly.
      a. The module shall be housed in a formed steel body and contain no discrete wire connections.
         1) No tools shall be required for module removal or insertion.
   4. The ACP shall be convection cooled.
   5. User Interface
      a. The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.
      b. The ACP shall provide an alpha-numeric keypad for data entry and navigation.
      c. The ACP shall provide a touch-sensitive control wheel for navigation.
      d. The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
      e. The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions.
         1) The backlight shall have a user selectable time out, including no time out.
   6. The ACP shall provide a front-panel RJ45 jack for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.
      a. The Ethernet port shall be secured behind the locking door.
   7. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.
      a. The SD slot shall be secured behind the locking door.
   8. The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
      a. The USB port shall be secured behind the locking door.
   9. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.
      a. The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
      b. The CF Card is stored in the back of the ACP, and can be accessed only by removing the ACP.
      c. The ACP data can be exchanged by inserting the CF card into another ACP.

C. Electrical
   1. The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
   2. The ACP shall require low-voltage power supplied by the Dimming or Control enclosure.
   3. The ACP shall be hot-swap capable.
   4. The ACP shall support Echelon LinkPower communications with remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.

a. The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require (2) #16 AWG wires.
b. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
c. Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m).
d. Link power wiring between stations shall not exceed 1313 ft. (400m).

5. The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.
6. The ACP shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
7. The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports.°
   a. °When used in a Dimming Enclosure, the second port is always an output port.
8. The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.
9. The ACP shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.

D. Functional
1. Capacity
   a. Shall support 1024 channels of control
   b. Shall support 2 physical DMX ports, each of which may be configured as an input or output
2. System
   a. Runtime application shall utilize support Net3 system interoperability
   b. System shall support the use of Network Time Protocol for real time clock synchronization
   c. System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
   d. System shall support local firmware upload from removable media (SD Card, USB Flash Drive)
3. Diagnostics
   a. Shall output an Event log
   b. Standard log shall store a fixed-length history of recent activity
   c. Separate critical log shall only store important messages (such as boot-up settings)
4. Configuration Data
   a. Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application
   b. Configuration Data can be retrieved from another Paradigm Processor

c. A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism
d. Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units
e. Configuration Data may be loaded to and from removable media access provided on front panel
f. Configuration Data for the entire System shall be available for download from any single Processor
g. Shall store configuration data for Dimming enclosure processors and shall make available for download

5. Scalability
   a. Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum System size
   b. The maximum number of Processors configured as a System shall be at least 12.
   c. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information
   d. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made
   e. Failure of a single Processor shall not prohibit continuing operation of the remaining Processors
   f. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems
6. Local User Interface
   a. Shall provide access to Processor setup (IP address)
   b. Shall provide access to Processor status and diagnostics
   c. Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics
   d. Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.
   e. Shall provide functionality to schedule astronomical and real time events (add/edit/delete)
   f. Shall allow for display of local DMX information
   g. Shall allow for transfer of log files to local removable media
   h. Shall allow to perform firmware upgrades for connected Dimming enclosures
   i. Shall allow for transfer of configuration to and from Dimming enclosures using removable media
   j. Shall allow for transfer of configuration to and from LCD Stations using removable media
   k. Shall allow for binding of Stations
7. Access Controls
   a. There shall be 2 user accounts - Administrator, and User with separate password protection
   b. Account and password settings shall be local to each Processor
   c. Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface
8. Web User Interface
   a. Shall be an internal web server accessible via Ethernet port

b. Shall support common web browsers on Windows and Mac platforms
c. Shall provide functionality to Activate and Deactivate Presets
d. Shall provide functionality to schedule timed events (add/delete)
e. Shall display status information
f. Shall display log files
g. Shall allow for configuration of Processor settings (date, time)
h. Shall allow for upload and download of configuration data
i. There shall be links to other web-enabled devices in the System, including other Paradigm Processors

9. Stations
   a. Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet
   b. Station discovery and binding shall be accomplished from the Local User Interface or Light Designer
10. Net3 and ACN Devices
   a. Net3 Devices shall be connected to and controlled from Paradigm Processors via Ethernet
   b. Paradigm Processors shall provide DMX-Net3 gateway functionality
   c. It shall be possible to send and receive Macro triggers defined within the System configuration via Net3
   d. There shall be support for Streaming ACN on up to 24 universes per Processor
11. Operation
   a. When contained in an dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot
   b. DMX output refresh rate shall be configurable
   c. There shall be support for 16-bit DMX Attributes
   d. DMX inputs may be patched to DMX and Streaming ACN outputs as external sources
   e. Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources
   f. Where there are multiple external sources then priority and HTP shall be used to perform arbitration
   g. External and internal sources shall be arbitrated based on user-selection of standard or custom rules
   h. On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output
   i. The total output may be the combination of many different Presets running concurrently
   j. There shall be no hard limit on number of concurrent cross fades
   k. Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence(LTP) or Highest Takes Precedence (HTP)
   l. LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP
   m. Settings due to LTP Presets may be automatically discarded from operation when overridden

n. It shall be possible to specify that a Preset or Attribute Control will persist when overridden
o. A Preset may be designated as an HTP Override and shall cause HTP values to be discarded
p. It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System
q. Each Preset shall have a status that can be Activated, Deactivated or Altered
r. Preset status may be set based on matching levels in the current output as an option
s. On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day

12. Serial Input/Output
    a. RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits
    b. RS232 shall support baud rates from 4800 to 115,200 bps
    c. Serial input and output messages are fully customizable
    d. Serial output messages can be generated by any Control or Event

2.4 architectural control processor: REFERENCED PRODUCT ETC unison station power module

A. Station processor Modules
    1. The Station Power Module shall be the Unison Paradigm P-SPM Series Station Power Module as manufactured by Electronic Theatre Controls, Inc., or equal.

B. Mechanical
    1. The Station Power Module (SPM) assembly shall be designed for use in DRd Series or ERn Rack Enclosures.
    2. The SPM shall convert input power into low-voltage (Class II) power with data line and a secondary auxiliary low-voltage line to energize button, button/fader, touchscreen, and interface devices for multi-scene lighting and building control.
    3. SPM module shall be contained in a plug-in assembly.
        a. The module shall be housed in a formed steel body and contain no discrete wire connections.
            1) No tools shall be required for module removal or insertion.
    4. The SPM shall be convection cooled.
    5. User Interface
        a. The SPM shall utilize light emitting diodes (LED's) to indication function, status and fault.
    6. The SPM shall be secured behind the locking door.
    7. Wall-mounted, direct wire and 19" rack-mount, connectorized repeater and dual-repeater variants shall be available from the same manufacturer where required on the project.

C. Electrical
    1. The SPM shall require no discrete wiring connections; all wiring shall be terminated into the dimming enclosure, unless required by a variant.
    2. The SPM shall require line-voltage power supplied by the contractor, terminated inside the dimming or control enclosure.
    3. The SPM shall be hot-swap capable.

4. The SPM, in conjunction with a matching Architectural Control Processor (ACP), shall support Echelon LinkPower communications with remote devices, including button, button/fader, touchscreen and interface stations, and shall interoperate with LonMARK-approved third-party devices.
   a. The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit.
   b. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
      1) Link power wiring shall permit a total wire run of 1640 ft. (500m)
      2) Repeaters allow an additional wire run of 1640 ft. (500m)
   c. Dual-repeaters allow two additional wire runs of 1640 ft. (500m)
5. Link power wiring between stations shall not exceed 1313 ft. (400m).
6. The SPM shall support auxiliary power for certain remote devices, including touchscreen and interface stations, as required by the device.
   a. The auxiliary power network shall utilize polarity-dependent, low-voltage Class II wiring, consisting of two # 16 AWG wires.
   b. Auxiliary wiring shall permit a total wire run of 1640 ft. (500m)
      1) Repeaters allow an additional wire run of 1640 ft. (500m)
      2) Dual-repeaters allow two additional wire runs of 1640 ft. (500m)
   c. The SPM shall supply 1.25 amps at 24v DC continuously.

D. Functional
1. Capacity
   a. Each SPM shall:
      1) Supply power for up to 32 button and button/fader stations.
         i) Repeaters and dual-repeaters allow 30 additional stations, 62 total
   b. Supply auxiliary power for a similar number of interface stations.
   c. Shall supply auxiliary power for up to four Touchscreen stations, when a like number of other stations are deducted from the total.
      1) Repeaters and dual-repeaters allow two additional Touchscreens (six total) when a like number of other stations are deducted from the total.
2. Operation
   a. The SPM shall not require configuration or programming.
   b. The SPM shall automatically detect faults in the wiring, indicate the fault, including the fault polarity, and shut down the output power.
      1) The SPM shall automatically reset when the fault is clear, and can be manually reset by removing and re-inserting the module.

2.5 INTERFACE STATIONS: referenced product etc UNISON HERITAGE CONTACT INTERFACE

A. Contact Interface Station

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
2. General

a. Unison Contact Interface shall provide direct interface (in and out) to external devices via contact closure. Interface enclosure shall consist of 8 input connections and 8 output connections.

3. Mechanical
   a. Contact Interface Stations shall be available in enclosures built for:
      1) Wall-mount
      2) Rack-mount
   b. Wall-mount Interfaces shall be:
      1) Designed for surface mount installation
      2) Shall be constructed of 16- gauge (.08) steel and are finished in black fine-texture powder coat paint.
      3) The enclosure shall be 14” W x 10.5” H x 3” D.
      4) Conduit access points shall be provided on the top and bottom of the enclosure.
   c. Rack-mount Interfaces shall be:
      1) Designed of use in 19” rack-mount enclosures
      2) Rack tray shall be constructed of 12-gauge aluminum.
      3) Cover shall be constructed of 14- gauge (.08) steel.
      4) Rack-mount interfaces shall be finished in black fine-texture powder coat paint.
      5) The enclosure shall be 14” W x 10.5” H x 3” D.
   d. The assembly shall consist of up to 16 connections; 8 inputs functionally coupled with 8 normally open relay contact outputs. Inputs and outputs may be configured as either maintained or momentary.
4. Electrical
   a. Unison control station wiring shall be an Echelon® Link power network.
      1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
      2) Contact Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
      3) Network wiring may be bus, loop, home run, star or any combination of these.
      4) Wiring termination connectors shall be provided with all stations.
   b. b. Ratings:
      1) The Input Rating shall be 5V@10mA (unit requires dry contact closure)
      2) Dry contact outputs shall consist of:
         i) Normally-Open 2-pole contact closure outputs;
         ii) 1A@30Vdc.
         iii) .5A@120V
   c. Contact Interface Stations shall offer the following Regular markings
      1) UL and cUL LISTED
      2) CE Market
      3) RHoS and WEE Compliant

2.6 four port network data distribution device: referenced product etc net3 four port gateway

A. General

1. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of stage, studio, and entertainment lighting systems. The gateway shall permit DMX-512 data to be encoded, routed over Ethernet and decoded back to DMX-512. The unit shall be a Net3 DMX 4-port Gateway as provided by ETC, Inc.
2. Gateways shall communicate over Ethernet directly with at least ETC, Inc.'s entertainment and architectural lighting control products and other Ethernet interfaces.
3. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
4. The unit shall support ESTA ACN and Streaming ACN
5. The unit shall support the ETCNet2 protocol suite.
6. The unit shall be tested to UL standards and labeled ETL Listed.
7. The unit shall be RoHS Compliant (lead-free).
8. The unit shall be CE compliant.
9. The gateway shall have a backlit graphic LCD display for identification (soft-labeling) and status reporting. Labeling shall be user configurable using Network Configuration Editor (NCE). Each gateway shall also have power and network activity LED's on both the front and rear of the unit. The LCD display shall show DMX port configuration indication as well as indicate the presence of valid DMX/EDMX signal. Units that do not indicate port configuration (input/output) and valid DMX/EDMX data shall not be allowed.

B. DMX Ports

1. DMX Ports shall comply with the requirements of the USITT DMX512 and ANSI E1.11 DMX512-A standards.
2. The DMX port shall be software-configurable for either input or output.
3. Hardware configuration override setting shall be provided on the gateway.
4. DMX input shall be fully opto-isolated from the gateway electronics.
5. DMX output shall be earth-ground referenced.
6. DMX Port shall be capable of withstanding fault voltages of up to 250VAC without damage.
7. Each port shall incorporate one 5-pin XLR type connector. A DMX Output port shall utilize female connectors and a DMX input port shall utilize male connectors.

C. Processor

1. Each gateway shall have sufficient processing power to manage up to 64,279 DMX universes (32,910,848 DMX addresses).
2. Maximum delay time from input to output shall not be greater than one packet time (approximately 22 m Sec.).
3. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility of older 3rd party DMX devices.

D. Mechanical

1. Rack Mount/Portable gateway

a. The rack mount/portable gateway will be fabricated of .16-gauge steel, finished in fine-texture, scratch-resistant, black powder coat. Dimensions shall be 8.5” (22 cm) wide x 8.0” (20 cm) deep x 1.75” (5 cm) high not including tabs.
b. The weight of the gateway shall be 3.5 lbs (1.6 kg) with four connector modules. An individual module shall weight no more than .25 lbs (.1 kg).

E. Power

1. Power for the gateway shall be provided either over the Category 5 (or better) cable, from 48V IEEE 802.3af compliant Power over Ethernet distribution equipment, or via conventional switches together with isolated in-line power supplies capable of an operating range of 8-28vDC provided by the gateway manufacturer. Power consumption shall not be greater than 5 watts.
2. The gateway electronics shall be electrically isolated from the power supplied over the Cat5 cable.
3. Power may be provided from IEEE 802.3af compliant power-over Ethernet distribution equipment, or by using conventional switches together with isolated in-line power supplies as provided by gateway manufacturer.

F. Configuration

1. Each gateway on the network shall be individually configurable using ETCNet 2 Network Configuration Editor (NCE) or Gateway Configuration Editor, running on a PC connected to the network. The PC shall only be required for configuration, labeling and signal routing, and shall not be required for normal operation of the system.
2. Each DMX gateway shall control up to 512 DMX addresses, within the confines of 64,279 DMX “universes”. The specific DMX data input or output by the gateway shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
3. Any number of DMX universes may be configured with any length up to 512 addresses as long as the total does not exceed 32,767. Any range of DMX addresses may be selected for each. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use.
4. All relevant routing information shall be stored in non-volatile memory at each gateway. The system shall recover from a power outage without requiring the PC to be online.

G. Network

1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications.
2. All network cabling shall be Category 5 or better (for 5e and Category 6), conforming to TIA-568A/B, and shall be installed by a qualified network installer.
3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
4. ESTA ACN and streaming ACN shall be supported.
5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.
6. Multiple DMX signal routing patches and multiple facilities shall be specifically supported and limited only by the file storage capacity of the computer with ETC Network Configuration Editor Software installed.

7. Each DMX gateway shall control up to 512 DMX addresses, per port within the confines of up to 64 DMX (32,767 EDMX addresses) "universes" when using EDMX and 64279 "universes" (32, 910,848 DMX addresses) when using Streaming ACN. Any range of DMX addresses may be selected for each. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use.
8. Units shall have built in DMX merger on a universe or channel-by-channel basis.
9. Units shall have built in prioritizer on a universe or channel-by-channel basis.

H. DMX Connector modules

1. Each gateway shall incorporate four connector module locations. Each module shall contain a single connector and its associated electronics for ease of service. Connector module options shall include a male DMX input connector, a female DMX output connector or a terminal strip connector.
2. Each connector module shall be fully opto-isolated from the gateway electronics and from each other.
3. DMX connector modules shall be capable of withstanding fault voltages of up to 250VAC without damage.

I. Environmental

1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
2. The storage temperature shall be -40° to 70°C (-40° to 158°F).
3. The operating humidity shall be 5% - 95% non-condensing.

J. Accessories

1. Flexible Hanging Bracket kit - bracket shall allow unit to be mounted in 3 orientations, U-Bolt option also available
2. Rack mount kit – a 1U rack-mount bracket that shall support either two complete units or one unit and a Front Access Panel kit. This kit shall allow up to eight ports of DMX in a 1U rack space.
3. Front Access Panel kit – a kit that allows the connectors on the rear of the unit to be accessed from the front of the unit in an equipment rack
4. Universal Power Supply with international plug-set included. Multiple power supplies shall be able to fit in a vertically stacked power strip.
5. ETC Network Configuration Editor (NCE) software

K. System Requirements

1. Provide the quantity and type of gateways required, as scheduled. Gateways and software shall be as manufactured by Electronic Theater Controls Inc. of Middleton, WI.
2. Provide Ethernet switches and power supplies as scheduled and as shown on drawings.
3. Provide a current generation PC with Windows operating system and a 10/100 Ethernet card.

2.7 company switch: REFERENCED PRODUCT ETC powersafe pro

A. General

1. The Company Switch shall be available in 2 models: PowerSafe Pro, and PowerSafe Compact; as designed by Electronic Theatre Controls.

2. Compact Models shall be available at 120/208V: 100A, or 200A; 3-phase, 4-wire plus ground.
3. Pro Models shall be available at 120/208V: 100A, 200A or 400A; 3-phase, 5-wire (double neutral) plus ground.
4. The Company Switch shall be UL and cUL listed and shall meet all applicable NEC standards.
5. The enclosure shall be NEMA 1 rated.

B. Mechanical

1. The Company Switch shall be fabricated of 16 gauge steel and finished using ETC styling with fine-textured scratch resistant epoxy paint.
2. The door which provides access to output connections shall be lockable with shunt trip interlock.
3. The “Compact” Enclosure size shall not exceed 25” high by 15.5” wide and 6” deep. The “Pro” Enclosure size shall not exceed 43.8” high by 18” wide and 6” deep.
4. Company Switch shall protect against access to power connections while the cabinet is energized so it can be guaranteed that output is in a “power off” state while connecting or disconnecting portable output cabling.
5. The company switch shall protect the user from unsecured access to output terminals and connectors in the following methods:
   a. PowerSafe Compact: Door brackets shall lock swing hinged covers in place until the front door is opened. These brackets shall prevent insertion of connections under power.
   b. PowerSafe Pro: Front access connector compartment shall protect against access to output connections behind a locked door while the cabinet is energized
6. The “Pro” Enclosure size shall not exceed 43.8” high by 18” wide and 6” deep.
7. Conduit entry shall be made via top, or side. Top and side panel shall free of conduit knockouts to allow for greater flexibility in contractor conduit entry.
8. A method of field isolating company switch chassis ground and connected equipment ground (“ISO ground”) shall be supported without installation of additional kits or parts. Company Switch products that require additional parts to be shipped or factory configuration of “ISO ground” shall not be deemed acceptable.
9. Company switch shall accept 3rd party locks on built- in bracket for support of NFPA 70E safety lockout/tagout procedures.
10. The unit shall be capable of mounting on a wall with integral keyhole fixing points.
11. LED power indicators shall be provided to show that power is on/available between each phase and neutral.
12. PowerSafe “Pro” shall provide an LED Work Light which shall automatically illuminate the output connectors and lugs during “hook up” of portable equipment cabling.
13. Lugs shall support up to 4/0 class K cable for bare end tie-in through 500kcmil screw terminals.

C. Electrical

1. PowerSafe Pro shall include six CAM style connectors for each phase, dual neutral, and ground. Standard order connector genders shall be females for each phase, with male ground and neutral connectors. Other connector gender combinations shall be available on request.

2. PowerSafe Compact shall include five CAM style connectors for each phase, neutral, and ground. Standard order connector genders shall be females for each phase, with male ground and neutral connectors. Other connector gender combinations shall be available on request.
3. PowerSafe Pro shall include dual neutral output connections for support of 200% rated neutral.
4. The enclosure shall accept up to 200A or 400A copper or aluminum to the full name plate rating of the enclosure at 100% of the rated main breaker with a minimum AIC rating of 65,000A.
5. System rating of Company Switch shall be 65,000 amps symmetrical Short Circuit Current Ratting (SCCR). Company Switch products that rely only on breaker AIC rating as a short circuit safety factor shall be deemed unacceptable. Company Switch products that have not proven this safety rating through high current short circuit testing with UL shall not be deemed safe for use under UL SCCR requirements and therefore are not acceptable.

D. Available Accessories

1. An option shall be provided and approved by UL for connection of field installed current transformers around incoming power conductors for connection to external 3rd party power meters.
2. An option shall be available in the PowerSafe Pro for strain relief.

2.8 Relay rack controls battery backup: REFERENCED Product ETc sensor battery pack option

A. General

1. The BatteryPack Option installs in a separate enclosure from the Sensor3 rack and keeps the processor energized in the event of power loss or interruption to the system. One of two Sensor3 PowerSupport options, the BatteryPack option is designed for applications where CEM3 Power Control Processor must remain online during power loss providing power for several minute or more. Each CEM3 requires its own battery pack. The enclosure can hold up to two battery packs.
2. Provides power for a single CEM3 Control processor for a minimum of 30 minutes.
3. UL and cUL LISTED.
4. CE Marked.

B. FEATURES

1. Designed for use with Sensor3 Power Control System.
2. Long term power back-up of control electronics for at least 30 minutes.
3. Automatically engages when power is lost.
4. Automatically recharges from power feed during normal power conditions
5. Two-hour recharge time from full discharge

C. FUNCTIONAL

1. Designed for use with Sensor3 Power Control Systems.
2. Compatible with CEM3 Power Control.
3. Seamless transfer from charge to power output without user intervention.
4. Prevents CEM3 from rebooting when power returns.
5. Allows for immediate control of the full system as soon as normal power is present

D. MECHANICAL

1. 18-gauge formed steel construction.
2. Fine-texture, scratch resistant, epoxy paint.
3. Field installed without tools.
4. Visible indicator lights clearly identify when the battery is providing power and if maintenance is required.
5. Installs using factory provided wire harness.

E. ELECTRICAL

1. Seamless transfer to battery power upon loss of normal power.
2. Provides 24vDC power for control processor during power loss.

F. THERMAL

1. Ambient room temperature: 0-40°C / 32-104°F Ambient humidity: 10-90%non-condensing.

BatteryPack Option Dimensions*

MODEL	HEIGHT		WIDTH		DEPTH	
	inches	mm	inches	mm	inches	mm
SR3-BPO	13.9	353.1	10	254	4.1	104.1
SR3-BPO2	13.9	353.1	10	254	4.1	104.1

BatteryPack Option Weights*

MODEL	WEIGHT		SHIPPING WEIGHT	
	lbs	kgs	lbs	kgs
SR3-BPO	10	4.5	13	5.9
SR3-BPO2	12.2	5.5	15.2	7.4

*Weights and dimensions typical

2.9 dual band enterprise class wireless access point: REFERENCED PRODUCT cisco aironet 1600 series access point

A. FEATURES:

1. Sleek design with internal antennas
2. Extended operating temperature
3. Versatile RF coverage with optional external antennas
4. UL 2043 plenum-rated for above-ceiling installation options or suspended from drop ceilings
5. 802.11n performance with existing PoE switches
6. Locks for theft protection
7. Controller-based or standalone deployment options
8. Supports rogue access point detection and denial-of service attacks
9. Management frame protection detects malicious users and alerts network administrators
10. Cisco ClientLink 2.0 Beamforming
11. Support for all client types without any client requirements or dependencies
12. Cisco CleanAir Express Spectrum Intelligence
13. Identifies, classifies and provides automatic remedial actions for different types of interference
14. Locates and visualizes sources of interference
15. Cisco VideoStream Technology
16. Efficient multicast-to-unicast conversion
17. Video call admission control to prevent oversubscription
18. Queue prioritization to help ensure best user experience for corporate videos
19. Warranty: Limited Lifetime Warranty that provides full warranty coverage of the hardware for as long as the original end user continues to own or use the product. The warranty includes 10-day advance hardware replacement and ensures that software media is defect-free for 90 days.
20. Enterprise-class chipsets and optimized radios
21. 802.11n with 3x3 multiple-input multiple-output (MIMO) technology with two spatial streams, which sustains 300-Mbps rates
22. Radio resource management (RRM): Automated self-healing
23. CleanAir Express: detects RF interference and provides basic spectrum analysis capability
24. Cisco ClientLink 2.0 technology: Improves downlink performance to all mobile devices including 802.11n while improving battery life on mobile devices such as smartphones and tablets
25. Cisco BandSelect technology: Improves 5-GHz client connections in mixed-client environments
26. Cisco VideoStream technology: Uses multicast to improve rich-media applications
27. Can scale to up to 18,000 access points with full Layer 3 mobility across central or remote locations
28. Cisco Network Assistant: provides a centralized network view with a user-friendly GUI

2.10 architectural button, fader & interface stations: REFERENCED PRODUCT ETC unison heritage stations

A. Button Stations
1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc.
2. Mechanical
a. Unison Heritage Button stations shall operate using up to ten programmable buttons.
b. All button stations shall be available with white, cream, ivory, gray or black faceplates and buttons.
1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
c. Stations shall have indicators lights at each button or fader.
1) Indicators shall be comprised of red, green and blue LED's.
2) Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button or fader it is associated with.
d. All faceplates shall be designed for flush or surface mounting.
e. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
f. Station faceplates shall be indelibly marked for each button or fader function.
g. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
h. All Button and Button/Fader stations shall be shall be designed to accept the infrared signal from a remote hand held IR transmitter.
1) The stations shall have a 60° reception angle and shall operate reliably within a 45' distance.
i. IR Transmitters shall be available in seven or twelve button configurations. Custom transmitters may have up to 10 programmable buttons.
1) IR transmitters shall be mounted in a hand-held black plastic controller. Transmitter dimensions shall be 1.875” wide, 6.625” long and 0.60” deep.
3. Electrical
a. Unison control station wiring shall be an Echelon® Link power network.
1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
3) Network wiring may be bus, loop, home run, star or any combination of these.
4) Network insulation displacement connectors shall be provided with all stations.
4. Functional

a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
   1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
      i) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
      ii) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
   2) System macros and sequences shall be programmable via LightDesigner system software.
      i) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
      ii) Macro and sequences shall be activated by button, time clock event or LightDesigner software.
   3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
      i) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
      ii) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
b. Station Button, Button/Fader, and Interface control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.
   1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.
   2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.
c. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.

B. Button/Fader Stations
   1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc.
   2. Mechanical
      a. Unison Heritage Button/Fader Stations shall operate using up to sixteen programmable faders and twelve programmable buttons.

b. All button/fader stations shall be available with white, cream, ivory, gray or black faceplates, fader knobs, and buttons.
   1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
c. Fader stations shall utilize standard 45-millimeter slide potentiometers.
d. Stations shall have indicators lights at each button or fader.
   1) Indicators shall be comprised of red, green and blue LED's
   2) Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button or fader it is associated with.
e. All faceplates shall be designed for flush or surface mounting.
f. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
g. Station faceplates shall be indelibly marked for each button or fader function.
h. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
i. All Button and Button/Fader stations shall be shall be designed to accept the infrared signal from a remote hand held IR transmitter.
   1) The stations shall have a 60° reception angle and shall operate reliably within a 45' distance.
j. IR Transmitters shall be available in seven or twelve button configurations. Custom transmitters may have up to 10 programmable buttons.
   1) IR transmitters shall be mounted in a hand-held black plastic controller. Transmitter dimensions shall be 1.875” wide, 6.625” long and 0.60” deep.

3. Electrical
   a. Unison control station wiring shall be an Echelon® Link power network.
      1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
      2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
      3) Network wiring may be bus, loop, home run, star or any combination of these.
      4) Network insulation displacement connectors shall be provided with all stations.

4. Functional
   a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface, or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
      1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
         i) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.

ii) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.

2) System macros and sequences shall be programmable via LightDesigner system software.

i) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.

ii) Macro and sequences shall be activated by button, time clock event or LightDesigner software.

3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.

i) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.

ii) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

b. Station Button, Button/Fader, and Interface) control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.

1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.

2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

c. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.

C. Connector Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc.

2. Mechanical

a. Unison connector stations shall provide an interface to portable Unison stations.

b. All connector stations shall be available with white, cream, ivory, gray or black faceplates, fader knobs, and buttons.

1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.

c. All faceplates shall be designed for flush or surface mounting.

d. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.

e. Station faceplates shall be indelibly marked for each function.

f. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.

3. Electrical
   a. Unison control station wiring shall be an Echelon® Link power network.
      1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
      2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
      3) Network wiring may be bus, loop, home run, star or any combination of these.
      4) Network insulation displacement connectors shall be provided with all stations.
4. Functional
   a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
      1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
         i) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
         ii) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
      2) System macros and sequences shall be programmable via LightDesigner system software.
         i) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
         ii) Macro and sequences shall be activated by button, time clock event or LightDesigner software.
      3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
         i) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
         ii) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
   b. Station Button, Button/Fader, and Interface control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.

1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.
2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

c. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.

D. Contact Interface Station

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc.
2. General
   a. Unison Contact Interface shall provide direct interface (in and out) to external devices via contact closure. Interface enclosure shall consist of 16 input connections and 16 output connections.
3. Mechanical
   a. The surface mount enclosure and cover shall be constructed of 16- gauge (.08) steel and are finished in black smooth matte powder coat paint. The enclosure shall be 14” W x 10.5” H x 3” D.
   b. Conduit access points shall be provided on the top and bottom of the unit.
   c. The assembly shall consist of up to 16 connections; 8 inputs functionally coupled with 8 normally open relay contact outputs. Inputs and outputs may be configured as either maintained or momentary.
4. Electrical
   a. Unison control station wiring shall be an Echelon® Link power network.
      1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
      2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
      3) Network wiring may be bus, loop, home run, star or any combination of these.
      4) Network insulation displacement connectors shall be provided with all stations.
   b. Ratings:
      1) The Input Rating shall be 5V@10mA (unit requires dry contact closure)
      2) Dry contact outputs shall consist of:
         i) Normally-Open 2-pole contact closure outputs: 1A@30Vdc & .5A@120V.

2.11 lighting control system configuration & control software: REFERENCED PRODUCT ETC lightdesigner

A. System Configuration

1. The Unison Paradigm LightDesigner software program shall be an application software package that facilitates off-line Unison Paradigm control system configuration. LightDesigner shall also enable a computer to be connected on-line with a Unison Paradigm lighting control system for real time preset selection, editing and recording.
   a. Software setup shall include Configuration and Space (Room) Wizards, Zone, Preset, Sequence, Station and Wall Properties, Touchscreen Station Setups, Time clock Events and Macros.
   b. The software program shall be supplied complete with Operators Manual and software disk.
2. Functions
   a. Configuration and Room Wizards
      1) The software shall provide easy step-by-step wizards to allow configuration of rooms, channels, walls and control stations.
      2) The program shall allow setup of all system parameters including quantity of rooms, Relays, zones, presets and control stations. System limitations shall be based on system's Unison processor.
      3) System program shall support a graphic display of individual rooms, showing zones, presets, control stations and moveable wall placement. Systems with non-graphic displays shall not be acceptable.
      4) Software shall support the programming and operation of multi-sectioned rooms with moveable partitions.
      5) LightDesigner shall support the programming of station and component electronic security.
      6) LightDesigner shall support the transfer of architectural system configurations to processors via Secure Digital (SD) Cards, USB Flash Drives, or Ethernet.
   b. Zone, Preset, Station and Wall Properties
      1) LightDesigner shall support the configuration of system zone properties. Configurable zone properties shall include zone name, input mode, Relay to zone patch, and maximum and minimum zone levels.
      2) LightDesigner shall support the configuration of system-preset properties. Configurable preset properties shall include preset name and fade time. Presets shall have a discrete fade time, programmable from zero to 86,400 seconds with a resolution of one hundred milliseconds.
      3) LightDesigner shall support the custom programming of control station buttons and faders. Button function assignments shall include Preset (last action, pile on, or toggle), Off, Manual, Zone, Record, Raise, Lower, Wall (toggle or direct) Lockout (toggle or direct), No Action, and Macro. Button properties shall include Lockout Level and Legend. Fader assignments shall include Zone, Preset, Master, and Fade time. Fader properties shall include Lockout Level and Legend.
      4) LightDesigner shall support the configuration of system wall properties. Configurable wall properties shall include wall name.

c. Time clock Events and Macros
   1) LightDesigner software shall support the programming of Astronomical Time Clock (ATC) events for up to ten standard day types and up to 24 custom day types. ATC events include selection of presets or macros. ATC events shall be triggered by sunrise, sunset, time of day and/or periodically.
   2) LightDesigner software shall support the programming of multifunction macro sequences. Macros shall be activated via buttons on any Unison station, or via time clock event.

B. Touchscreen Station Configuration
   1. The Unison Paradigm Control Designer software program shall be an application software package that facilitates off-line Unison Paradigm Touchscreen station configuration.
      a. Software setup shall include Configuration and Design Wizards, to create a graphical representation of a control environment.
      b. The software program shall be downloadable from the manufacturer's website free of charge.
   2. 2. Functions
      a. Touchscreen Setup shall include standard or custom control pages. Standard page types shall include zone, preset, wall, or security.
      b. Each page may contain graphic objects including buttons, straight or curved faders, and other graphic controls. Pages may also contain imported bitmap images, pop-up windows, animations, numeric keypads, tabs, and clocks.
      c. Object Assignments shall include any Action assignable within the System.
      d. It shall be possible to adjust LCD contrast and brightness. It shall also be possible to program the station to dim to any level during periods of inactivity.

C. Minimum Computer Requirements
   1. The software shall require the Windows XP SP2 (Home or Pro) operating system running on a x86-Windows-compatible computer (2 GHz Pentium 4 or better) with a minimum of 1 GB of hard drive space and 1 GB RAM, OpenGL graphics acceleration, a monitor capable of displaying at least 1024 x 768 screen resolution, a CD-ROM optical drive, Ethernet port, USB port or SD card slot, keyboard and mouse.
   2. Contractor shall provide computer with minimum requirements as listed above. See TL series drawings for more information on specific computer and related devices to provide for the lighting system control software.

2.12 grid iron Junction Boxes: referenced product etc grid iron junction boxes

A. Gridiron Junction Boxes shall be fabricated from 16-gauge cold rolled steel with 14-gauge end panels. They shall be finished with fine-textured, scratch-resistant, black powder coat. For 30 circuits and less they shall be 14” H x 14” W x 4” D and for 31 to 60 circuits they shall be 14” H x 28” W x 4” D. Cover(s) shall be attached with machine screws and Tinnerman retainer nuts. Cover(s) shall be 16-gauge cold rolled steel. Cover(s) shall be hinged, and mounting should allow installer to orient the hinged door to open in any direction.

2.13 PURE SINE WAVE UNINTERRUPTIBLE POWER SUPPLY WITH SURGE SUPPRESSION AND POWER FILTRATION: REFERENCED PRODUCT MIDDLE ATLANTIC PREMIUM SERIES UPS-1000R/2200R RACKMOUNT UNITERRUPTABLE POWER SUPPLY

A. General
   1. Provide the specific model of backup UPS as listed on the contract documents *and* as is needed based upon the plugged equipment power requirements (provide per intended load, regardless of what is shown on contract documents).
   2.

B. Features:
   1. Pure Sine Wave technology with Automatic Voltage Regulation to improve the quality of power provided to the A/V system
   2. Surge suppression utilizes a clean line-to-neutral design that does not pass noise contamination to ground
   3. Models with bank control available
   4. Individual outlet control available
   5. Internet enabled models available, which include: - Real time UPS monitoring via the Web - Remote management and configuration of UPS via Web Browser or NMS (Network Management System) - Auto-shutdown to protect servers/workstations from data loss due to power failure - Schedule shutdown/start-up/reboot of the UPS - Event logging to trace UPS operational history - Data logging for analyzing power conditions - Event notification via email and SNMP traps - Supports TCP/IP, SNMP/HTTP, NTP, DNS, SMTP protocol - MIB (Management Information Base) provided - Quick installation and user friendly interface - User upgradeable firmware via FTP - Security management provided
   6. Control system integration via RS-232 and USB and analog I/O
   7. Load shedding allows extended run time for system-critical components by disconnecting power to less-critical components
   8. Line Interactive Technology
   9. Power Manager software allows extensive configuration and event notification capabilities
   10. Energy Saver design reduces power consumption by up to 75% when compared with traditional UPS designs
   11. 9’ SignalSAFE™ power cord minimizes stray magnetic fields
   12. UL Listed in the US and Canada

C. Accessories (Provide with all accessories listed on the contract drawings):
   1. UPS-IPCARD - Web based control shall be enabled on non-internet enabled Middle Atlantic Products UPS by UPS-IPCARD, which shall be installed into the Expansion Port on the rear of the UPS. This shall be compatible with UPS firmware v1.65 or greater, and provide full functionality when used on models with firmware v1.75 or greater.
   2. UPS-RLCARD - Remote shutdown of the UPS shall be enabled on non-internet enabled Middle Atlantic Products UPS by UPS-RLCARD, which shall be installed into the Expansion Port on the rear panel of the UPS. This shall be compatible with UPS firmware v1.65 or greater. A user supplied remote push button and external +12VDC source shall be connected to the DB-9 connector on the UPS-RLCARD to activate the remote shutdown feature.

3. Expansion Battery - Rackmount expansion battery pack shall be Middle Atlantic Products model# UPS-EBPR. Expansion battery pack shall be suitable for use with both UPS-1000R and UPS-2200R. UPS-EBPR shall measure 19.00" W x 3.50" H x 19.29" D and occupy 2 rackspaces. UPS-EBPR shall require 22.66" useable depth. With __ hot swappable batteries connected to the unit, there is a __ minute run time at half load and a __ minute run time at full load (refer to chart). Rackmount expansion battery pack shall be warrantied for a period of 2 years.
4. Replacement Battery - Replacement Battery Pack for the UPS shall be Middle Atlantic Products model # UPS-RBP. Replacement battery pack shall be suitable for use with both UPS-1000R__ and UPS-2200R__. Replacement battery shall be warrantied to be free from defects in materials and workmanship under normal use and conditions for a period of 2 years.

D. Technical Specifications:

UPS-1000 Series					
Utility Voltage (AC)	≤ 80	81-105	106-133	133-147	>147
Fans Engaged	front & rear	rear only	none	rear only	front & rear
dBA above Ambient	22dBA	11dBA	0	11dBA	22dBA

UPS-2200 Series					
Utility Voltage (AC)	≤ 80	81-105	106-133	133-147	>147
Fans Engaged	Front & Rear	Rear only	None	Rear Only	Front & Rear
dBA above Ambient	27dBA	14dBA	0	14dBA	27dBA

Model#	Capacity	Outlet Control	Internet enabled
UPS-1000R	1000VA	critical / non-critical bank	w/ optional UPS-IPCARD
UPS-1000R-IP	1000VA	critical / non-critical bank	yes
UPS-1000R-8	1000VA	individual outlet	w/ optional UPS-IPCARD
UPS-1000R-8IP	1000VA	individual outlet	yes
UPS-2200R	2150VA	critical / non-critical bank	w/ optional UPS-IPCARD
UPS-2200R-IP	2150VA	critical / non-critical bank	yes
UPS-2200R-8	2150VA	individual outlet	w/ optional UPS-IPCARD
UPS-2200R-8IP	2150VA	individual outlet	yes

		UPS-1000R Series	UPS-2200R Series
Communication	Software	Middle Atlantic Power Manager™	Middle Atlantic Power Manager™
Management	Self-Test	Manual Self-Test via front panel	Manual Self-Test via front panel
	Auto-Charger/ Auto-Restart	yes	yes
	COM Interface	Primary: - RS232 Communication + Control - Analog Status Notification + Control Secondary: - Analog status notification only	Primary: - RS232 Communication + Control - Analog Status Notification + Control Secondary: - Analog status notification only
	Built-in USB Interface	yes	yes

Estimated Run Times UPS-1000R Series								
Load (VA)	120	240	360	480	600	720	840	960
Load (W)*	84	168	252	336	420	504	588	672
Load (A)	1	2	3	4	5	6	7	8
# of expansion batteries	Estimated Run Time (Minutes)							
UPS only	102	51	34	26	20	17	15	13
1	561	283	190	143	114	94	80	69
2	1020	515	345	260	207	171	145	125
3	1479	747	501	377	300	249	211	181
4	1938	979	657	494	394	326	276	238
5	2397	1211	813	611	487	403	341	294
6	2856	1443	968	728	580	480	407	350
7	3315	1676	1124	845	674	557	472	406
8	3774	1908	1280	962	767	635	537	463
9	4233	2140	1435	1079	860	712	603	519
10	4692	2372	1591	1196	954	789	668	575

*Assuming a Power Factor of .7

Estimated Run Times UPS-2200R Series																
Load (VA)	120	240	360	480	600	720	840	960	1080	1200	1320	1440	1560	1680	1800	1920
Load (W)*	90	180	270	360	450	540	630	720	810	900	990	1080	1170	1260	1350	1440
Load (A)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
# of expansion batteries	Estimated Run Time (Minutes)															
UPS only	102	51	34	26	20	17	15	13	11	10	9	9	8	7	7	6
1	561	283	190	143	114	94	80	69	60	53	47	42	37	33	29	26
2	1020	515	345	260	207	171	145	125	109	96	84	75	66	58	51	45
3	1479	747	501	377	300	249	211	181	158	139	122	108	95	84	74	64
4	1938	979	657	494	394	326	276	238	207	181	160	141	124	109	96	84
5	2397	1211	813	611	487	403	341	294	256	224	197	174	153	135	118	103
6	2856	1443	968	728	580	480	407	350	305	267	235	207	182	161	141	122
7	3315	1676	1124	845	674	557	472	406	353	310	272	240	212	186	163	142
8	3774	1908	1280	962	767	635	537	463	402	352	310	273	241	212	185	161
9	4233	2140	1435	1079	860	712	603	519	451	395	348	306	270	237	208	181
10	4692	2372	1591	1196	954	789	668	575	500	438	385	339	299	263	230	200

*Assuming a Power Factor of .75

2.14 single port DMX ETHERNET NODE: referenced product pathway connectivity pathport uno

A. General

1. The Pathport Uno shall be a single-port TCP/IP-compliant gateway node to encode, route and decode DMX data over Ethernet.
2. The node shall support the following protocols for DMX-over-Ethernet transport: Pathport, streaming ACN (Net 3), Strand Shownet, ArtNet. The node shall support, as an output device only, ETC Net2.
3. The node shall incorporate one 5-pin XLR connector mounted on the front face. A female connector shall be used on a nominal output node. A male connector shall be used on a nominal input node.
4. The node shall incorporate one female RJ45 connector mounted on the circuit board for connection to standard Ethernet wiring.
5. The node shall operate as a 10MB device.

B. Appearance
   1. The node shall be mounted on a mild steel, single-gang Decora-style faceplate and shall fit a standard, deep back box.
   2. Finish shall be matte black or stainless steel.
   3. The node shall be of pleasing appearance, suitable for high-visibility architectural locations.
   4. There shall be two status LED's on the face: one blue LED shall indicate an active network link; one green LED shall indicate active DMX.
   5. There shall be an "identify" function available through management software that shall flash the two LED's together at twice their normal brightness.

C. Power
   1. The node shall only operate on IEEE 802.3af Power-over-Ethernet, supplied by an IEEE 802.3af compliant Ethernet switch (by others) or in-line power supply.
   2. The node's DMX port shall withstand fault voltages of up to 250VAC without damage.

D. Configuration
   1. The node shall be available in DMX input and DMX output versions.
   2. The node shall be fully and remotely configurable using Pathport Manager software running on a Java-enabled PC or Mac connected to the Ethernet network. Pathport Manager software shall not be required for regular operation of the node. Configuration shall include but not be limited to:
   3. Each node shall accept a user-defined name and IP address.
   4. Port direction shall be reversible.
   5. DMX output refresh rate shall be user-selectable.
   6. Each node shall manage up to 128 DMX universes.
   7. Custom channel patches shall be possible, allowing the routing of any input universe or channel to any output location in any order.
   8. HTP merging and/or signal prioritizing shall be possible of up to eight input channels to create one output channel.
   9. DMX-over-Ethernet transmit and receive protocols shall be user-selectable.
   10. Each node's configuration, patching and routing shall be stored locally in the node in non-volatile memory. The node shall recover from power interruption without use of configuration software.
   11. Multiple nodes on the same network may be remotely configured over the same Ethernet connection.
   12. Each node shall incorporate a four-position jumper switch for hard selection of DMX universes one through four.

E. Compliance
   1. The Pathport Uno shall be ETL-listed as a conforming low-voltage device.
   2. The Pathport Uno shall be compliant with the RoHS directive.
   3. The Pathport Uno shall be a conforming CE device.
   4. Each node shall be fully compliant with ANSI E1.11 DMX512A and ANSI E1.20 Remote Device Management standards.

2.15 show controller hardware: REFERENCED PRODUCT etc unison mosaic show controller MSC-x

A. Programming requirements:

1. Provide an ETC APG (advanced programmer) for 12 hours of system programming in order to implement the Mosaic MSC-1 device into the overall system. MSC-1 intents are as follows:
   a. Program (5) presets into the system to control the relay panel channels. Preset #1 will control the RP-1 Audio Relay Panel relay devices. Preset #2 will control the RP-2 Lighting Relay Panel relay devices. Preset #3 will control the RP-3 Video Relay Panel relay devices. Presets #4 & #5 TBD by owner.
   b. Program the system for remote user access interface via web browser in order to be able to fire presets for system configuration changes, lock/unlock system relays, etc.
   c. Provide programming and implementation assistance in the tie-in of this system with the owner's internet access portal, IT department, static IP address, etc.

B. General

1. The Controller shall be a microprocessor-based system specifically designed for control of lighting and related systems in an architectural or entertainment application. A personal computer running emulation software shall not be acceptable.
2. Provide all required interconnect cabling.
3. The Controller shall store operating software and show data in non-volatile solid-state memory. This memory shall be removable for purposes of backup or disaster-recovery.
4. Show data may be downloaded from a remote personal computer over an Ethernet or USB connection.
5. It shall be possible to update the Operating Software by download from a remote personal computer over an Ethernet connection.
6. The Controller shall commence show playback automatically on receiving power without additional external inputs.
7. The Controller shall have an internal real-time clock that continues to operate when external power is absent. It shall be capable of adjusting for Daylight Savings Time automatically and can be updated over the Internet using the Network Time Protocol (NTP).
8. The Controller shall be able to calculate sunrise and sunset times based on longitude and latitude information, and use these as triggers for events.
9. The capacity of the controller shall be defined in terms of number of control channels being used, and the maximum capacity of each unit shall be factory-configured to user requirements.
10. There shall be visual indicators on the Controller showing status of the controller and its interfaces.
11. The Controller shall operate a web server on its Ethernet interface. This shall allow status information, control and configuration options to be accessed remotely.
12. The appearance and content of the web interface may be customized by the user.
13. The Controller shall allow lighting to be programmed as separate zones, with independent triggering and manual intensity control.
14. The Controller shall support multiple timelines, crossfades and effects running concurrently.

15. The Controller shall support playback of video media with individual pixels mapped to lighting fixtures in an array.
16. The Controller shall output control data as digital video via Firewire DV and DVI
17. The Controller shall be capable of receiving a live video input via Firewire DV and mapping individual pixels to lighting fixtures in an array.
18. The Controller shall support two full-duplex RS232 Serial Ports for interfacing to show control devices.
19. The Controller shall support DMX-in for receiving triggers
20. The Controller shall support multiple remote modules connected via Ethernet for support of additional show control interfaces, such as contact closures, analogue inputs, relay outputs and serial.
21. The Controller shall support multiple streams of timecode and audio data within a single networked system.
22. The Controller shall have a recessed switch for resetting the unit without removal of power.
23. The Controller shall have an internal watchdog feature that will restart the unit in the event of program failure.
24. Multiple Controllers shall automatically synchronize and share triggers when programmed as part of a single show and linked via Ethernet during playback.
25. The Controller shall support conditional logic and execute user-defined Lua scripts to support advanced show control operations.
26. The Controller shall be provided with a 5 year manufacturer warranty.
27. The Controller shall output control data as ETCNet2, Philips KiNet, Pathport and Art-Net II protocols simultaneously via Ethernet.

C. Mechanical

1. Enclosure and mounting shall comply with IEC 60297
2. The controller shall be a 2U 19” rack mount enclosure (19” x 3.5” x 15”)
3. The controller shall be entirely solid-state with no moving parts, fans or hard disc drives

D. Electrical

1. The Controller shall be designed to support the following standard connectors:
   a. RJ45 socket for 10/100/1000 Base-TX Ethernet for control data
   b. RJ45 socket for 10/100/1000 Base-TX Ethernet for system management
   c. USB-A Socket for USB 2.0
   d. (2) IEEE 1394 socket for DV input and/or output
   e. (2) 9-pin D plug for RS232 serial input/output
   f. 5-pin XLR for USITT DMX512 input
   g. DVI-I socket for DVI output
   h. Fused IEC socket for 115-250VAC/47-63Hz/2-1A mains input and power cables for North America, Europe and UK shall be provided.

E. Thermal

1. The controller shall operate in a temperature range from 0°C to 50°C (32°F to 122°F)

F. Software

1. The Controller shall be supported by programming software running on either a PC or Mac platform. Programming features shall include:
   a. Comprehensive architectural and automated fixture library

b. Drag and drop placement of fixtures on plan
c. Drag and drop patching of fixtures to output addresses
d. Import of any media for mapping to fixture arrays
e. Timeline-based programming and playback
f. Extensive range of editable effect presets
g. Drag and drop placement of effect presets and media on timeline
h. Variety of triggering options for firing system-wide events
i. Each trigger event may be configured to initiate one or more lighting or show control action
j. Each trigger event may be configured to test one or more conditions before executing its actions
k. Simulation of individual timelines, and entire project with triggers
l. Live output from software for programming verification purposes
m. Controller and network management tools
n. Export TSV reports for all aspects of programming

G. Protection and Patents

1. The Mosaic Controller is protected under license by the following patents:
   a. U.S. Patents: 6,016,038; 6,150,774; 6,166,496; 6,211,626; 6,292,901; 6,340,868; 6,459,919; 6,528,954; 6,548,967; 6,577,080; 6,608,453; 6,624,597; 6,636,003; 6,717,376; 6,720,745; 6,774,584; 6,777,891; 6,781,329; 6,788,011; 6,801,003; 6,806,659; 6,869,204; 6,883,929; 6,888,322; 6,897,624; 6,936,978; 6,965,205; 6,967,448; 6,969,954; 6,975,079; 7,014,336; 7,031,920; 7,038,398; 7,038,399; 7,042,172; 7,064,498; 7,113,541; 7,132,635; 7,132,785; 7,132,804; 7,135,824; 7,139,617; 7,288,190; 7,231,060
   b. Canadian Patent: CA 2,302,227
   c. Hong Kong Patent: HK 1025416
   d. Australian Patent: AU 757000; AU 2003203584
   e. European Patents: EP 1 016 062 B1; EP 1 224 845 B1; EP 1 234 140 B1; DE 698 07 092 C0; DE 600 21 911 C0; DE 600 23 730 C0

2.16 show control configuration software: REFERENCED PRODUCT etc unison mosaic designer 2

A. System Configuration

1. The Control System Configuration software shall be the Unison Mosaic Designer 2 software as provided by ETC, Inc., or equal
2. Definitions
   a. A system is the configuration of one or more Mosaic Show Controllers
   b. A fixture is a controllable entity with one or more attributes
   c. An attribute is a parameter of control such as intensity, pan or gobo select
   d. A group is a selection of fixtures that can be stored and recalled
   e. A trigger is a single point of control to the system (e.g. contact closure, serial command, timed event, etc.)
   f. Actions are items of functionality that can occur within a running Mosaic system in response to events (e.g. start timeline, pause timeline, set intensity, etc.)
   g. A timeline is a series of connected steps referencing control with timing information
   h. A scene is a static look created for any fixture type.

i. Effects are attribute settings that result in continually varying levels following a specified curve and using additional timing parameters (e.g. period, offset)

3. System Configuration
    a. The application interface shall be based around (i) a tree-view; (ii) a workspace area; (iii) item selector
    b. There shall allow multiple 2-dimensional layouts that display the organization or layout of the project
    c. It shall be possible to represent data about the workspace area graphically (layout) or in tabular form
    d. Items displayed on the layout may be arranged using drag-and-drop interaction
    e. Layout views shall support zoom
    f. Layout views shall support a management grid with user-defined spacing and color with associated snap-to-grid functionality
    g. There shall be an auto-backup feature
    h. It shall be possible to add fixtures by selecting a fixture template from the provided library or download additional fixture templates from an internet hosted service
    i. It shall be possible to create a fixture layout based on data imported from a defined documentation format. (E.g. CSV)
    j. There shall be provision for help functionality to be accessed from within the application
    k. It shall be possible to import images as a background image to the layout view
4. Channel Configuration
    a. There shall be functionality to patch channels to DMX and/ or Ethernet Protocols including sACN, Philips KiNet Pathway XDMX and ARTNET
    b. There shall be support for Channels with split patches (e.g. VL5)
    c. It shall be possible to swap pan and tilt axes for a moving-light fixture
    d. It shall be possible to invert pan and tilt axes for a moving-light fixture
    e. It shall be possible to specify a minimum and maximum value for an attribute
    f. It shall be possible to specify a default value for an attribute
5. Design and Simulation
    a. There shall be control of LED arrays supporting pixel mapping of static or video media in any Apple® QuickTime® supported file format
    b. There shall be control of moving lights (as a type of fixture)
    c. There shall be independent control of every attribute of a channel or fixture
    d. Appropriate graphical controls shall be provided for non-intensity attributes (e.g. color picker)
    e. It shall be possible to create groups as a selection shortcut
    f. The plan shall show simulation feedback for channels in a graphical form
    g. It shall be possible to simulate control events
    h. The simulation may be linked to the actual online system to synchronize playback and inject control events
6. Timelines
    a. Timelines may be displayed and modified in linear form
    b. Timelines may be set on an individual attribute basis
    c. All timelines may include split timing

d. Timelines shall be applied based on priority
e. It shall be possible for all timelines to include effects
f. The end state of a timeline shall be user configurable

7. Scenes
    a. Scenes may be displayed and modified in a graphical form
    b. Multiple fixtures may be selected and modified at once
    c. Scenes may be inserted into timelines
    d. Scenes may be able to be recalled independent of timelines
8. Triggers
    a. It shall be possible to trigger actions using external trigger or individual events
    b. It shall be possible to set conditions for each trigger
    c. It shall be possible to specify timed events, including repeat intervals such as daily, weekly etc.
    d. It shall be possible to specify astronomical timed events
    e. Serial input data shall be treated as a trigger and shall be handled as a standard or custom action
9. Actions
    a. There shall be a standard Actions for starting, and stopping timelines and scenes
    b. There shall be a standard action for pausing and resuming timelines.
    c. There shall be standard actions to set timeline intensity
    d. There shall be standard actions to set timeline position
    e. There shall be standard actions for setting fixture color
    f. There shall be standard actions for working with external triggers connected to Expansion Modules
    g. It shall be possible to initiate custom scripts as actions
10. Network
    a. Shall report online status of Mosaic Show Controller and remote devices
    b. Shall allow for configuration of network properties (IP) of Mosaic Show Controllers
    c. Shall allow for upload of configuration data to all or individual Mosaic Show Controllers
    d. Shall allow for download of configuration data from Mosaic Show Controllers
    e. Shall allow for download of logging data from Mosaic Show Controllers
    f. Shall provide for performing firmware upgrades to Mosaic Show Controllers
    g. Shall allow for discovery of connected Mosaic Show Controllers
    h. Shall supports an integrated web server for remote connectivity and control of programmed timelines
11. Reports
    a. It shall be possible to generate tabular reports and customize their layout and appearance
    b. It shall be possible to print reports
12. Resources
    a. Effect curves and fade profiles shall use a common format and allow custom variants to be generated by the user
    b. Additional fixture templates may be defined by the user (custom fixtures)

B. Minimum Computer Requirements

1. Microsoft Windows
    a. The software shall require the Windows 7,8 or 10 (32/64bit) operating system running on a Windows-compatible computer (1 GHz Intel processor or better) with a minimum of 100 MB of hard drive space and 1 GB RAM, OpenGL graphics acceleration, a monitor capable of displaying at least 1024 x 768 screen resolution, Ethernet or USB port keyboard and mouse.
2. Macintosh OS
    a. The software shall require Macintosh OS-X 10.7.x (Mountain Lion) or later operating system running on a compatible computer (1 GHz Intel processor or better) with a minimum of 100 MB of hard drive space and 1000GB RAM, OpenGL graphics acceleration, a monitor capable of displaying at least 1024 x 768 screen resolution, Ethernet or USB port keyboard and mouse.

C. Protection and Patents

1. The Mosaic Controller is protected under license by the following patents:
    a. U.S. Patents: 6,016,038; 6,150,774; 6,166,496; 6,211,626; 6,292,901; 6,340,868; 6,459,919; 6,528,954; 6,548,967; 6,577,080; 6,608,453; 6,624,597; 6,636,003; 6,717,376; 6,720,745; 6,774,584; 6,777,891; 6,781,329; 6,788,011; 6,801,003; 6,806,659; 6,869,204; 6,883,929; 6,888,322; 6,897,624; 6,936,978; 6,965,205; 6,967,448; 6,969,954; 6,975,079; 7,014,336; 7,031,920; 7,038,398; 7,038,399; 7,042,172; 7,064,498; 7,113,541; 7,132,635; 7,132,785; 7,132,804; 7,135,824; 7,139,617; 7,288,190; 7,231,060
    b. Canadian Patent: CA 2,302,227
    c. Hong Kong Patent: HK 1025416
    d. Australian Patent: AU 757000; AU 2003203584
    e. European Patents: EP 1 016 062 B1; EP 1 224 845 B1; EP 1 234 140 B1; DE 698 07 092 C0; DE 600 21 911 C0; DE 600 23 730 C0

2.17 network data distribution device: referenced product etc net 3 two-port gateway

A. General

1. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of stage, studio and entertainment lighting systems. The gateway shall permit DMX-512 data to be encoded, routed over Ethernet and decoded back to DMX-512. The unit shall be a Net3 DMX 2-port Gateway as provided by ETC, Inc.
2. Gateways shall communicate over Ethernet directly with at least ETC, Inc.'s entertainment and architectural lighting control products and other Ethernet interfaces.
3. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
4. The unit shall support ESTA ACN and Streaming ACN
5. The unit shall support the ETCNet2 protocol suite.
6. The unit shall be tested to UL standards and labeled ETL Listed.
7. The unit shall be RoHS Compliant (lead-free).
8. The unit shall be CE compliant.

9. The gateway shall have a backlit graphic LCD display for identification (soft-labeling) and status reporting. Labeling shall be user configurable using Gateway Configuration Editor (GCE). Each gateway shall also have power and network activity LED's on both the front and rear of the unit. The LCD display shall show DMX port configuration indication as well as indicate the presence of valid DMX/EDMX signal. Units that do not indicate port configuration (input/output) and valid DMX/EDMX data shall not be allowed.

B. DMX Ports
1. DMX Ports shall comply with the requirements of the USITT DMX512 and ANSI E1.11 DMX512-A standards.
2. The DMX port shall be software-configurable for either input or output.
3. Hardware configuration override setting shall be provided on the gateway.
4. DMX input shall be fully opto-isolated from the gateway electronics.
5. DMX output shall be earth-ground referenced.
6. DMX Port shall be capable of withstanding fault voltages of up to 250VAC without damage.
7. Each port shall incorporate one 5-pin XLR type connector. A DMX Output port shall utilize female connectors and a DMX input port shall utilize male connectors.

C. Processor
1. Each gateway shall have sufficient processing power to manage up to 64,279 DMX universes (32,910,848 DMX addresses).
2. Maximum delay time from input to output shall not be greater than one packet time (approximately 22 msec.).
3. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility of older 3rd party DMX devices.

D. Mechanical
1. Wall Mount/Portable gateway
   a. The Wall mount Gateway will be fabricated of .16-gauge steel, finished in fine-texture, scratch-resistant, black powder coat. Suitable enclosures for the gateway shall include 2-gang standard or deep backbox.
   b. The weight of the gateway shall be 2.5 lbs (1.1 kg).

E. Power
1. Power for the gateway shall be provided either over the Category 5 (or better) cable, from 48V IEEE 802.3af compliant Power over Ethernet distribution equipment, or via conventional switches together with isolated in-line power supplies capable of an operating range of 8-28vDC provided by the gateway manufacturer. Power consumption shall not be greater than 5 watts.
2. The gateway electronics shall be electrically isolated from the power supplied over the Cat5 cable.
3. Power may be provided from IEEE 802.3af compliant power-over Ethernet distribution equipment, or by using conventional switches together with isolated in-line power supplies as provided by gateway manufacturer.

F. Configuration

1. Each gateway on the network shall be individually configurable using ETCNet 3 Gateway Configuration Editor, running on a PC connected to the network. The PC shall only be required for configuration, labeling and signal routing, and shall not be required for normal operation of the system.
2. Each DMX gateway shall control up to 512 DMX addresses, within the confines of 64,279 DMX "universes". The specific DMX data input or output by the gateway shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
3. Any number of DMX universes may be configured with any length up to 512 addresses as long as the total does not exceed 32,767. Any range of DMX addresses may be selected for each. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use.
4. All relevant routing information shall be stored in non-volatile memory at each gateway. The system shall recover from a power outage without requiring the PC to be online.

G. Network
1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications.
2. All network cabling shall be Category 5 or better (for 5e and Category 6), conforming to TIA-568A/B, and shall be installed by a qualified network installer.
3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
4. ESTA ACN and streaming ACN shall be supported.
5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.
6. Multiple DMX signal routing patches and multiple facilities shall be specifically supported and limited only by the file storage capacity of the computer with ETC Network Configuration Editor Software installed.
7. Each DMX gateway shall control up to 512 DMX addresses, per port within the confines of up to 64 DMX (32,767 EDMX addresses) "universes" when using EDMX and 64279 "universes" (32, 910,848 DMX addresses) when using Streaming ACN. Any range of DMX addresses may be selected for each. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use.
8. Units shall have built in DMX merger on a universe or channel-by-channel basis.
9. Units shall have built in prioritizer on a universe or channel-by-channel basis.

H. Environmental
1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
2. The storage temperature shall be -40° to 70°C (-40° to 158°F).
3. The operating humidity shall be 5% - 95% non-condensing.

I. Accessories - Provide the following:
1. Net3 Gateway Configuration Editor (GCE) software

J. System Requirements

1. Provide the quantity and type of gateways required, as scheduled. Gateways and software shall be as manufactured by Electronic Theatre Controls Inc. of Middleton, WI.
2. Provide Ethernet switches and power supplies as scheduled and as shown on drawings.
3. Provide a current generation PC with Windows operating system and a 10/100 Ethernet card.

2.18 Wiring Devices (Distribution Equipment): See drawings for details

A. Wiring devices shall be fabricated from 16 gauge cold rolled steel, in 6' 0" sections as required. Devices shall be properly cleaned, primed and painted with fine-textured, scratch resistant, black powder coat. Circuit numbers shall be 3/4” Lexan tags with white letters on black background.
B. Individual pigtails and outlets shall be evenly spaced, on 12" centers in connector strips, or as otherwise specified. Where a circuit would fall on a joint it shall be moved 3" towards the junction box end of the strip.
C. All connectors shall be flush mount 20 Amp 2P&G unless otherwise noted.
D. Devices except for wall-mounted boxes shall be supplied with appropriate hardware for mounting as shown on the drawings. Connector strips shall have brackets on 5' centers. Connector strips shall have a terminal block on one end as shown on the drawings.
E. Wiring devices shall be UL Laboratories Listed.

2.19 dmx splitter: REFERENCED PRODUCT pathway connectivity edin rackmount dmx opto-splitter

A. Edin Opto Splitter Modules:
   1. The modules shall be Pathway Connectivity eDIN #1002 opto-splitters or equal.
   2. Each module shall feature:
      a. One isolated DMX input connector.
      b. Four buffered DMX output connectors.
      c. One passive DMX pass thru connector.
      d. Shall fit standard DIN-rail form factor with snap-on DIN rail housings.
      e. DMX512-A compliance.
      f. Pluggable terminal block connectors.
      g. Power & data daisy-chain capability.
      h. 2500 V opto isolation.
      i. 250 V fault protection on all DMX ports.
      j. Self-healing input/output protection (no fuses)
      k. End-of-line termination switch.
      l. Status LED’s (power, DMX In, DMX Out).
      m. RoHS 2002/95/EC compliance.
      n. ETL listed (when factory installed in a Pathway enclosure).

B. Power Supply:
   1. The power supply shall be a Pathway Connectivity #1001-RM or equal (must be short enough to fit in the 2 RU height panel kit).
   2. 9 – 30 VDC, 30 W.
   3. Size – 2” x 4.5”.

C. Edin Rack Mount Panel Kit:
   1. The rack mount panel kit shall be a Pathway Connectivity #1103 or equal.
   2. Features:

a. DIN rail (16.5” long) – 2 pieces.
b. Blank steel rack panel with solid bottom pan (on which to mount DIN rail) with a black powder coat finish.
c. Integral cable management system.
d. Face dimensions – 19” W x 2RU (3.5”) H. Back dimensions (solid bottom pan) – 17” W x 10” D.

2.20 din rail system: referenced product pathway connectivity din rail system

A. eDIN #1103 Rack Mount Panel Kit:
1. Features:
a. Blank steel rack panel with solid bottom pan (on which to mount DIN rail) with a black powder coat finish. Made in single piece construction.
b. Integral cable management system.
c. Face dimensions: Standard EIA 19” (482mm) x 3.5” (2RU height that will accommodate all eDIN modules).
d. Tray dimensions (solid bottom pan) – 17” W x 10” D (430mm x 254mm).
e. DIN Rail Supplied: Two sections 16.5” (420mm) long each, 5.1 lbs (2.3 kg).
f. DIN rail made from cold rolled carbon steel sheet with a electrolytic zinc plating or chromated bright surface finish.
g. DIN rail: Standard 35 mm x 7.5 mm.
h. DIN rail is a mounting system only and does not carry voltage.
i. Complies with DIN 50045, 50022 and 50035 Standards.

B. Power Supply:
1. Provide a power supply with the following features:
a. 1001-30: Power supply suitable for use with Rack Mount Panel Kit.
b. Mount power supply neatly, so that it does not interfere with the DIN rail system or any DIN rail mounted devices and per all applicable codes.
c. Provide additional power supplies as required in order to power all necessary DIN rail mounted devices.
d. Provide separate UL listed enclosures, etc. as necessary for power supplies.
e. Do not power the DIN rail themselves. Power only the DIN rail devices.
f. Protect all power cabling from becoming inadvertently shorted or routed to improper areas, terminals, etc.

C. Calculate required DIN rail mounted devices necessary for this project and provide as many DIN rail rack mount panel kits, power supplies and accessories as is required in order to mount and power all DIN rail equipment.
D. Do not drill face/tray of DIN rail rack mount kit in order to route wiring. All wiring shall remain concealed behind face and routed as required to other devices.

2.21 WIRE STANDARDS: ALL WIRE IN OR OUT OF CONDUIT WILL BE TYPE CL2-CL3 UNLESS OTHERWISE REQUIRED BY NEC AND JOB SITE CONDITIONS. PORTABLE CABLE EXCLUDED.

A. WIRE – PORTABLE CONTROL CABLES (those cables for use with DMX512-A and USITT DMX512/1990 Systems):

1. The data transmission rate (250 kbits/s) used by DMX512 requires the selection of a portable DMX512 cable that does not significantly distort the signal or give rise to spurious signal reflections. Cables intended for use with audio systems (such as microphone cables), while having the convenience of flexibility, availability and relative low cost, may not be suitable for use with DMX512 because of their high capacitance and incorrect characteristic impedance; at DMX512 data rates this will give rise to bit time distortion and signal reflections/overshoot.
2. Maximum and minimum cable lengths
   a. Maximum and minimum run lengths are specifically omitted due to a number of factors, including signal quality, device operating characteristics including capacitive values, and installation environment. Maximum distance runs without repeaters, therefore, shall be determined by standard industry practices of approx. 330 feet. Regardless of the overall run lengths, the system shall run properly, reliably and without errors, glitches, etc. due to improper use of installed/portable cabling or connectors, terminations, etc.
3. Construction
   a. Portable DMX512 cables shall use twisted pair conductors. Conductors shall be of stranded construction. The raw cable used for a DMX512 cable assembly shall be declared by its manufacturer as suitable for use with EIA-422/EIA-485/EIA-485-A systems. Shielding shall be on individual pairs or overall shielding of pairs or both. The portable cable itself shall be flexible and rugged enough for the repeated coiling and uncoiling to which it will be subjected.
      1) Cables implementing only the Primary Data Link shall consist of at least one twisted pair and be marked according to ANSI E1.27-1, Clause 7.1.
      2) Cables implementing both Data Links shall consist of at least two twisted pairs and be marked according to ANSI E1.27-1, Clause 7.1.
      3) Cables implementing only the Secondary Data Link shall not be allowed.
4. Impedance
   a. Portable DMX512 cables shall have a characteristic impedance in the range 100 to 120 ohms. Due to the characteristic impedance of 120 ohms in EIA-485 systems, 120 ohms is preferred.
5. Capacitance
   a. Capacitance between conductors within a shield shall not exceed 19.8 pF/ft (65 pF/m). Capacitance between any conductor and the shield shall not exceed 35 pF/ft (115 pF/m).
6. Dielectric Withstanding Protection
   a. Dielectric rating for portable DMX512 cables shall conform to prevailing electrical codes.
7. Connection Methods - Required Connector
   a. Portable cables shall use 5-pin XLR connectors. The physical pin designations of the 5-pin XLR shall be in accordance with Table 1 (see below).
   b. Any use of alternate connectors shall comply with ANSI E1.11.

8. Electrical Specifications and Physical Layer
   a. General
      1) The physical layer of a DMX512 data link is constrained by earth grounding practices, termination methods, signal levels, EMI, and accidental damage by connection to other devices. Where a conflict exists, DMX512-A shall govern.
   b. DMX512 Portable Cables
      1) General
         i) A DMX512 Portable Cable is a digital data transmission cable designed for the provisional interconnection of two DMX512 devices. Portable cables shall each have two prescribed connectors, a male 5-pin XLR at the end nearest the transmitting device and a female 5-pin XLR at the end nearest the receiving device. Pins shall be designated 1 through 5. There shall be no connection to the shell.
9. Data link common and grounding topologies
   a. In all cases Pin 1 of DMX512 portable cable connectors shall act as Data Link Common. The wire connected to Pin 1 shall be no smaller than the wire used for the twisted pairs in the cable.
10. Each data link shall consist of a separate twisted pair.
11. Terminations
   a. All DMX cabling shall be terminated per applicable standards and so that all devices in any given data run work properly. Use DMX terminators where and as needed and recommended by equipment manufacturers.
   b. 5-Pin XLR Cabling:

Table 1 – Signal Designations Summary		
Use	5-Pin XLR Pin	DMX512 Function
Common Reference	1	Data Link Common
Primary Data Link	2	Data 1-
	3	Data 1+
Secondary Data Link	4	Data 2-
	5	Data 2+

   c. CAT5 Pinout DMX Cabling: *

Wire Color & #	Function	Equivalent XLR Pin #
1 (White/Orange)	Data + (pair 1 true)	3
2 (Orange)	Data – (pair 1 complement)	2
3 (White/Green)	Optional Data + (pair 2)	5
6 (Green)	Optional Data – (pair 2)	4
4 (Blue)	Unassigned	--
5 (White/Blue)	Unassigned	--
7 (White/Brown)	Common for pair 1	1
8 (Brown)	Common for pair 2	1

* The above table is shows the ANSI E1.27-2 standard DMX pinout when using Category 5 (or higher) wire and an RJ45 connector.

The above table is intended for DMX512 cabling only - **NOT** DMX-over-Ethernet cabling. Great care must be taken to prevent the accidental connection of DMX equipment to non-DMX equipment. The connection of DMX equipment to non-DMX equipment such as Ethernet switches or telephone equipment may result in serious equipment damage and/or personal injury, as pins 4 and 5 may carry voltages of up to 48VDC or greater.

Category wire is not recommended for loose or temporary cabling. The use of RJ45 connectors for DMX equipment should be restricted to patch bays in access controlled rooms and should not be used for the direct connection of portable equipment.

Please be aware that some non-standard pin-outs are also in use (i.e. Color Kinetics, etc.) and that custom cabling, connectorizations, etc. may be required in order to interface non-standard pin-outs with the specified system.

2.22 Racks AND hardware SWING OUT WALL RACK: DWR Series Pivoting Wall Rack - DWR-35-26PD

A.

1. EIA compliant 19” wall mount rack shall be Middle Atlantic Products DWR-35-26PD. Tool-Free Quick-Mount™ system enables one-person installation. Useable depth shall be __” (refer to chart) and shall extend into the back pan 3.5”. Center section and back pan shall be 16-gauge steel, phosphate pre-treated and finished in a black textured powder coat. Rackrail shall be constructed of 11-gauge steel with tapped 10-32 mounting holes in universal EIA spacing with black e-coat finish and marked rack spaces. Rack shall be constructed to swing open for component cabling access, center section shall pivot for either left or right opening. Rack shall have a rear knockout panel with 1/2”, 3/4”, 1”, 1-1/2”, 2” and 3” electrical knockouts installed in base, and a rear knockout panel with 1/2”, 3/4”, 1”, 1-1/2”, 2” and 3” electrical knockouts, four Decora® cutouts, and BNC knockouts for UHF/VHF antennas installed in top. Large laser knockout on back pan shall have a 12-1/2” x 12-1/2” cutout for electrical pull-box. Fan knockouts on top and bottom shall allow for installation of up to four 4-1/2” fans. Rack shall have 2” knockouts, 4” knockouts for Wiremold 4000® Series raceways, and knockouts for UCP Series universal connector panels on the side. Top, bottom and sides shall feature vertical vent pattern. DWR Series enclosures shall satisfy the 2007 & 2010 CBC; 2006, 2009 & 2012 IBC; ASCE 7-05 (2005 Edition) & ASCE 7-10 (2010 Edition) and the 2006 & 2009 editions of NFPA 5000 for use in areas of high seismicity, Seismic Use Group III, Zone 4 or Seismic Design Category (SDC) “D” with lateral force requirements for protecting 140 lbs. of essential equipment in locations with the highest level of seismicity and top floor or rooftop installations with an Importance factor (Ip) of 1.5 when used with DWRSR-ZL Latch. Rack shall be UL Listed in the US and Canada to the UL-2416 (NWIN) Category when used with optional bonding kit, model # PET-K-__. DWR Series shall meet all enclosure requirements towards PCI DSS (Payment Card Industry Data Security Standard) Compliance. Rack shall be GREENGUARD Gold Certified. Rack shall comply with the requirements RoHS EU Directive 2002 / 95 / EC. Rack shall be manufactured by an ISO 9001 and ISO 14001 registered company. Rack shall be warrantied to be free from defects in materials or workmanship under normal use and conditions for the lifetime of the rack.
2. Options
   a. Front doors shall be reinforced 16-gauge steel, model # FD-XX (solid), VFD-XX (vented, 25% open area), LVFD-XX (vented, 64% open area), PFD-XX (plexi), (XX= # of rackspaces of DWR rack)
   b. Keyless Latch replaces keylock, fits front & rear doors, shall be models # LATCH
   c. Rear rail kit 11-gauge, 10-32 threaded, sold in pairs, hardware included, shall be model # DWR-RRXX
   d. Fan kits with two 4-1/2” exhaust fans, fan guards and vent blockers, shall be model # DWR-FK17 (fits DWR-xx-17), DWR-FK22 (fits DWR-xx-22), DWR-FK26 (fits DWR-xx-26), DWR-FK32 (fits DWR-xx-32)

e. Vent Blockers used to promote active thermal management, shall be model # VBK-D17 (fits DWR-XX-17), VBK-SD22 (fits DWR-XX-22), VBK-E20 (fits DWR-XX-26)
f. Optional cover plate / shelf kit shall be model # DWR-CVR • Minimum-clearance latch shall allow side-by-side or corner mounting, shall be model # DWRSR-ZL
g. Optional bonding kit for UL-2416 (NWIN) compliance shall be Middle Atlantic Products PET-K-D/EWR (for backpan to center section), PET-K-D/EWRD (for backpan to center section to front door), PET-K-FD (for front door to center section)

B. RACK DRAWERS: REFERENCED PRODUCT MIDDLE ATLANTIC AUDIO D SERIES.
1. Provide ONE rack drawer for each CR rack. Locate system as-built drawings and manuals inside this drawer.
2. EIA compliant 19” rackmount drawer shall be Middle Atlantic Products model # DX or TDX (X = # of rackspaces required, refer to chart). Drawer shall have an overall height of __” (refer to chart), and useable depth of 14-1/2”. Drawer base shall be 20-gauge steel, top and sides shall be 16-gauge steel. Drawer faceplate shall be .090” thick aluminum with a __ (black brushed & anodized or black textured powder coat) finish (refer to chart). Drawer shall use full extension, ball bearing slides. Grommet shall be provided for safely passing cables through the cable entry point at the rear of the drawer on 2, 3 and 4 space models. 2, 3 and 4 space drawers shall include a no-slip drawer mat. Drawer shall have a 50 lb. weight capacity.
3. Drawer shall be warrantied to be free from defects in materials or workmanship under normal use and conditions for a period of three years. Drawer shall be UL Listed in the US and Canada.
4. Drawer shall be GREENGUARD Indoor Air Quality Certified for Children and Schools. Drawer shall be RoHS EU Directive 2002/95/EC compliant. Drawer shall be manufactured by an ISO 9001 and ISO 14001 registered company.

C. POWERCOOL

1. EIA compliant 19” PowerCool™ Rackmount power distribution and cooling unit shall be Middle Atlantic Products model # PD-COOL-__(refer to chart), with a __ (15, 20 refer to chart) amp capacity, 2 stage, normal mode (Line to Neutral) spike and surge suppression with dry contact and LED status indicators and EMI filtering. PowerCool shall activate at 87°F (30.5°C), reach full speed at 95°F (35°C) and switch off at 85°F (29.4°C). PowerCool shall displace 50 CFM with a maximum decibel level of 29 dB (measurements made 1 meter from source, centered horizontally and vertically). PowerCool shall operate at a static pressure of .031 in. H20. PowerCool shall have a removable 10” temperature probe. PowerCool shall have a normally open contact closure for remote surge suppression status notification to customer supplied monitoring device shall operate on 120 volt AC/60Hz nominal power. PowerCool shall have a removable 6’ __A (14-3) IEC SignalSAFE™ power cord with IEC C-(14 or 20) receptacle (refer to chart). PowerCool shall have __(0,1) front and 10 NEMA 5-__R outlets, and (circuit breaker switch with switch guard, keyswitch, always on, refer to chart) located on the front of the unit. “Clean ground” surge suppressor design shall not pass noise contamination to the ground. PowerCool shall occupy one rackspace with a (flat black, black brushed and anodized finish, refer to chart). PowerCool shall comply with the requirements of RoHS EU Directive 2002/95/EC. PowerCool shall be manufactured by an ISO 9001 registered company. PowerCool shall be warrantied to be free from defects in materials and workmanship under normal use and conditions for a period of 3 years. PowerCool shall be ETL listed to UL standard 1419 in the US and CAN/CSA C22.2 #60065 in Canada.

D. MODULAR POWER RACEWAYS: REFERENCED PRODUCT MIDDLE ATLANTIC MPR RACEWAYS. SEE DRAWINGS FOR CIRCUIT QUANTITIES AND CONFIGURATION.

1. MPR modular raceways shall be Middle Atlantic Products model # MPR-6. Power modules shall be M-20. Isolated ground outlets shall be available, suffix part with IG (ex. RLM-20IG). Stand-alone power modules shall be RLM-xx-1C and shall include a 9’ power cord with NEMA 5-15P plug or 5-20P plug. MPR components shall be warrantied to be free from defects in material and workmanship under normal use and conditions for a period of 3 years. MPR components shall be UL Listed separately and as a system in the US and Canada.
   a. Modules on the same circuit shall interconnect using J series jumpers, which feature #12 (20 amp) wire with genderless 30 amp connectors at both ends and require no hard wiring.
   b. All modules on separate circuits shall connect using T series tails, which feature #12 (20 amp) wire with genderless appliance-grade 30 amp connector on one end and wire tails for J-box connection on the other.
   c. Two separate circuits can feed two duplexes on M-2X modules. Remove the factory-installed jumpers (line & neutral) and feed each duplex using two T series tails.
   d. Isolated ground outlets shall not be mixed with non-isolated ground modules on the same circuit.
   e. Module chassis shall be constructed of 18-gauge steel finish in a durable black powdercoat.
   f. The modules shall be attached to MPR raceways using two conveniently located screws.

E. BLANK PANELS: REFERENCED PRODUCT MIDDLE ATLANTIC AUDIO BL SERIES.
   1. EIA compliant 19” blank panels shall have a black powdercoat finish. Blank panels shall be constructed of 16-gauge aluminum.

F. VENT PANELS: REFERENCED PRODUCT MIDDLE ATLANTIC AUDIO VT SERIES.
   1. EIA compliant 19” vent panels. Vent panel shall be constructed of 16-gauge aluminum and shall have a black powder coat finish.
      a. VT perforation pattern shall be: 5/32” dia. hole, with 3/16” staggered centers. Open Area 63%

G. RACK DRAWERS: REFERENCED PRODUCT MIDDLE ATLANTIC AUDIO D SERIES.
   1. EIA compliant 19” rackmount drawer shall have an overall height of X”, and useable depth of 14-1/2”. Drawer base shall be 20-gauge steel, top and sides shall be 16-gauge steel. Drawer faceplate shall be .090” thick aluminum with a black brushed & anodized finish. Drawer shall use full extension, ball bearing slides. Laser knockout shall be provided for passing cables through the rear of the drawer. Drawer shall be UL Listed in the US and Canada. Provide all drawers with keylock option.

2.23 LED RACK WORK LIGHT: REFERENCED PRODUCT middle atlantic lt series

A. Features:
   1. LT series shall have an adjustable width of 17.73” to 21”, a height of 1.75” and a depth of 1.72”.
   2. LT series shall have a light temperature of 2,700-6,500K, and provide __lm (refer to chart).

	Light Qty	Interconnect Cable / Length	Light Temperature	Lumens
LT-CABUTL-SINGLE	1	no	2700-6500K	480-540lm
LT-CABUTL-DUAL	2	yes / 118 [3000]	2700-6500K	960-1080lm

3. LT series light bar shall have an adjustment range of 100º. LT series shall have a cord length of 59”, and the interconnect cable (LT-CABUTL-DUAL only) shall be 118”.
4. LT Series shall include power adaptors for US, BS, SAA and EU. LT Series shall have a UL Listed power supply that meets US DOE Level VI requirements with an output of 12VDC, 2 Amps.
5. LT Series shall have an input voltage range of 90VAC to 260VAC, an input frequency range of 50/60Hz, and a max AC current draw of 800mA AC.
6. LT Series shall meet the EU RoHS Directive 2011/65/EU. LT Series shall be warrantied to be free from defects in materials and workmanship under normal use and conditions for a period of 3 years.
7. LT Series shall be CE Marked (single light only) and FCC Part 15, Class B.

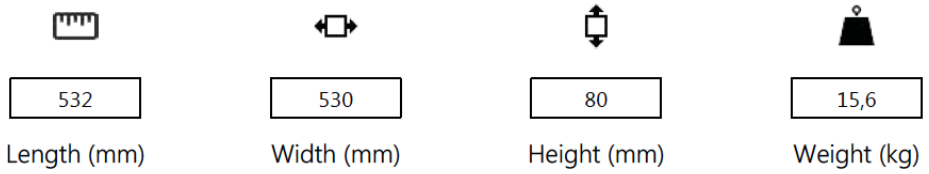
B. Technical Specifications:

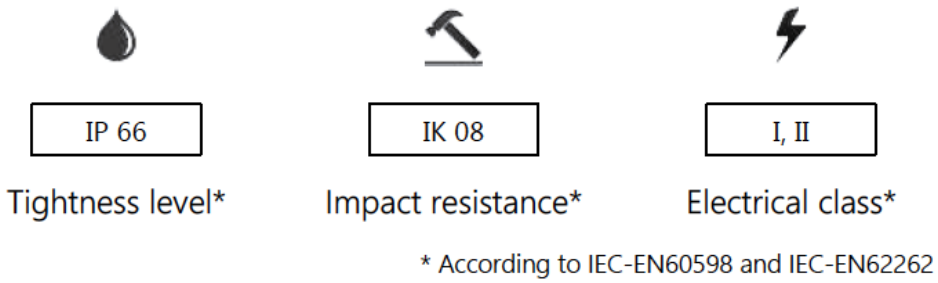
TECHNICAL SPECIFICATIONS	LT-CABUTL-SINGLE	LT-CABUTL-DUAL
INPUT (AC/DC ADAPTER)		
Input Voltage Range	90VAC - 260VAC	
Input Frequency Range	50/60Hz	
Max AC Current Draw @ Full Load	800mA AC	
OUTPUT (AC/DC adapter)		
Nominal DC Output Voltage	12VDC	
DC Output Voltage Range	11.4VDC - 12.6VDC	
Typical DC Current Draw	Single Light 0.6ADC, Dual Light 1.2ADC	
Max DC Load Current	2.0ADC	
Short Circuit Protection	Yes	
DC Output Connector	3.5mm x 1.35mm x 12mm, Center Positive	
PHYSICAL (AC/DC adapter)		
Dimensions	1.8 x 3.5 x 1.5 in (45.5mm x 88mm x 38mm)	
AC Receptacles	Four (4) Interchangeable: US, BS, SAA, EU	
Weight Lb. (G)	0.39lb (175g)	
REGULATORY(AC/DC adapter)		
Safety	UL, cUL, CE	UL, cUL
EMI (Adapter and Lights)	FCC Class B, CE	FCC Class B
Efficiency	Meets US DOE Level VI requirements	
ENVIRONMENTAL (lights and AC/DC adapter)		
Operating Temperature	32F TO 104F (0C TO 40C)	
OPERATING RELATIVE		
Humidity	0 TO 90% NON-CONDENSING	

1.02 high output lowbay white only LED worklight FIXTURE: REFERENCED PRODUCT schreder lighting llc omnistar

A. Standard (All OMNIstar fixtures ship with the following items standard):

1. XP-G2 standard output LEDs or XPL-HD high output LEDs
2. Clear flat glass protector - 5mm tempered glass (IK08 rated)
3. IP66-rated integral driver box and optical unit (remote driver box optional)
4. Single fixture with large U-Type Bracket / Yoke
5. Standard 3' cable and quick-connectors between optical unit and driver box
6. 10kV/10kA surge protection
7. 5 year warranty
8. LED's: ^ #
   a. Standard XP-G2
      1) Watts
         i) 222 Watt
9. Optics: +
      1) T3SA (Symmetric 60o, 5121)
10. Color Temperature
   a. Standard
      1) NW (Neutral 4000K, 70CRI)
   b. Optional *
      1) CE (Cool 5700K, 80CRI)^
11. Voltage/EL Class #
   a. Standard
      1) SV (120-277V CLI)
12. Finish:
   a. Standard Textured Finishes
      1) BK (RAL9011T Black)
13. Options: *
   a. Mounting Options & Accessories - Verify With Architectural
      1) SUS - Single fixture, Suspension mount, caribiners
      2) SH6 - 2-3/8" (60mm) Horizontal/Vertical slip fitter
      3) PT6 - 2-3/8" (60mm) Post-top mount adapter
   b. Dimming Options *
      1) DMX - Custom dimming
14. Characteristics:

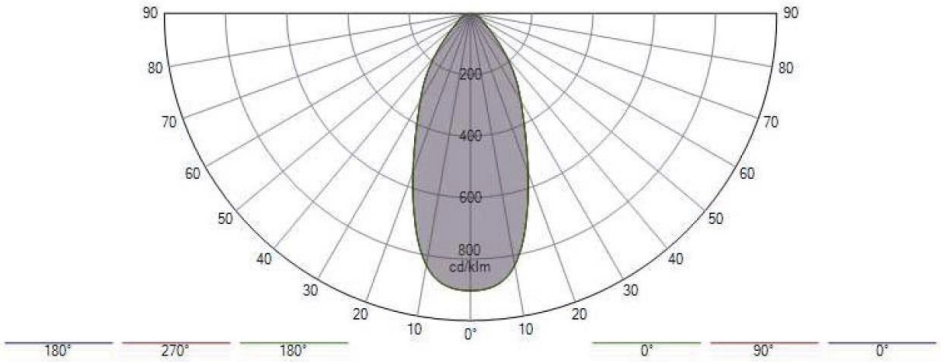




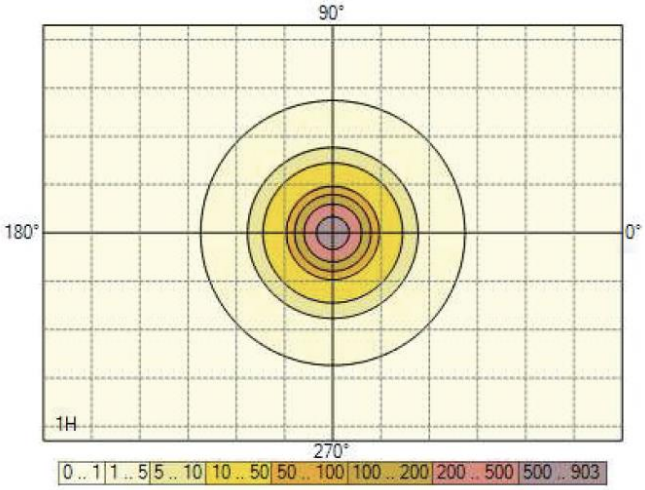
15. Features:
    a. Cost-effective and efficiency to maximise energy and maintenance savings
    b. Flexibility: modular approach for high-power applications
    c. LensoFlex®2 or collimators offering high performance photometry, comfort and safety
    d. ThermiX® with thermal sensor included on the PCBA for long lasting performance
    e. On-site photometric adjustment
    f. Surge protection 10kV (optional)
    g. Designed to incorporate Owlet range of control solutions: autonomous network and interoperable network
    h. exemples Keyfeature
16. Information for 1,000 lumen matrix:
    a. Efficacy (%): 82,7
    b. UWLR (%): 0,0
    c. G Class (EN 13201-2): G6 IES Type: V - VeryShort
    d. Information for 1000 lm matrix
    e. Imax (cd): 903
    f. Aperture 0-180°: 24 - 24
    g. Aperture 90-270°: 24 - 24
    h. I 70-80-90-95 (cd): 24 - 7 - X - X
    i. DLOR (%): 82,7
    j. ULOR (%): 0,0 Nema type: 5x5
    k. US standard
17. Photometrical Characteristics:

Acronym	Colour temp.	CCT (K)	CRI	Typical luminaire output (lm)	Luminaire power (W)	Luminaire efficacy (lm/W)	Current (mA)	Typical led flux (lm)	LED Count
OMNIOB	NW	4250	70	25700	222	116	500	31300	144

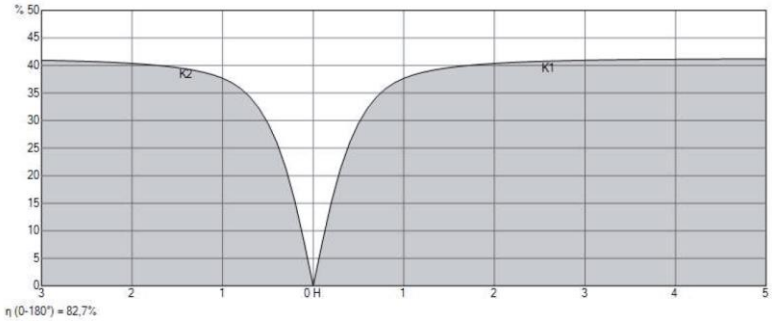
18. Housing & Finish:
    a. Housing in high-pressure, die-cast aluminium, polyester powder coated
    b. Protector: thermally hardened glass
    c. Screws in stainless steel
    d. Colour: provide as indicated on the contract documents (black is our standard desired finish)
    e. Luminaire Cl.S (front 45°): 0.168m²
    f. Tightness - optical: IP66
    g. Tightness - driver: IP66
    h. Impact resistance: IK08
19. Optical Unit:
    a. “FutureProof” optical unit, replaceable on-site, enclosed in the housing with a removable gasket - Shore50
    b. Protected against lens degradation with a 5mm thick extra clear hardened glass
    c. Flatbed PCB with acrylic lens overlay principle
    d. Various photometric distributions: from motorway to large areas
    e. CRI > 70
    f. ULR: 0%
    g. LED lumen depreciation
    h. Lifetime residual flux @ Tq=25°C @ 100.000 hrs: 350mA & 500mA: 90%; 700mA: 80%
20. Electrical:
    a. Class I or Class II
    b. Input voltage: 120-277V - 50-60Hz
    c. Power factor > 90% at full load
    d. 10kV surge protection
    e. Automatic power-off at opening
21. Standards & Certifications:
    a. CE
    b. ENEC
    c. LM79-80
    d. ETL
    e. ROHS
    f. All measurements in ISO17025 accredited laboratory
22. Options:
    a. OWLET remote management and dimming options (DALI or 0-10V)
    b. Structured glass for comfort
    c. Back light control
    d. WW & CW LEDs
    e. Various types of mounting systems can be accommodated with tilting mechanism
23. Accessories: Provide with DMX Dimming and FG Difuse Glass Option
    a. Provide with DMX Dimming and FG Diffuse Glass Option
24. Typical Polar/Cartesian Diagram:



25. Typical Isolux Diagram:



26. Typical K-Curve Diagram:



27. Note: The above polar plots, diagrams and curves may not represent all output and LED configurations present within this product line. The manufacturer's current diagrams specific to each LED array configuration, power package, optics package, etc. shall be the actual determining factor of equivalency when comparing substituted products. These diagrams shown here are typical and diagrammatic only.

1.03 wall mounted relay panel and load center: referenced product etc unison echo relay panel

A. General

1. The wall mount relay panel shall be the Echo Relay Panel as manufactured by ETC, Inc., or equal
2. Relay Panels shall be UL508, UL67, and UL924 Listed, and shall be so labeled when delivered
3. Relay Panels shall consist of a main enclosure with 30 pole breaker subpanel, relay/Relay sub panel, integral control electronics, and a low voltage subpanel for data terminations and provision for accessory cards
   a. Up to two accessory cards shall be supported per relay panel

B. Mechanical

1. The panel shall be constructed of 16-gauge steel. All panel components shall be properly treated and finished in fine-textured, scratch resistant paint
2. Relay panels shall be available in 120 and 277 Volt AC configurations
   a. 120V enclosures shall be 67.5" high by 14.36" wide and 4" deep with a weight not more than 80 pounds
   b. 277V enclosures shall be 67.5" high by 20" wide and 6" deep with a weight not more than 130 pounds
3. The panel shall be capable of being mounted on the surface of a wall or recessed mounted
   a) 120VAC panels shall support mounting between standard wall stud framing (16-inch on center spacing)
4. Choice of panel covers shall be available for surface or recess mount applications. This outer panel shall ship complete with a locking door to limit access to electronics and breakers, breakers
   a. Optional center-pin reject security screws shall be available for all accessible screws
   b. Recess mount doors shall extend 1" beyond all panel edges to hide wall cut-out
5. The unit shall provide interior cover over breaker panel to allow access only to class 2 wiring and prevent direct access to class 1 line voltage components
6. The Relay panel shall support up to twenty-four 20-amp single pole circuits made up of relays or 300W phase-adaptive Relays
   a. Two and three-pole relay circuits shall be supported at decreased density where each pole constitutes one of the available single-pole circuits. Mixing of circuits in any combination shall be supported
   b. Panels that do not support an integral Relay module shall not be acceptable
7. Relays shall include integral switches for manual control while power is unavailable to the panel such that critical lighting can be set to an on state, without the need for power to the panel
8. Relay output lugs shall accept 6-14AWG copper wire
9. Breaker subpanel may include up to twenty-nine 20-amp single pole, up to fourteen 20 amp double pole, or nine three pole breakers as required in any combination up to capacity
10. Control wiring for DMX, station bus, and Emergency input terminations shall land on removable headers for contractor installation.

C. User Interface

1. The user interface shall contain a graphical display with button pad to include 0-9 number entry, up, down back arrow navigation and enter
2. Test shortcut button shall be available for local activation of preset, sequence and set level overrides
3. The user interface shall have a power status LED indicator (Blue), a DMX status LED indicator (Green), a network status LED indicator (Green) and an LED indicator (red) for errors
4. Interface shall allow the backlight to timeout and shall provide user editable options to shut off backlight completely as well as adjust screen contrast
5. Ethernet interface shall default to automatic IP through link local and DHCP. Upon receiving IP address, the address of the Network Interface Card (NIC) shall display in the about menu. Static address and settings shall also be possible
6. The control interface shall support a USB memory stick interface for uploads of configurations and software updates

D. Functional

1. Panel setup shall be user programmable. The control interface shall provide the following relay setup features (per circuit):
   a. Type (1 pole, 2 pole, or 3 pole)
   b. Name
   c. Circuit Number
   d. DMX address
   e. sACN address
   f. Space Number
   g. Circuit Modes
      a) Normal (priority and HTP based activation and dimming)
      b) Latch-lock
      c) Fluorescent
      d) DALI
   h. On threshold level
   i. Off threshold level
   j. Include in UL924 emergency activation
   k. Allow Manual
2. Relay panels shall support discrete addressing of each relay. Panels that are restricted to use of start address with sequential addressing and cannot assign each 0-10V output control to any internal relay shall not be acceptable
3. The panel shall be capable of switching all relays on or off at once, or in a user-selectable delay per relay using a period of 0.1 to 60 seconds, in 0.1 second increments
4. An Ethernet connection shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit via an internal Web UI or central monitoring interface
   a. Control electronics shall report the following information per branch circuit.
      a) Breaker state (On/Off)
      b) Breaker state (Open/Closed)
      c) Current draw (In Amps)
      d) Voltage
      e) Energy usage

b. Panels that do not report this information shall not be acceptable.

5. Built-in Control shall include:
   a. Ability to record up to 16 presets in each space from the control panel, connected control stations, or timed events
   b. Presets shall be programmable by recording current levels (as set by DMX or connected control stations), by entering levels on the control panel directly, manually selecting relay state on each relay or a combination of these methods. From the control panel, stations, or timed events it shall be possible to record values for up to 16 zones per space
   c. Up to 8 spaces in a single rack for total of up to 16 spaces shall be supported per system or system subnet
   d. Indication of an active preset shall be visible on the control panel display
   e. One 16-step sequence per space for power up and power down routines
   f. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by setting included relays to "on", while setting non-emergency relays "off". Each relay can be selected for activation upon contact input
   g. Upon Data loss the system shall provide options to hold last look infinitely or hold for a configured time period set by the installing technician then fade/switch to the input of the next available priority
   h. Control electronics shall respond directly to control stations for zone, preset, and sequence control. Systems that require secondary control systems for this functionality are not acceptable
   i. After power loss, electronics shall be capable of holding the system in its previous state until new level data (DMX, architectural presets, sequences and zones, or local overrides) is received to make each relay change state
6. The control of lighting and associated systems via real time and Astronomical clock controls
   a. The relay panel shall allow the activation of presets, sequence, and zone programming of up to 50 time clock events via a built in real and astronomical timeclock
   b. System time events shall be programmable via the control panel.
      i) Time clock events shall be assigned to system day types. Standard day types include: everyday, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday
      ii) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event
      iii) System shall automatically compensate for regions using a fully configurable daylight saving time
      iv) Presets shall be assigned to events at the time clock
      v) The time clock shall support event override
      vi) It shall be possible to override the timed event schedule form the face panel of the time clock
   c. The time clock shall support timed event hold
      i) It shall be possible to hold a timed event from the face panel of the processor
      ii) Timed event hold shall meet California Title 24 requirements
7. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any relay being patched to any DMX control address

a. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components
b. The relays shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz
c. Setting changes shall be able to be made across all, some, or just one selected relay in a single action from the face panel
d. DMX data loss shall allow for levels/relays to be held for ever or for a specified time before switching to a lower priority source
e. Initial Panel setup
   1) The relay panel shall automatically detect the type of relay or Relay installed in each location without need for manual configuration of the physical arrangement.
   2) Quick rack setup shall be available to apply address settings across all circuits for rack number, DMX Start Address, sACN universe, and sACN start address.
   3) Emergency Setup Menu shall provide optional delays when emergency is activated or deactivated, and option to turn off non-emergency circuits shall be available. Record function shall allow circuits that are turned on to be added to the emergency setting

E. Electrical

1. Relay Panels shall be available to support power input from:
   a. 120/208V three phase 4-wire plus ground
   b. 120/240V single phase 3-wire plus ground
   c. 277/480V, 230/400V and 240/415V three phase. 4-wire plus ground
2. Conduit Entry:
   a. Feeders:
      1) Top or top-side (upper 6” of either side)
      2) Bottom or bottom-side 6” of either side
      3) Feeders shall enter through the top or bottom according to the orientation of the enclosure
      4) Feeder entry shall be nearest to the location of the feeder lugs or main breaker
3. Load:
      1) Load wiring shall enter through the top or bottom of the enclosure
      2) Load wiring shall enter through the top/bottom surface nearest to the breaker sub panel
      3) Load wiring may also enter through left and/or right side provided a low voltage chase is not required through the same area. If class 2 chase is required, a field installable barrier panel shall be provided upon request. When installed, the left or right side of the panel, where the barrier has been installed, shall not permit load wiring
   b. Low Voltage:
      a) Top or top-side (upper 6” of either side)
      b) Bottom or bottom-side (bottom 6” of either side)
      c) For low voltage conduit entry at the relay end of the cabinet, conduits shall be located at the outer 3” of the top/bottom panel
      d) Field installed low voltage channel shall be provided separately for installation on the left or right side of the panel to allow class 2 wiring to traverse the panel from top to bottom or bottom to top
4. All relays shall be mechanically latching

5. The relay shall be capable of switching 20A at up to 300V
6. The relay panel shall support a maximum feed size of 200 Amps
7. Relay panels shall support main circuit breaker options:
    a. Main breaker options shall be optional and available for purchase upon request
    b. Main breakers shall be field installable
    c. Main breakers shall be available in 100 and 200 Amps for 120V systems and 150 Amps for 277V systems
    d. Series rated SCCR ratings apply as follows with appropriate main breaker:
        1) 22,000A at 120/240V
        2) 10,000A at 100A; 120/208V
        3) 10,000A, 22,000 or 42,000 at 200A; 120/208V
        4) 14,000A at 150A and 200A; 277V/480V
        5) 65,000A at 200A; 277V/480V
    e. Main breakers shall allow the following range of wire sizes:
        1) 1AWG-300kcmil at 120/240V
        2) 3/0 to 300kcmil at 120/208V
        3) 6AWG-300kcmil at 277V/480V

F. Relay

1. Each relay shall have a manual override switch with on/off status indication
2. Relays shall be rated for use with:
    a. 16A Electronic Ballast loads @ 120, 240 and 277V
    b. 20A Tungsten loads at 120, 240, and 277V
    c. 20A 277V Ballast (HID)
    d. Motor loads with ratings of 20 FLA @ 120V, 17 FLA @ 240V, and 14 FLA @ 277V 100,000A symmetrical SCCR
3. Isolation shall be 4000V RMS
4. Relays shall be latching state
5. Rated Life:
    a. 1,000,000 mechanical activations
    b. 100,000 cycles at full resistive load
    c. 30,000 cycles full motor, inductive, tungsten, and electronic (LED)
    d. Decreasing loading shall increase the rated life of the relay inversely proportional the square of the load
6. Relays shall support reporting of current usage with an accuracy of five percent of the connected load

G.Phase Adaptive Relay

1. The phase adaptive Relay module shall be fully rated for loads up to 300W
2. By default, phase adaptive Relays shall automatically detect the required dimming mode based on connected loads and lock the mode in at power-up
3. The phase adaptive Relay shall support tungsten/incandescent, 2-wire fluorescent, line-drive LED, electronic transformer and magnetic transformer loads
    a. Magnetic transformer loads shall be supported at 120V up to 300W when the connected transformers are loaded to their rated current capacity
4. Relays that do not support magnetic loads shall not be acceptable
5. The panel shall support a maximum phase dimming load of 7,200W f populated fully with (24) 300W Relay modules. Panels that do not support phase Relays and relays combined in a single panel shall not be accepted

H. Relay Panel Accessories

1. A low voltage 0-10V dimming option shall provide up to 24 0-10v control outputs that are linked to relay circuits within the panel. Each output shall support up to 400mA of current sink per output
2. A contact input option shall provide 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained, or momentary toggle
3. A DALI control option shall provide 24 control loops of broadcast DALI control, with each loop controlling up to 64 DALI devices
4. A RideThru option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present
5. A tamperproof hardware kit shall be available that provides center reject Torx head screws to prevent access to panel interior by unqualified individuals.
6. Provide with a custom wiring harness in order to interface with the Sensor Battery backup system as required.

I. Main Breaker options shall be available as specified in Section E.6 Thermal

1. The panel shall be convection cooled. Panels that require the use of cooling fans shall not be acceptable
2. The panel shall operate safely in an environment having an ambient temperature between 32ºF (0ºC) and 104ºF (40C), and humidity between 5-95% non-condensing.

1.04 emergency bypass interface and detection: referenced product etc Emergency bypass detection kit (ebdk)

A. Where required to detect the loss of normal power and trigger special-purpose lighting presets, the detection means shall be the Emergency Bypass Detection Kit as manufactured by Electronic Theatre Controls, Inc., or equal.

B. Mechanical

1. The Kit Enclosure shall be a surface mounted, constructed of 16-gauge, formed steel panels with a removable front cover.
2. The Emergency Bypass Detection Kit shall include a 3-pole, 10 amp breaker for local over-current protection and simulation of normal power loss.
   a. The enclosure shall have a lockable door to allow limited access to the over-current protection breaker
3. All components shall be properly treated and finished.
   a. Exterior surfaces shall be finished in fine textured, scratch-resistant, powder coat paint
4. The EBDK enclosure shall provide discrete high and low voltage wiring compartments with voltage barrier.
5. EBDK dimensions and weights shall not exceed:
   a. 10.5” H x 14” W x 4.2” D 11 lb.
6. Accessories
   a. Emergency Bypass Detection Tap Kit (EBDK-TAP)
      1) The Emergency Bypass Detection Kit shall support an optional tap kit for normally power loss sensing within an ETC Unison DRd Enclosure
      2) The Tap Kit shall provide fused over-current protection for sense feed wiring without the need for an external circuit breaker
      3) The Tap Kit shall install within an ETC Unison DRd Enclosure

b. Emergency Bypass Restore Switch (EBDK-SWITCH)

1) The Emergency Bypass Detection Kit shall support an optional switch kit ,requiring manual override before allowing the EBDK to return to a normal power state

2) The Restore Switch shall be a single-gang device, fully finished, and supplied with mounting holes.

i) The EBDK Switch Kit shall be clearly labeled identifying intended operation

ii) The Switch shall be labeled Lighting System Restore

iii) The Switch shall include a red indicator that is illuminated when bypass operation is active

3) The EBDK Switch shall require two 16-gauge wires for connection to the Emergency Bypass Detection Kit

i) Up to two Bypass Restore Switches shall be supported per Emergency bypass Detection it

C. Electrical

1. Emergency Bypass Detection enclosures shall support 100 to 277 volt configurations
   a. EBDK enclosures shall be field configurable for single-phase, bi-phase, and three-phase operation without the need for additional components.
2. Phase Loss Detection circuitry shall provide 0.5 second delay to prevent nuisance tripping
3. The EBDK shall provide an integrated circuit breaker for over-current protection and simulation of normal power loss
4. The Emergency bypass detection Kit shall support isolated outputs for connection to multiple dimming products simultaneously
   a. Three isolated contacts shall be provided
   b. Each contact shall support connection of up to four dimming products.
5. The Emergency Bypass Detection Kit shall be completely pre-wired by the manufacturer. The contractor shall provide input feed and control wiring.
6. All control wire connections shall be terminated via factory provided connectors.
   a. Factory provided connector shall support 12 to 22-gauge wiring
   b. Emergency lighting input shall support load shedding
7. The Bypass Detection Kit shall prove a normally-closed input for interface with fire alarm systems
8. The Bypass Detection Kit shall be UL and cUL Section 924 Listed for interaction with similarly listed dimming and switching panels

D. Thermal

1. Ambient room temperature: 0-40°C / 32-104°F
2. Ambient humidity: 10-90% non-condensing

1.05 emergency dmx interface and control: referenced product etc DMX Emergency bypass CONTROL (DEBC)

A. Where required to trigger special-purpose lighting presets and bypass normal lighting controls during emergency or panic situations, the bypass means shall be the DMX Emergency Bypass Controller (DEBC) as manufactured by ETC, Inc., or equal

B. Functional

1. The DMX Emergency Bypass Controller shall be capable of overriding a single universe of ANSI E1.11–2008, USITT DMX512-A control signals from “Normal” to “Bypass” when a trigger signal is detected via a contact closure trigger input

a. The DMX Emergency Bypass Controller shall output to a single DMX output or up to six optically-isolated DMX outputs
b. The DMX Emergency Bypass Controller shall poll the bypass trigger input after a power loss and react upon start up
c. The default or recorded preset shall be recalled immediately on restart if the trigger is also applied at restart
d. Controllers that do not support E1.11–2008 compliant DMX communication shall not be acceptable

2. The DMX Emergency Bypass Controller shall be capable of recording a single DMX preset (snapshot) of 512 channels for recall during "Bypass" mode
3. The DMX Emergency Bypass Controller (DEBC) shall have internally accessible, labeled DIP switches for configuration of:
   a. DMX Record Mode
      1) All 512 channels (default)
      2) Selected channels, snapshot
   b. Contact input type
      1) Normally open (default)
      2) Normally closed
   c. Wait Time for Restore incoming DMX (bypass trigger removed)
      1) 0 Seconds (default)
      2) 10 Second Wait
      3) 30 Second Wait
      4) 10 Minute Wait
4. The DMX Emergency Bypass Controller shall support a single bypass input using two input modes:
   a. Bypass triggering shall be supported via a maintained contact input configurable for normally open (N.O.) or normally closed (N.C.) operation
   b. The contact input shall support +12VDC wet input to provide interface with fire alarm or secondary trigging systems. Bypass controllers that do not support a fire alarm input shall not be acceptable.

C. Mechanical

1. The DMX Emergency Bypass Controller (DEBC) enclosure shall be a surface mounted enclosure with a removable cover, constructed of 16-gauge, formed steel with a removable front cover
   a. All components shall be properly treated and finished in fine textured, scratch-resistant, powder coat paint
   b. DEBC enclosure shall have a minimum of four keyed mounting holes for wall attachment
   c. DEBC enclosure shall have a visible label stating the product name, manufacturer name, indicator functions, control functions, ratings and listings
2. The DMX Emergency Bypass Controller (DEBC) enclosure shall provide discrete high and low voltage wiring compartments with voltage barrier
3. The DMX Emergency Bypass Controller (DEBC) shall have a single bi-color LED indicator visible from the exterior of the enclosure
   a. LED shall indicate Normal state with a "green" color light
      1) Normal state illuminates steady green when Power and DMX are present
      2) LED Off indicates Power or DMX are not present

b. LED shall indicate Bypass state with a "red" color light
   1) Bypass state includes bypass input contact trigger or 'test' active

4. The DMX Emergency Bypass Controller (DEBC) shall have a single test button accessible from the front of the enclosure without removing any panels
   a. The test button shall immediately trigger bypass state for as long as it is held down, and release the bypass state immediately upon release of the button
      1) The test button shall be momentary only
      2) The test button shall be recessed to prevent accidental triggering
5. The DMX Emergency Bypass Controller (DEBC) shall have a single, internally accessible button for DMX Record (snapshot) with an indicator LED for record action
      1) The record button shall be momentary only and held for at least 3 seconds before activation to prevent accidental recording
      2) The LED indicator will flash rapidly when record function is active
      3) The LED indicator will illuminate steady when record function is complete
6. The DMX Emergency Bypass Controller (DEBC) dimensions and weights shall not exceed:
   a. 9" H x 11" W x 2" D,
   b. 8lbs (single output); 14.5lbs (multi-output)

D.Electrical

1. The DMX Emergency Bypass Controller shall be completely internally pre-wired by the manufacturer
2. The contractor shall provide input feed and control wiring to the provided terminals
   a. DMX Emergency Bypass Controllers (DEBC) shall support 100 to 277 volt input power, 50/60 Hz, 150mA maximum current
3. DEBC shall support labeled terminations for two 24 – 10 AWG solid or stranded power wires
4. DEBC shall support one Grounding Lug for 24-14 AWG solid or stranded ground wire
5. DEBC shall support labeled, socketed termination connections for DMX Input and DMX Output wiring
   a. Terminations shall support Belden 9729 cable or equivalent
      1) DMX Termination kits for Belden 9729 shall be supplied with the controller
      2) Optional Termination kits for Belden 1583A (or equivalent Category 5 cable) shall be available from the manufacturer
6. DEBC shall support labeled, socketed termination for the bypass contact input
   a. Termination shall support two, 30-12 AWG low-voltage wires
   b. The bypass input shall support a maintained normally open (N.O.) or normally closed (N.C.) dry contact input
   c. A +12VDC wet contact input shall also be available for interface to fire alarm systems.
   d. DEBC shall support socketed DMX transceiver chips
      1) A spare DMX transceiver chip shall be supplied in a labeled, inactive socket
7. The DMX Emergency Bypass Controller (DEBC) shall internally switch from the normal DMX input (pass through) to the bypass DMX output using electromechanical relays when triggered
   a. The DEBC shall have non-volatile memory for storage of a single recorded sequence of 512 channels
      1) The recorded sequence shall persist through power outages

2) The default sequence shall have all 512 channels at "full" if no sequence is recorded

b. The DEBC shall have a DMX baud rate of "Slow" (20 packets per second) for increased compatibility during bypass DMX output

8. The DEBC shall be available in two versions capable of output to a single DMX line or up to six optically-isolated DMX lines
9. The DMX Emergency Bypass Controller shall be UL and cUL Section 924 LISTED for interaction with similarly listed products

E. Thermal

1. Ambient room temperature: 0-40°C / 32-104°F
2. Ambient humidity: 10-95% non-condensing

1.06 emergency lighting transfer switch: referenced product etc BRANCH CIRCUIT EMERGENCY LIGHTING TRANSFER SWITCH (BCELTS)

A. General

1. The Branch Circuit Emergency Lighting Transfer Switch (BCELTS) shall be the SC1008 as manufactured by ETC, Inc., or equal
2. The BCELTS shall provide automatic transfer of a single branch circuit from normal to emergency power source, when normal power fails
3. The BCELTS shall transfer a lighting load branch circuit from a Relay/ relay or secondary control output to a second power source in the event of a loss of power to the primary power source, a normal system failure, or activation of a fire alarm
4. The system shall be listed under ANSI / UL1008 Transfer Switch Equipment and comply with ANSI / NFPA 110 Standard for Emergency and Standby Power Systems, and ANSI / NFPA 70 (NEC), including Article 700, 701 and 702 safety standards. Emergency transfer systems that do not comply with the below stated NEC articles and sections shall not be permitted
   a. Satisfies requirements of the National Electrical Code (NFPA 70):
   b. Article 700 – Emergency Systems
   c. Article 701 – Legally Required Standby Systems
   d. Article 702 – Optional Standby Systems
   e. Section 518.3(C) – Assembly Occupancies
   f. Section 520.7 – Theatres and Similar Locations
   g. Section 540.11(C) – Motion Picture Projection Rooms
5. The BCELTS shall transfer a single circuit at 120V or 277V up to 20 Amperes in capacity

B. Transfer Switch

1. The BCELTS shall be a UL1008 transfer switch listed for Emergency Systems (NEC Articles 700 and 701; UL CCN WPWR)
   a. Transfer switches not listed under UL1008 shall not be acceptable
   b. Transfer switches listed under UL1008 for Optional Standby (NEC Article 702; UL CCN WPXT) applications only shall not be acceptable
   c. Automatic Load Control Relays (ALCR) listed under UL924 shall not be acceptable
2. The switch shall be positively latched and unaffected by voltage variations or momentary outages so that constant contact pressure is maintained and temperature rise at the contacts is minimized
3. The switch shall be electrically interlocked to ensure only one position, either Normal or Emergency, is engaged at any time

4. The switch shall be break-before-make to ensure that normal and emergency sources are never interconnected within the unit
5. Built-in fuses shall provide 10,000 Ampere Short Circuit Current Rating (SCCR) on the connected emergency circuit
6. Switch contacts shall withstand transfer without welding, with 180º phase displacement between normal and emergency power sources if both sources are energized
7. Transfer switch contacts shall be rated for mixed loads, including electric discharge lamps and tungsten filament lamps
8. Transfer switch shall be rated for a minimum of 6,000 cycles at full tungsten load

C. Control Circuitry

1. The control circuitry shall direct the operation of the transfer switch
2. A field-configurable normally closed (NC) or normally open (NO) dry contact closure input shall be provided
   a. Up to (10) BCELTS devices may be connected to a single remote loop
3. The BCELTS shall support transfer of a 0-10V or DALI controlled circuit
   a. Upon activation of emergency transfer the BCELTS shall break the 0-10V or DALI control circuit, driving connected 0-10V circuits to full output and DALI circuits to their default level.

D. Operation

1. Transfer to alternate emergency supply will occur when normal supply sense voltage drops below 80V when used at 120V or 277V

E. Enclosure

1. The BCELTS shall be mounted in a NEMA 1 interior type enclosure finished in fine-textured epoxy paint
2. The enclosure shall be 8.5”H x 10.5”W x 2.75”D
3. The system shall be provided with an approved overlay mounted on the front of the enclosure, stating, “BRANCH CIRCUIT EMERGENCY LIGHTING TRANSFER SWITCH”
4. The enclosure shall be provided with an approved label indicating that the system is UL1008 LISTED for Emergency Systems

PART 3 - EXECUTION

3.1 General:

A. All liability for rigging, fastening, wiring and other installation methods shall be borne by the contractor alone. If the contractor has a reason to believe that safety will be compromised in the installation of any specified equipment in the locations specified, they must note this at the time of bid and offer alternatives in writing.
B. Maintain the integrity of all fire-walls and doors during construction and upon completion.
C. All methods must be cosmetically acceptable to the owner. All equipment shall be installed neatly, with respect to level & plumb, sight lines and finish. All wiring must be neatly run and concealed in an orderly fashion and attached to appropriate support structures.
D. Identify any equipment requiring licensing and initiate licensing procedures for all such equipment.

E. Coordinate all work with other on-site trades in order to achieve a coordinated progress at all times.
F. All RDM fixtures (remote device management) shall incorporate the latest RDM standard in fixture addressing, remote management, reporting, etc. (must be ANSI E1.37.2 or later compliant).

3.2 Wiring and Racks:

A. All CR (communications rack) wiring shall be neatly tie wrap bundled (or as indicated otherwise on contract drawings) with wires parallel and perpendicular to rack sides and backs All wiring shall be properly strain relieved as it exits the rear connection points on the related equipment, shall be routed out to lacing bars, shall be routed out along lacing bars to rack side areas and shall be tie wrapped to the lacing bars. All rack wiring shall be performed as noted. Loose, haphazard or otherwise poorly managed wiring without proper strain relief shall not be allowed.

B. Provide all internal network/DMX style wiring, etc. Needed inside the relay panel & all required interconnections & feeds to external equipment.
C. Control hookup is provided by the factory technician.
D. Within the Relay/relay rack all wiring splices must utilize butt style line insulated splices crimped with a controlled cycle termination tool. Referenced style Panduit BSV10X-D or equal. Size splices per gauges of wiring to be spliced. See written specifications for more info.
E. All wiring that is not in conduit shall be plenum rated wiring (Belden 1585A or equal).

F. All control booth wiring shall be neatly tie wrap bundled and dressed neatly.
G. All lighting or power cables & wiring must be dressed neatly with tie wraps & eyes or ring runs & tucked up against underside of lighting countertop
H. No undue stress shall be placed on any connection by a lack of support of the wiring within the rack.
I. Any wiring splices necessary must utilize butt style inline insulated splices crimped with a properly adjusted controlled cycle termination tool. Referenced style Panduit BSV10X-D or equal. Size splices per gauges of wiring to be spliced & provide as required. No incorrectly sized splices shall be allowed.
J. Any equipment having accessible controls that are not normally used during system operation will have its controls capped or otherwise locked such that they are not adjustable. If no other means is feasible the use of security covers is mandated. Rack doors are not acceptable as means of tamper resistance for controls.
K. Provide all (rack panels, bottom/top pans, spreader bars, access panels, etc.) blank and/or vent panels as needed to complete each rack with no unfilled spaces, as per rack elevations or as required by alternates to equipment specified. No racks with unfilled panel spaces shall be allowed. Seal all air gaps around conduit entry holes as needed in order to keep air gaps to a minimum.
L. Wiring Standards - Plenum Rated Cable: Unless specifically noted on the drawings, all low voltage wiring is to be CL2/CL3 wiring.
M. No rack rails will be allowed for equipment mounting in the rear of the rack unless otherwise noted in this specification.

N. All conduits indicated on the drawings shall terminate directly into racks as shown – top, bottom or at any of the provided knockout locations (unless otherwise and specifically indicated on the drawings as otherwise) and so as not to obstruct access to the racks or adjacent walkways or approaches.

O. Route conduits into racks with as few bends as possible – use sweep elbows where necessaryAll wiring shall be protected in conduit until it has reached the internal space of the indicated rack(s).

P. All system related racks shall be mounted vertically and as intended by the manufacturers. No racks shall be allowed to be mounted horizontally.

Q. The contractor shall program the main relay rack(s) control module(s) to “hold last look” upon loss of DMX signal. Duration of this hold shall be for 15 minutes (unless the system has been shut down or turned off by the architectural control system). This shall prevent the room from going dark in the case of lighting console failure or inadvertent disconnection of DMX/NET input from lighting control console to the system.

R. CONDUITS:

1. Use separate conduits for data and other control cabling. Control power and ground may be run with data for the same devices.
2. All conduits shall be concealed unless the owner has been notified in writing and accepts by written approval the location of all exposed conduits.
3. A pull string shall be left in place by the installing contractor after pulling all wiring through each conduit. This pull string shall be tied off at both ends and left for future use.
4. All lines, cabling or wiring in any conduit run must be free from any splices or junction points.
5. All lines, cabling or wiring must be free from damage. Any that exhibits stress, damage, intermittent signal problems, data errors or other anomalies due to excessive pull torque shall be replaced.

S. JUNCTION/GANG BOXES:

1. Unless otherwise specified all controls, receptacles, user interface stations, plugs and outlets shall be located in an appropriately sized gang box. No multi-gang backboxes with raised, tile ring, extension ring or mud ring style reducers to obtain the specified faceplate gang size shall be acceptable in lieu of the indicated device backbox.
2. Any junction (i.e. terminal blocks, punch down blocks etc.) shall be housed in metal enclosures with an attached ground. No such connections may be made in ceiling spaces or other areas without the use of a steel enclosure.
3. Any field added junction boxes shall be sized and located for ease of troubleshooting access and all connections within shall be connected on terminal strips, which are clearly identified, in a logical, consistent & permanent manner.

3.3 ASSEMBLY AND PRE-TEST:

A. LIGHTING FIXTURES:

1. Install connectors as required on fixtures prior to bench test and focus.
2. Attach all safety cables to fixtures by removing one yoke bolt and sliding the fixed end loop of the safety cable over the yoke. Reinstall the yoke bolt.

3. All incandescent lamps shall be burned in for at least 8 hours to check for defective lamps. Replace any lamps that fail and burn those lamps in for at least 8 hours.
4. Adjust incandescent lamp center for highest output flat field (bench focus). This is required for any new and/or existing to remain and be reused fixtures.
5. All LED fixtures shall be DMX addressed, set up in the proper color mode, have fan speeds set to quietest mode of operation, etc. and tested with addressing in place.
6. Each LED fixture shall be turned on and "burned in" at full for (2) weeks in the contractor's shop in order to check for defective power supplies, drive electronics packages or other fixture anomalies.
7. See TL series drawings for a more complete description of the procedures recommended for bench focusing of fixtures.

B. LIGHTING EQUIPMENT (OTHER THAN FIXTURES):
1. All new equipment shall be turned on/burned in and tested prior to delivery to the site. No equipment may be delivered to the site without being fully tested off-site. The equipment does not need to be under load during this period.
2. This includes, but is not limited to, the lighting control console, fader wing panels, video displays/monitors, remote focusing units, Blues System power supplies, portable network gateways/nodes, architectural control processors, followspot fixtures and related power supplies, network switches, portable Relay devices and any other lighting related portable equipment. Burn in requirements do not apply to installed Relay racks, grid iron junction boxes, individual Relay modules or DMX distribution racks.

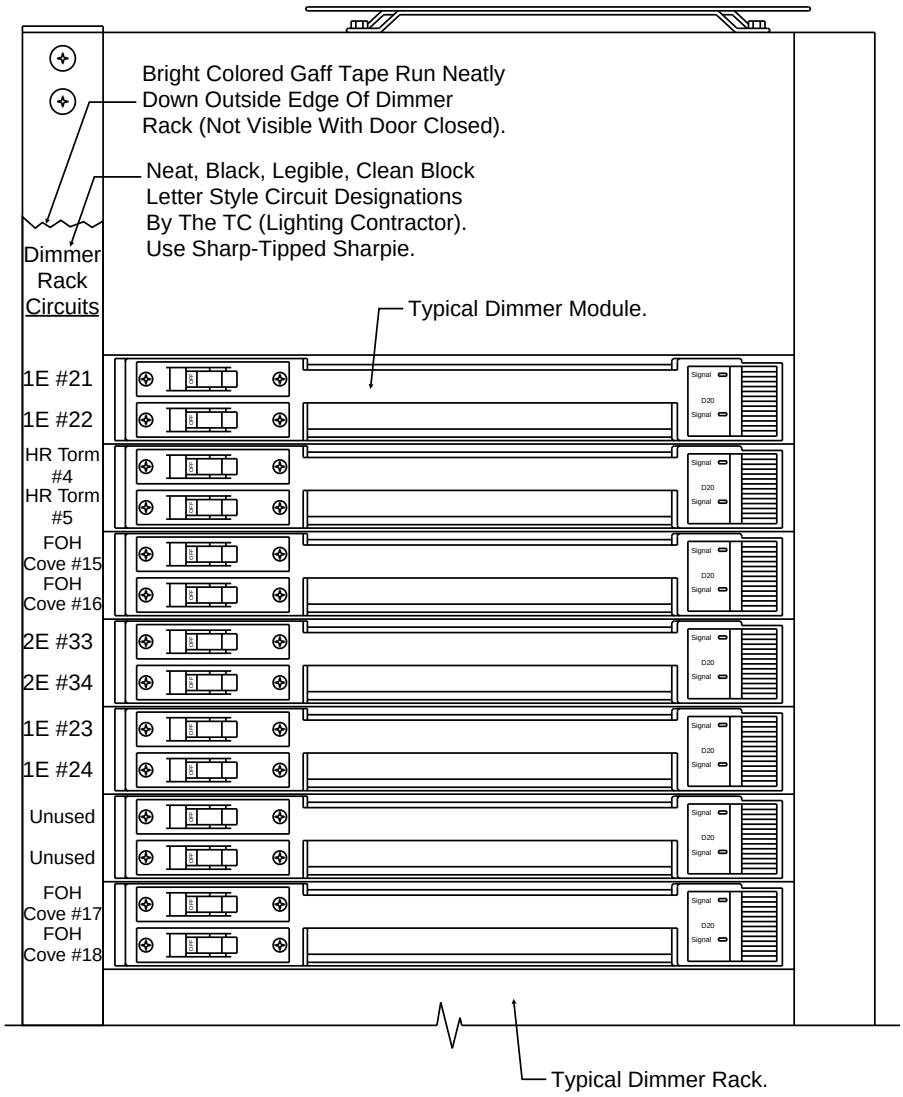
3.4 Finishes & Cleaning:

A. All finishes shall be returned to their original finish and condition after any temporary machining or other work.
B. Cover any walls, furniture, finished floors and carpeted areas to catch all metal particles, grit, etc. that may occur during installation.
C. Cover and protect all equipment left or installed on site during construction.
D. Provide thorough cleaning of all work areas including vacuuming, spray cleansers and dust removal as required. Clean all equipment fan filters before final acceptance tests.
E. Provide a thorough cleaning of all lighting system and related devices, including but not limited to, fixtures, housings, racks, cables/cordsets, data lines, reflectors, lenses, modules, mounting pipes, controls, consoles, etc. regardless of status (new or existing to remain/reuse). Cleaning shall be after all dust/dirt creating work has been completed and just prior to walk-through/punch list and turnover to the owner.
F. Maintain clean work areas, removing all debris daily.

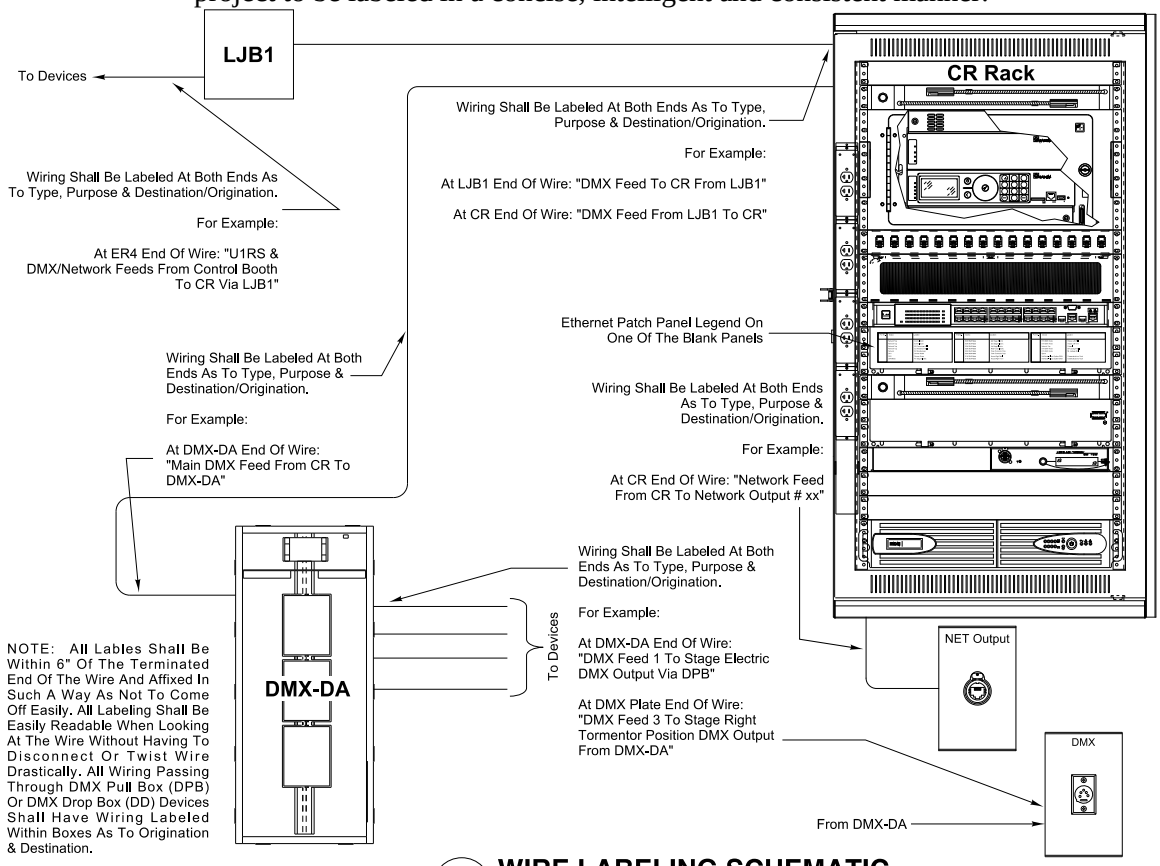
3.5 Labeling:

A. All switches, cables, wire, controls and outlets will be permanently and logically marked during installation. Submit to the consultant for approval a listing of intended nomenclature. Where possible engrave directly upon plates and assemblies. Where disassembly would be required the use of adhesive or screw on engraved labels will suffice. Engravings will be paint filled for best contrast with black or white paint.

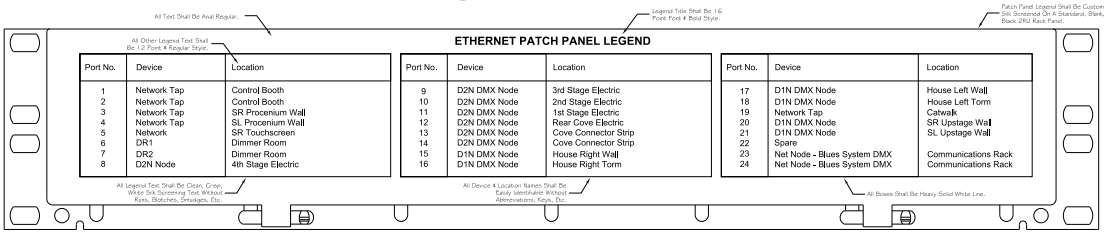
B. Do not use Dymo style labels or hand lettering. No cables shall be labeled with masking tape, gaffer tape or other material subject to degradation. Such labeling may be done on a temporary basis during installation so long as all such labels are removed and their adhesive cleaned off when final labeling is applied. Self-laminating labels are preferable for the final labeling system.
C. Permanently mark cables with an identifying label at each end in a consistent, logical manner.
D. Color-coding of the entire system shall be logical and adhere to accepted industry standards.
E. The contractor shall provide the owner with a laminated hard copy chart (Microsoft Excel style) of the Relay channel assignments and locations along with any soft patched devices, DMX assignments, Network assignments, house, accent and worklighting channel assignments, submaster assignments, etc. to be left at the control console location.
F. The contractor shall label each circuit in each Relay rack as to its destination (permanent black marker on bright colored gaff tape is acceptable – printed legibly). Contractor may also use any style of durable, stick-on, printed style labeling that will remain adhered, is approved by the manufacturer, does not violate NEC and is large enough to easily read. Example for circuit #32 would be – “1E #32” (First Electric, Circuit #32) OR example for circuit #2 would be – “Cove, Circuit #2” OR example for circuit #102 would be – “Houselights R1” (row 1 of houselights). Contractor shall also provide multiple copies of a typed “spreadsheet-style” sheet showing all circuit assignments along with their destinations, designations, descriptions and locations to the owner for future reference. Place one laminated copy of this sheet on the wall beside the Relay rack. See diagram below for more info. This includes any existing and to be reused Relay racks - layout may deviate from what is shown due to physical differences and constraints of existing racks vs diagram that follows. In that case, provide labeling for each such rack that is as similar to what is shown as is possible, while placing labels as needed and in locations that make sense, do not impede airflow, module removal or rack functionality or violate existing rack manufacturer’s specifications.


Bright Colored Gaff Tape Run Neatly Down Outside Edge Of Dimmer Rack (Not Visible With Door Closed).
Neat, Black, Legible, Clean Block Letter Style Circuit Designations By The TC (Lighting Contractor). Use Sharp-Tipped Sharpie.
Dimmer Rack Circuits
Typical Dimmer Module.
1E #21
1E #22
HR Torm #4
HR Torm #5
FOH Cove #15
FOH Cove #16
2E #33
2E #34
1E #23
1E #24
Unused
Unused
FOH Cove #17
FOH Cove #18
Signal
D20
Signal
Typical Dimmer Rack.

G. The following schematic diagrams have been provided as examples of acceptable and intended wiring & patch panel legend labels to be included for all racks, wiring destinations & originations: (these schematic drawings are diagrammatic only and do not reflect all of the actual parts and/or components, etc. designed into this project.) Contractors (Both EC and lighting contractors) shall use these schematic diagrams as guides and references and label or wire all related and additional devices in a similar manner to those shown here. These diagrams are typical of all lighting related devices, communications racks, etc. designed into this project. The intent is for all portions of this project to be labeled in a concise, intelligent and consistent manner.



1 **WIRE LABELING SCHEMATIC**
SCALE: NONE



Port No.	Device	Location
1	Network Tap	Control Booth
2	Network Tap	Control Booth
3	Network Tap	SR Procenium Wall
4	Network Tap	SL Procenium Wall
5	Network	SR Touchscreen
6	DR1	Dimmer Room
7	DR2	Dimmer Room
8	D2N Node	4th Stage Electric

Port No.	Device	Location
9	D2N DMX Node	3rd Stage Electric
10	D2N DMX Node	2nd Stage Electric
11	D2N DMX Node	1st Stage Electric
12	D2N DMX Node	Rear Cove Electric
13	D2N DMX Node	Cove Connector Strip
14	D2N DMX Node	Cove Connector Strip
15	D1N DMX Node	House Right Wall
16	D1N DMX Node	House Right Torm

Port No.	Device	Location
17	D1N DMX Node	House Left Wall
18	D1N DMX Node	House Left Torm
19	Network Tap	Catwalk
20	D1N DMX Node	SR Upstage Wal
21	D1N DMX Node	SL Upstage Wall
22	Spare	
23	Net Node - Blues System DMX	Communications Rack
24	Net Node - Blues System DMX	Communications Rack

1 **PATCH PANEL LEGEND LABELING SCHEMATIC**
SCALE: NONE

3.6 Rigging:

A. The following minimum standards apply in addition to the standards referenced elsewhere in this specification. These guidelines do not negate the standards referenced elsewhere in this specification.
B. All equipment not described as portable in this specification will be rigidly held in place as per the manufacturer’s recommendations or as indicated.
C. All rigging and related fastening methods must be treated as permanent. All threads shall be treated with vibration compounds such as Vibratite or Loctite as per manufacturer's recommendations and shall be visible upon inspection.
D. All rigging hardware shall be load rated with the load rating or approval stamped on each piece of hardware.
E. No chain of any type will be acceptable for the hanging or backup support of any equipment except in the case of trim chains.
F. No stainless steel or galvanized wire rope shall be secured with Crosby clamps or other threaded type fittings alone. Compression type closures such as Nicopress with thimbles and copper sleeves ONLY must be utilized for all wire rope terminations. Each closure must have a backup closure. All wire rope is to have strain relief thimbles installed where it attaches to other rigging components. The contractor shall never violate the minimum bend radius when using or installing wire rope.
G. All loose ends of the wire rope will be neatly taped down after Nicopress is installed and crimped. No frayed rope ends will be allowed under this specification. This includes safety cables.
H. Nothing shall be allowed into the interior of any Nicopress or equal compression connection oval sleeves except the wire rope itself. Any taping of wire rope ends shall be performed only after all compression connections are properly swaged.

3.7 ROUGH-IN:

A. All equipment locations shall be coordinated with other trades to eliminate interference with required clearances for equipment maintenance and inspections.
B. For equipment and connections provided in this contract, prepare roughing drawings as follows:
C. New equipment: Obtain equipment roughing drawings and dimensions, then prepare rough-in drawings. Submit as part of submittal package prior to installation. Do not install prior to written approvals.

3.8 PERFORMANCE:

A. The systems will be utilized for worklighting on stage. The intent is for the preset lighting controls to accommodate most of the general lighting needs.
B. For relay circuits powering LED fixtures, set Relay profile to be on in all cues, etc. So that LED fixtures are always powered on during performances. Relays shall be set to be turned off when system is not in use in order to preserve drive electronics' estimated max life cycle. Perform this function in the architectural control system programming software.
C. Program all stage lighting presets to maintain the minimum required egress levels of lighting at all times and in all cues based upon local building codes. The minimum egress lighting level is .2 fc.

D. Provide custom signage for the Relay/relay rack location as indicated. Provide all nomenclature indicated plus additional as applicable. Mount signage on an adjacent wall near the Relay/relay rack as space allows.

E. Provide the consultant, owner and architect with the following files as it regards the lighting system, control console, paradigm system, misc. Devices and controllers. All project related final lighting system files shall be provided in both compiled and uncompiled (editable) formats and in the current software/firmware format. All files must be named so that identification as to project, file type/intent, etc. Is readily identifiable from the name alone. Provide all files saved to a thumb drive:
   1. ETC Paradigm Lightdesigner config file
   2. ETC concert config file
   3. ETC console config file
   4. All console template files
   5. Network system config files

F. Provide the owner with a copy of the pathway Pathport manager gateway configuration editor (5.3 or later), via manager software (if applicable) DMX/RDM device configuration softwares and 12 hours of additional training on those platforms (in addition to training noted elsewhere on the drawings or in the written specifications) so that the owner or owner's designated operators will have a full working knowledge of how to address, readdress, maintain, troubleshoot and reconfigure the network gateways located within this system.

G. Post a complete copy set of the lighting system one-line diagram, system as-built drawings, laminated excel spreadsheets of all circuit & DMX/network assignments, etc. as listed on TL flow diagrams) in the CR rack drawer. Provide an additional laminated circuit assignments sheet for the lighting console position.

H. Training & Instruction:
   1. Provide all on-site owner training, software training, architectural system preset programming (including pushbutton & LCD stations), edited DVD training video, bench & field focus of fixtures, etc. As detailed on the bid drawings and in written specifications.

I. LIGHTING SYSTEM NETWORK:
   1. Provide all ethernet style switches to be power over ethernet switches with all ports/outputs powered. Provide quantity of switches and outputs in order to output signal to all lighting system network devices.
   2. After final system setup and configuration, provide the owner with a usb flash memory drive (memory stick or thumb drive) device with a complete copy of the "as built" system configuration stored on it - including electronic as built drawing set (4 GB drive - in addition to other drives noted).
   3. Instruct the owner on how to make basic system and preset setup changes with a standard web browser (via Lightdesigner access).

4. The lighting system network shall not be hardwired to or capable of being interconnected with the building-wide network or direct access to a gateway providing internet (world wide web) access. The lighting system network is comprised of simple network devices that do not have the capability or protection to remain immune to viruses, etc. The lighting system network must remain a stand-alone network. Failure to segregate the lighting system network from the building-wide network and internet access could result in a catastrophic failure of the entire lighting network and loss of vital data (including show files, system patch, fixture profiles, default system setup, etc.) If infected with a computer virus, and which would result in the need for a total system reboot back to factory defaults (all "as built" system configuration files would then need to be recreated from scratch).

J. Verify the load requirements for all PoE switch outputs and the related devices being powered via the network switch. Provide a switch that is capable of powering all network devices & outputs indicated per the manufacturer's recommendations.

K. Perform all DMX and network programming, Relay assignments, device addressing and related software/firmware setup, LED setup, modes and addressing, etc. All LED fixtures, network gateways, Stage lighting fixtures and RDM setups and any other DMX/network/RDM addressable devices shall be addressed in an intelligent, consecutively numbered, individually addressed manner prior to completion of the project and final acceptance tests.

3.9 Initial Post completion tests & SET UP:

A. ARCHITECTURAL CONTROL STATIONS:

1. All architectural control stations (pushbuton, key stations, LCD stations, etc.) shall be named in the Light Designer and Control Designer software so that they reflect the actual room and geographic locations within the room (i.e. stage South Entrance, etc.).
2. Preset names and designations TBD by owner. The contractor shall obtain these descriptions from the owner in writing prior to ordering these faceplates or programming the architectural control system. All stations shall be labeled with the owner indicated names and with specific nomenclature as indicated on the bid drawings. No device model number names shall be allowed. Names shall be engraved on device plates with a high contrasting color in a legible, large enough font size so that they are easily seen and read. No black on black or self-adhesive tape labels shall be allowed.

B. ARCHITECTURAL SYSTEM PRESETS:

1. Architectural lighting will be included in the preset configurations.
   a. All pushbutton stations shall be programmed so that, when no presets are selected and no lights are on, there is an led or button on each station that is lit at all times so that the stations are readily visible in the dark.
   b. All faders shall be programmed per owner's instructions (typically faders control groups of similar fixtures and/or fixtures in similar locations as a group).

c. All pushbutton stations shall be programmed so that engaging any particular pushbutton toggles the associated preset on and off with subsequent pushes of that button. All preset pushbuttons shall trigger mutually exclusive presets (turning the previous preset off as it engages the selected preset) and shall not operate in a pile-on style hierarchy. In other words, if a user engages preset #1 by pressing the associated button, this should trigger all previous light levels or presets to “off” and turn “on” or trigger the lights and light levels associated only with that particular button and preset.

d. Architectural Station Presets:

1) All preset stations MUST be set up and loaded with the “looks” as directed by the owner. The contractor shall not decide for himself nor preload any temporary preset looks into the architectural control system that the owner hasn’t desired. The contractor should obtain all of these programming directives in writing prior to system turn-on so that they can be easily programmed during commissioning, etc.

2) All preset buttons located on pushbutton stations shall have the capability to respond to whichever preset the owner wishes, including conventional theatrical, Stage lighting and LED color mixing fixtures. In other words, the pushbutton stations shall not be restricted as to which system preset each button or class of stations can trigger.

3) UH10005 (5 Button Stations): These stations are typically programmed to recall the first four system presets from the architectural controller and off. Contractor shall program each station to control presets as directed by the owner.

e. Ipad & Iphone Programming:

1) The contractor shall fully program and set up the iPad tablet to control both the lighting system console as well as the architectural control system. This includes fader pages, preset button programming, etc. This also includes purchasing the apps, setting up an Apple/Android ID/user account for the owner (if one does not already exist - or interfacing with owner personnel in order to obtain existing account login info), downloading the various control software apps (both architectural system and lighting control console interface apps) and setting up/training the owner on the apps and their use in the aud as a portable lighting system controller (both for the lighting console and the architectural control system).

2) The contractor shall be responsible to setup and program up to (10) additional wireless devices by owner designated personnel that can control various aspects of the architectural control system or lighting control console. App purchases shall be the responsibility of the device owner for personal devices. The contractor shall simply assist in setting up presets, fader pages, etc.

C. TOUCHPANEL SETUP:

1. Intent: Touchpanel screen layouts shall be similar to what is shown. Not all control screens have been shown, but a representative sample has been provided so that the contractor gets a real sense of the intent of the look and layout and feel of each touchpanel. Buttons shall be gel style as noted. Touchpanel background shall be a slate/silver grey color with a brushed aluminum look. Buttons shall be a royal blue color. All gel button text shall be black, unless otherwise noted.

2. Dialing and QWERTY keypads, drop down dialog boxes, etc. shall be black background with white text and shall float over other control screens (feather backpanel edges as needed). All buttons shall be high-resolution, crisp edged buttons that do not appear with jagged edges, pixelization, etc. The control screen layout file shall be sized so that it fits onto the allotted memory inside the specified touchpanel. There may be additional screens and controls that the contractor will need to program into the touchpanel system that do not appear in the following descriptions or on the detailed screen layout drawings. The contractor shall provide all screens & programming necessary for a complete system and may need to field tweak or add/delete functionality to the touchscreen system based upon immediate user and consultant feedback. Color selections for screen background, font colors, etc. shown on the contract documents shall be followed unless the owner has a specific preference as to the color scheme, layout, etc.
3. The contractor shall be required to coordinate with other contractors providing touchscreens for this project so that the theme and layout of all touchscreens within this space match.
4. The info button on each screen, if touched, shall bring up a floating, pop-up window on top of and centered on the current screen that gives a brief, but detailed, explanation of the intents of the screen and the parameters the user must select.
5. Each touchpanel screen shall incorporate a standard “Home Screen” that uses the owner’s logo as the background behind all button/preset display overlays. Actual logo to be used is TBD by the owner. Contractor is to obtain appropriate file from owner. Size logo on screen as directed by owner.
6. Each touchpanel screen shall incorporate a “Home” button or object on every screen (or physical button on unit – if screen is so equipped) that will take the user to the home screen (Main Menu) whenever this button is activated.
7. Each touchpanel screen shall incorporate a “Back” button or object on every screen, except the Home screen, (or physical button on unit – if screen is so equipped) that will take the user back to the previous page/screen whenever this button is activated.
8. All touchpanel buttons shall be programmed so that, when a button or preset is selected, the active icon highlights or changes color and becomes visually distinguished from all other buttons/presets on the page in order to easily identify and indicate which button or preset has been activated and is currently active.
9. Contractor is to submit all screen layouts (jpeg screen shots are acceptable) to the consultant for final approval prior to loading all software.
10. Contractor is responsible for all touchpanel and control system programming and final touchpanel screen looks, layouts and icons and for interfacing each piece of controlled equipment with the lighting control system and other related systems (such as Crestron interfaces, iPad, iPod, iPhone apps, etc.).
11. The contractor shall provide a minimum of two levels of password/passcode access to the touchscreens and their functionality. There shall be a user level password access, which limits those users to only certain functions. There shall be an administrator level password access, which provides those users with unlimited access to all system functions present and programmed.
12. The contractor shall provide all touchscreens to mirror each other and so that system selections, etc. performed on one screen automatically show up on all other architectural control screens.

13. The contractor shall provide, as part of his bid price, all touchscreen layout buttons, menus, background, layout, programming, etc.
14. All access to the LCD programming functions, preset changes, clock functions, recording capabilities, etc. shall be password protected.
15. Program the architectural control system LCD displays with a submasters page, rehearsal light preset, several Stage lighting presets, stage worklight preset and other as requried by the owner.
16. A secondary level of password protection shall be setup so that all other LCD and pushbutton stations can be locked out from functioning or altering the lights during an event. The intent of this feature is so that accidental activation of unwanted lighting fixtures during a performance is avoided. Program the astrological clock to reset all LCD and pushbutton station functionality (and deactivate lockout) at midnight of every day - 365 days per year.
17. LCD touchscreens shall be located within the system topology in such a way as to allow snapshotting functions from a lighting control console into the architectural control system LCD and pushbutton units. All LCD touchscreens shall be mirror images of each other (both containing the same screens, information, etc.).
18. LCD touchscreens shall recall all presets and shall incorporate fader and button pages, etc. See above and specifications for more information on LCD programming requirements.

D. DMX & UNIVERSE SETUP GUIDE:

1. The goal in setting up the DMX addresses for this project is to make things simple for the end user both in operation of the system and in finding fixtures, Relays, relays, etc.
2. This type of approach will embrace a compact setup/layout. It is our intention to outline a conceptual path forward without actually assigning universes and/or actual addresses. That will still be left up to the contractor to figure out and perform based upon the final fixture count, selections, owner input, etc. The initial objective is as follows:
3. DMX Assignment Order (addressing given/shown on an ascending order priority basis) –
    a. Relay rack and dimmed modules (incandescent fixture control)
    1) Beginning with DMX address #1 and continuing in ascending order without gaps in assignments until all Relay rack/dimmed modules have been addressed.
    b. Relay rack and non-dimmed and/or constant/relay modules (LED & moving head fixture control)
    1) Beginning with the next free address after the last Relay rack/dimmed module address and continuing in ascending order without gaps in assignments until all non-dimmed, constant and relay modules have been addressed.
    2. Addressing for lighting devices
        i) Beginning with the next free address after the last non-dimmed, constant and relay module address and continuing in ascending order without gaps in assignments until all theatrical fixtures have been addressed.

ii) Fixtures should be addressed in the following ascending order: front of house (first cove, second cove, etc.), stage (1st electric, 2nd electric, 3rd electric, etc.), side house lighting (side galleries, Shakespeares, tormentors, balcony pipes, etc.) *.

iii) Fixtures should be grouped by type and assigned DMX addresses as such at each location for ease of use

4. The intent is that all DMX addressing should occupy as few universes of DMX control as is possible and without the facility's DMX addressing being spread over multiplied universes of control. What should be avoided is assigning each physical location to a different DMX universe (i.e. first electric DMX universe #1, second electric DMX universe #2, … Stage lighting to DMX universe #7, etc.).

5. A typical layout would look like the following:

DMX Assignment Schedule				
Description	*Fixture/Relay #*	*DMX Channel Assignments*		
Relay Racks	Relay Channels #1 - XX	1	-	XX
Stage Lighting Fixtures	Sequential all on separate DMX channels	XX	-	XX

† Always obtain final owner sign-offs for all DMX assignments. Failure to do so could result in the contractor having to reprogram all or large portions of the lighting system in order to accommodate the owner's wishes.

3.10 Owner instruction:

A. The contractor shall provide a training program at the project location and with the project equipment (owner's equipment), consisting of the following hours/periods of instruction specifically and exclusively regarding the lighting system (total training time not to exceed 12 hours. No training block to be less than 4 hours in duration. This time is in addition to training time noted below):
B. All owner instruction to be provided by the contractor as part of this contract shall be scheduled and performed within 12 months of the final system turnover date to the owner.

1. The turnover date is defined as the date of completion of all open punch list items

C. All training hours are exclusive of travel time.

3.11 Training:

A. Training must provide useful information that covers the majority of how a system will be used by the owner. This also applies to documentation and video training.
B. On a job by job basis this training may vary significantly. The hours allotted may be used by the owner as required for any purpose related to the system.

3.12 QUALIFICATIONS of Trainers:

A. All persons performing system training must be experienced operators of the specific equipment in the project. If no one on the contractor's staff has experience on a specific device, then they will need to provide outside personnel in order to perform the training sessions.

3.13 SCHEDULING FOR TRAINING:

A. Initial Training must be scheduled by the contractor with at least two weeks advance notice.
B. If the contractor arrives for a scheduled training session and the owner personnel are not present, then the contractor must notify the owner that a four-hour training segment has been forfeited.
C. If a scheduled session lasts less than four hour it will still expend four hours of allotted training time.

3.14 Initial training:

A. Walk through the facility and familiarize the owner with where all primary system equipment is and what it does. This should include any primary and secondary power panels feeding the systems, system disconnects and the identification of individual system breakers.
B. Train on primary control surfaces (consoles, touchscreens, etc.) for the most commonly used functions.
C. Train on saving and restoring software programmed devices.
D. It is recommended that most training be hands on with the owner's personnel operating the equipment.

3.15 Warranty and Service:

A. The contractor guarantees all equipment, materials (excepting incandescent lamps) and workmanship to be free from defects for a period of one year from owner acceptance. This warranty supersedes all manufacturers warranties for the one-year period. Any manufacturer's warranty that exceeds the one-year will continue to be applicable. The contractor will replace any defective materials at no charge to owner. Any equipment replaced during the one-year warranty will have a new one-year warranty to the owner.
B. The contractor guarantees all labeling to be free from defects for a period of two years from the date of owner acceptance. In cases where the label's adhesive fails or the label suffers from degradation causing it to become unreadable, the label will be considered defective and will be replaced at no cost to the owner.
C. LED Fixtures that fail in the first 90 days will be replaced at no cost.
D. The contractor will respond by phone to requests for service within 2 business hours and respond with a technician being sent (if needed) within 1 business day.
E. Any equipment that tends to "drift" or whose performance deteriorates during the warranty period will be considered defective, even if such drifting is normal during break in. This equipment will be readjusted by the contractor at no additional charge to the owner.
F. Provide all service at the owner’s location regardless of any manufacturer warranty terms regarding carry in service.
G. During the warranty period if any equipment failed will take more than 24 hours to repair, the contractor will make available and interconnect at no cost to the owner suitable temporary equipment to maintain a fully operational system until repairs are complete.

3.16 Demonstration and acceptance:

A. CONDITIONS FOR SCHEDULING FINAL ACCEPTANCE:

1. The system is required to be complete and fully tested. Any failure that may have occurred between the contractor's final tests and the date of acceptance will be noted and can be corrected after that date
   a. Final setup for the Stage lighting system must be scheduled so that the owner or owner’s representative, consultant, contractor and factory technician are all present. This will also constitute the final acceptance meeting for the Stage lighting system and all related preset setups. A factory technician must be present at this time or no final setup or final acceptance will be performed. If the factory technician has to return for this meeting, it will be at no additional charge to the owner.

B. PROCEDURE FOR SCHEDULING FINAL ACCEPTANCE:

1. The contractor will have the appropriate equipment available to focus/adjust the lights (for example, ladder, manlift, etc.).
2. Tools must be on hand to remove connector plates and provide for other possible inspections.
3. All racks must be able to be opened for inspection.
4. The contractor will demonstrate operation of all major components of the systems including, but not limited to, the following:
   a. Demonstrate all system functions and presets.
   b. Demonstrate programming input.

c. Demonstrate operations of all devices with the lighting console.

3.17 CONDITIONS OF ACCEPTANCE:

A. It is understood that the consultant cannot inspect every aspect of the installation. The contractor is responsible for installation quality and methods, fabrication quality and methods, and performance of their work. Acceptance of the project will constitute an acceptance of the following:
B. All specified equipment is installed, and the system is operating in an acceptable manner from a functional standpoint (See checklist below for specific functional requirements).
C. Upon completion and acceptance of the project the contractor will provide to the owner a letter stating that all of the equipment and installation methods meet or exceed the specification requirements in all respects, and that the system as installed meets all of the applicable standards and codes required under the specification and meets applicable federal, state and local codes and laws.
D. ACCEPTANCE TESTS CHECKLIST:

1. Prior to acceptance testing there are a number of conditions that need to be verified. There are also site conditions required for the consultant to perform tests as indicated. The contractor shall ensure that every item on this checklist has been performed and verified prior to the consultant's acceptance tests can begin. Scheduling of the consultant to perform final acceptance tests must be coordinated with the owner, the project's construction manager (or clerk of the works), the contractor and the consultant (See paragraphs above for detailed requirements).
2. STAGE LIGHTING – TYPICALLY TAKES 3 – 4 HOURS:
   a. Required attendance – A technician fully capable of programming and operation on all software including the console, architectural controls and any other software must be on site.
   b. Any remote programming software that requires an external computer to address the lighting system must be on site, on line and loaded into a laptop provided by the contractor and ready for use if system programming changes are required.
   c. All lighting circuits tested and verified.
   d. All lighting console patching including color and any moving lights must be complete.
   e. Architectural presets and control patching complete.
   f. LCD screens completely programmed, mirror images of each other and fully functional, including password protection, astrological clocking functions, etc.
   g. All lighting system labeling complete, including wire management, yoke and fixture labeling, portable cabling, etc.
   h. All nodes and DMX distribution completely programmed and patched.
   i. Remote focusing device (RFU, RFR or other wireless console control devices) verified and operational.
   j. Emergency lighting transfer cabinet system tested and verified, including trigger from fire alarm with the resultant emergency circuits trigger.
   k. Network configuration software set up and fully programmed.

3.18 Closeout DOCUMENTATION:

A. All closeout documentation, including training videos, must provide the owner with usable content. The determination of acceptability will be determined by the Consultant. Poor quality training videos and documents will be rejected.
B. Closeout Documentation is to be submitted within two weeks of system completion.
C. Contractor must submit the following items. All items should be part of the O&M Manual. Provide the quantity and form (paper and/or electronic) of these closeout documents as is indicated in the contract front-end documentation. Physical copies shall only be required if front-end documentation requires them.
D. System testing documentation as required by final testing and acceptance procedures outlined in this document.

1. All paper copy O&M Manual submissions shall be in heavy-duty, D-Ring style, 3-Ring binders All electronic copies shall be "bound" in an Adobe Acrobat style portfolio (see below for more complete information).
2. Complete technical manuals for all equipment installed.
3. List of serial numbers of all equipment installed
4. Warranty cards for all equipment.
5. Manufacturer MSDS sheets for all applicable equipment.
6. Operations & Maintenance Manuals shall include English and Spanish only.
7. Operations & Maintenance Manual: An operations and maintenance manual (or "Systems Manual") written in English on the safe use of a that particular site's lighting, dimming and controls system(s) shall be provided by the contractor to the owner. (provide separate manual sections for different spaces included in this project – each to be a separate, complete and distinct section in the manual for each differing or multiple system and location). This manual should include the following:
   a. Table of contents.
   b. A contractor written simplified guide to operating the system Include at minimum:
      1) A contractor written simplified troubleshooting guide or what to check and where to check if no lights will come on. Provide this in a 2-column style format.
      2) How to power up and power down the lighting system, etc.
   c. A simplified guide to operating the architectural control system, an understanding of pile on system architecture and where the button stations get their content. If editing has been made available on LCD screens, provide a guide on how to save over presets that affect button stations.
   d. Microsoft Excel spreadsheets of all initial lighting system patch data, DMX assignments and fixture types at final set up.
   e. Emergency contact number(s) and procedures to follow in the event of a catastrophic system failure.
   f. One copy of the "Workbook" version of each of the following training guides used (only provide for levels trained on):
      1) ETC Level 1 console training – Essentials.
      2) ETC Level 2 console training – Enhanced Skills.
      3) ETC Level 3 – Advanced Programming.

g. Maintenance procedures and recommended schedules required for equipment installed that requires regular scheduled maintenance.
h. A DVD (or set of DVDS, depending on requirements listed Under Training Sections above) and a USB thumb drive with all content included on it.

E. O&M Manual pdf requirements: The contractor shall provide a pdf copy (with appropriate titles) for each piece of documentation listed above and bound together in a pdf portfolio/binder, labeled with the owner's name and with the submitting contractor's information. All electronic manuals shall contain only equipment and information that pertains to the project. Where factory manuals are available the contractor shall provide these. Where factory manuals are not available, the contractor shall provide high resolution (150 dpi minimum and fully optimized in Acrobat or equal), full page, properly and consistently oriented pages in a consecutive ascending order. All pdf portfolio and binders produced and submitted shall be professionally put together and presented well. All manuals shall be saved as standard Adobe Portable Document Format (PDF).

END OF SECTION

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Luminaire-mounted photoelectric relays.
2. Luminaire types.
3. Materials.
4. Finishes.
5. Luminaire support components.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260926 "Lighting Control Panelboards" for panelboard-based lighting control.
3. Section 260936 "Modular Dimming Controls" for architectural dimming systems specified in Section 265100 "Interior Lighting."
4. Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
5. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Wiring diagrams for power, control, and signal wiring.
6. Photoelectric relays.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Wind Load Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control reports.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Load Performance:

1. Pendant mounted luminaires shall withstand the effects of wind forces.
2. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the wind forces specified in the Architects Wind Assessment Report.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location where indicated.

E. CRI of minimum 70. CCT as indicated on Lighting Fixture Schedule.

F. L70 lamp life of 35,000 hours.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: Unless otherwise noted 277 V ac.

J. Source Limitations:

1. Obtain luminaires, by Type, from single source from a single manufacturer.
2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Per manufacturer's recommendation.

B. Comply with UL 773 or UL 773A.

2.4 LUMINAIRE TYPES

A. Refer to Lighting Fixture Schedule for Types and requirements.

2.5 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: By type per Lighting Fixture Schedule.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes: By type per Lighting Fixture Schedule.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage and coating.
c. CCT and CRI for all luminaires.

2.6 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

A. Factory-Applied Finish Luminaires: By type per Lighting Fixture Schedule.

B. Color: By type per Lighting Fixture Schedule, coordinate and confirm final selection with Architect.

a. Retain "Factory-Applied Finish for Steel Luminaires" Paragraph below when luminaire material is steel that is not to be field painted and is not required to match finish of pole or support materials.

2.7 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

   a. IES LM-5.
   b. IES LM-50.
   c. IES LM-52.
   d. IES LM-64.
   e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619

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SECTION 267650 - PERFORMANCE SOUND SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

1.2 SUMMARY

A. Section includes:

1. Amphitheater audio and audio-visual systems
2. Racks, wiring, and patch panels.

B. Related Requirements:

1. Section 260100 “Basic Electrical Materials and Methods”.
2. 260519 “Low-Voltage Electrical Power Conductors and Cables”.
3. Section 260526 “Grounding and Bonding for Electrical Systems”.
4. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
5. Section 260553 “Identification for Electrical Systems”.
6. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 COMPLIANCE

A. In addition to compliance with Section 260100 “Basic Electrical Materials and Methods” comply with the requirements of the following:

1. SAE - Society of Automotive Engineers
2. TIA – Telecommunications Industry Association
3. SMPTE - Society of Motion Picture and Television Engineers
4. UL - Underwriters Laboratories (Electrical components, devices and accessories shall bear a UL label where applicable)
5. USITT- United States Institute for Theater Technology "Recommended Guidelines for stage rigging and stage machinery-specifications and practices".

1.4 ACTION SUBMITTALS

A. In addition to the front end submittal requirements all submittals will be provided to the Owner's system consultant for final approval:

AVL Designs, Inc.
1788 Penfield Road
Penfield New York 14526

585-586-1100
585--586-1143 Fax

Attn: Seth Waltz

B. Product Data: For each type of product.

1. Include construction details, legible data sheets, material descriptions, dimensions of individual components and profiles, and finishes for.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, and mounting attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Rack and panel layouts with proposed labeling.
4. Scaled control room elevations.

5. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and factory-authorized service representative.

B. Proposed construction schedule.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For all system components to include in maintenance manuals.

B. Operation and Maintenance Data: For for all system components to include in operation and maintenance manuals.

C. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to [ASTM C 1021] [ASTM C 1093] for testing indicated[and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC Standard 17025].

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.8 DELIVERY, STORAGE, AND HANDLING

A. It is each contractor's responsibility to receive all device shipments, equipment, deliveries, etc. for their own equipment on/at the job site personally. Each contractor shall be responsible to arrange for storage of all received materials on site until the appropriate time when they shall either turn them over to installing contractor or install them.

B. If the contractor chooses to allow a third party to receive shipments on his behalf the contractor bears sole responsibility for any missing and/or damaged parts.

C. Any equipment that is furnished by the contractor for installation by others shall be turned over to the installing contractor at a time that fits into their production schedule and the project's overall construction schedule.

1.9 FIELD CONDITIONS

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: 3 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS AS PROVIDED BY AVL DESIGNS, INC.

A. Direct pre-bid requests for information to the Owner’s design consultant.

B. Performance requirements

1. The requirements of the referenced equipment are not generic in nature. Specific performance, control, and routing capabilities are necessary for any alternate equipment. The details set forth herein and within the functional description of the system are the critical criteria for selection of each piece of equipment.

2. In bidding equipment from manufacturers other than those referenced be aware that all functional information included in this specification as well as the manufacturer's specifications, physical size, serviceability, warranty terms, product availability, and other non technical issues may be determining factors in product equivalency. Final judgment as to equality will be solely that of the owner, architect, and consultant.

2.2 19-INCH EQUIPMENT RACKS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Middle Atlantic Products; Legrand North America, LLC. (Design Basis

B. The rack shall be an EIA compliant 19” wall mount rack. Tool-Free Quick-Mount™ system enables one-person installation. Useable depth shall extend into the back pan 3.5”. Center section and back pan shall be 16-gauge steel, phosphate pre-treated and finished in a black textured powder coat. Rackrail shall be constructed of 11-gauge steel with tapped 10-32 mounting holes in universal EIA spacing with black e-coat finish and marked rack spaces. Rack shall be constructed to swing open for component cabling access, center section shall pivot for either left or right opening. Rack shall have a rear knockout panel with 1/2”, 3/4”, 1”, 1-1/2”, 2” and 3” electrical knockouts installed in base, and a rear knockout panel with 1/2”, 3/4”, 1”, 1-1/2”, 2” and 3” electrical knockouts, four Decora® cutouts, and BNC knockouts for UHF/VHF antennas installed in top. Large laser knockout on back pan shall have a 12-1/2” x 12-1/2” cutout for electrical pull-box. Fan knockouts on top and bottom shall allow for installation of up to four 4-1/2” fans. Rack shall have 2” knockouts, 4” knockouts for Wiremold 4000® Series raceways, and knockouts for UCP Series universal connector panels on the side. Top, bottom and sides shall feature vertical vent pattern. DWR Series enclosures shall satisfy the 2007 & 2010 CBC; 2006, 2009 & 2012 IBC; ASCE 7-05 (2005 Edition) & ASCE 7-10 (2010 Edition) and the 2006 & 2009 editions of NFPA 5000 for use in areas of high seismicity, Seismic Use Group III, Zone 4 or Seismic Design Category (SDC) “D” with lateral force requirements for protecting 140 lbs. of essential equipment in locations with the highest level of seismicity and top floor or rooftop installations with an Importance factor (Ip) of 1.5 when used with DWRSR-ZL Latch. Rack shall be UL Listed in the US and Canada to the UL-2416 (NWIN) Category when used with optional bonding kit, model # PET-K-__. DWR Series shall meet all enclosure requirements towards PCI DSS (Payment Card Industry Data Security Standard) Compliance. Rack shall be GREENGUARD Gold Certified. Rack shall comply with the requirements RoHS EU Directive 2002 / 95 / EC. Rack shall be manufactured by an ISO 9001 and ISO 14001 registered company. Rack shall be warrantied to be free from defects in materials or workmanship under normal use and conditions for the lifetime of the rack.

C. Options

1. Front doors shall be reinforced 16-gauge steel, model # FD-XX (solid), VFD-XX (vented, 25% open area), LVFD-XX (vented, 64% open area), PFD-XX (plexi), (XX= # of rackspaces of DWR rack)

2. Keyless Latch replaces keylock, fits front & rear doors, shall be models # LATCH
3. Rear rail kit 11-gauge, 10-32 threaded, sold in pairs, hardware included, shall be model # DWR-RRXX
4. Fan kits with two 4-1/2” exhaust fans, fan guards and vent blockers, shall be model # DWR-FK17 (fits DWR-xx-17), DWR-FK22 (fits DWR-xx-22), DWR-FK26 (fits DWR-xx-26), DWR-FK32 (fits DWR-xx-32)
5. Vent Blockers used to promote active thermal management, shall be model # VBK-D17 (fits DWR-XX-17), VBK-SD22 (fits DWR-XX-22), VBK-E20 (fits DWR-XX-26)
6. Optional cover plate / shelf kit shall be model # DWR-CVR • Minimum-clearance latch shall allow side-by-side or corner mounting, shall be model # DWRSR-ZL
7. Optional bonding kit for UL-2416 (NWIN) compliance shall be Middle Atlantic Products PET-K-D/EWR (for backpan to center section), PET-K-D/EWRD (for backpan to center section to front door), PET-K-FD (for front door to center section)

2.3 RACK DRAWERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Middle Atlantic Products; Legrand North America, LLC. (Design Basis)

B. EIA compliant 19” rackmount drawer shall have a useable depth of 14-1/2”. Drawer base shall be 20-gauge steel, top and sides shall be 16-gauge steel. Drawer faceplate shall be .090” thick aluminum with a black brushed & anodized finish. Drawer shall use full extension, ball bearing slides. Grommet shall be provided for safely passing cables through the cable entry point at the rear of the drawer on 2, 3 and 4 space models. 2, 3 and 4 space drawers shall include a no-slip drawer mat. Drawer shall have a 50 lb. weight capacity.

C. Drawer shall be warrantied to be free from defects in materials or workmanship under normal use and conditions for a period of three years. Drawer shall be UL Listed in the US and Canada.

D. Drawer shall be GREENGUARD Indoor Air Quality Certified for Children and Schools. Drawer shall be RoHS EU Directive 2002/95/EC compliant. Drawer shall be manufactured by an ISO 9001 and ISO 14001 registered company.

E. OPTIONS

1. PART # FITS: ACCOMMODATES:
2. DCDP D4, DC4, TD4 103 Compact Discs
3. DVDP D4, DC4, TD4 40 DVDs;
   a. PS3, Xbox 360TM, WiiTM games;
   b. Blu-ray, HD-DVD, DVD-Audio media
4. DVHSP D3, DC3, TD3 24 VHS Tapes
5. Keylock option - add a keylock to any D or TD drawer, model # LK
6. Pick-and-pluck foam insert keeps tools and equipment in place and safe from damage. Available for 2, 3 and 4 space drawers, model # FI-2, FI-3 and FI-4

2.4 MPR

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Middle Atlantic Products; Legrand North America, LLC. (Design Basis)

B. PR modular raceways shall be Middle Atlantic Products model # MPR-xA (x = number 8” of modules accommodated) (See chart prior to determining x). Power modules shall be RLM-xxA, or M-xxA (refer to chart). Isolated ground outlets shall be available, suffix part with IG (ex. RLM-20IGA). Stand-alone power modules shall be RLM-xx-1CA and shall include a 9.5’ SignalSAFE™ power cord with NEMA 5-15P plug or 5-20P plug. (See chart to determine which stand-alone power modules are suitable for your application). The MPR, RLM and M series shall be finished in durable black powder coat. MPR components shall be ETL Listed to UL Standard 5 separately and as a system in the US and Canada. MPR shall be GREENGUARD Gold Certified. MPR shall comply with the requirements of RoHS EU Directive 2002/95/EC. MPR shall be manufactured by an ISO 9001 registered company. MPR components shall be warrantied to be free from defects in material and workmanship under normal use and conditions for a period of 3 years.

C. Options

1. JMS-12X6 Master / Slave Jumpers allow economical M Series modules to be switched remotely by an RLM Series module. Sold in packs of 6.
2. MPR-SS transient voltage surge suppressor provides protection when mounted in raceways.
3. J-XX6 Jumpers contain convenient genderless jumpers on each end. Sold in packs of 6 (x = jumper length) (See chart to determine which jumpers are suitable for your application).
4. T-XX6 Tails contain a convenient genderless jumper on one end and wire-tails for J-box connection on the other. Sold in packs of 6 (x = tail length) (See chart to determine which tails are suitable for your application).
5. MPR-BL A, blank covers, available in 2”, 4” or 8” lengths (refer to chart)
6. MPR-SEQA six-step sequencer fits in module opening of MPR raceway (See A&E spec sheet # 96-01062).
7. MPR-JB Junction Boxes available (refer to chart).
8. 8” ground wires with termination rings for grounding stud shall be model # G-8X10. Sold in packs of 10

2.5 COMPONENT PERFORATIONS

A. VT perforation pattern shall be: 5/32” dia. hole, with 3/16” staggered centers Open Area 64%

B. VTF perforation pattern shall be: 1/16” dia. hole, with 1/8” staggered centers Open Area 25%

C. VTP slot pattern shall be: 0.075” x 3.125” obround on 0.313” centers (horiz.) Open Area 20%

D. EVT/HR-EVT slot pattern shall be: 0.075” x 1.25” obround on 0.313” centers (vert.) Open Area 17%

2.6 BLANK PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Middle Atlantic Products; Legrand North America, LLC. (Design Basis)

B. Blank panels shall be Middle Atlantic Products model # __ (refer to chart). Blank panels shall be __ rackspaces in height with a __ finish (refer to chart). Blank panels shall be ___" wide (refer to chart). Blank panels shall be constructed of 1/16" thick aluminum. Blank panels shall be RoHS EU Directive 2002/95/EC compliant. Blank panels shall be manufactured by an ISO 9001 and ISO 14001 registered company. Blank panels shall be warrantied to be free from defects in material or workmanship under normal use and conditions for the lifetime of the panel.

C. EIA compliant, 16-gauge aluminum with black powder coat finish.

D. BL Series

2.7 SECURITY COVERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Middle Atlantic Products; Legrand North America, LLC. (Design Basis)
2. BL Series

2.8 VENT PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Middle Atlantic Products; Legrand North America, LLC. (Design Basis)

B. Audio VT Series

C. EIA compliant 19" vent panels. Vent panel shall be constructed of 16-gauge aluminum and shall have a black powder coat finish.

1. VT perforation pattern shall be: 5/32" dia. hole, with 3/16" staggered centers. Open Area 63%

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to evaluate <Insert product or material> [fabricator's quality-control and testing methods].

B. Testing: Test and inspect <**Insert product or material**> according to <**Insert standard**>.

1. <**Insert applicable test requirements**>.

C. Factory Tests: Test and inspect assembled equipment[, by a qualified testing agency,] according to [ARI] [ASME] [IEEE] [NEMA] <Insert standards organization>.[Affix standards organization's [certification] [label].]

1. <**Insert applicable testing requirements and procedures**>.

D. <**Insert product or material**> will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 General

A. Contractor will adhere to all requirements of the general contract for this project as called for in the project manual.

B. The contractor will verify all on site dimensions prior to ordering or installation of critically dimensioned equipment and wiring. In a case of a discrepancy between these documents and attached drawings, construction documents, and actual on site dimensions the contractor will notify the owner and consultant before making any changes in intended work.

3.2 Wiring and Racks:

A. Connectors (The priority for use of connectors is as follows):
1. Wherever barrier strips or Phoenix connectors are available to connect equipment these are the preferable means for connection. Barrier connections are to be made utilizing insulated crimp connectors. Phoenix connectors may be utilized without crimp connectors if proper strain relief is provided to avoid fatigue to the connection.
2. Next in order of preference are XLR type connectors. Where no other means is available balanced 1/4" are to be used. Unbalanced 1/4" and RCA are to be use only if no other means of connection is possible. Use right angle jacks where needed for space requirements. Banana jacks are not to be used on amplifier outputs.
3. All wiring (except AC power) entering or leaving the rack will be connected via terminal strips or direct connection to the equipment terminals or connectors. No in line connectors are acceptable. Appropriate connectors and controlled cycle crimping devices will be employed. No wire nuts may be used in any system wiring except AC power.
4. All AR (audio rack) wiring shall be neatly tie wrap bundled (or as indicated otherwise on contract drawings) with wires parallel and perpendicular to rack sides and backs All wiring shall be properly strain relieved as it exits the rear connection points on the related equipment, shall be routed out to lacing bars, shall be routed out along lacing bars to rack side areas and shall be tie wrapped to the lacing bars.
5. All wiring shall be neatly tie wrap bundled (or as indicated otherwise on contract drawings) with wires parallel and perpendicular to rack sides and backs and/or control booth walls or roll top desks (i.e. no random angle wiring). All wiring shall be dressed

neatly from devices to input/output plates with excess cable hidden below the countertop and secured as described below.

6. No equipment or terminal strips will be mounted to the sides, doors, top or bottom of the racks. Tie down bars will be provided by the contractor for neat wiring in adherence with industry standard practice.
7. No rack rails will be allowed for equipment mounting in the rear of the rack unless otherwise noted in this specification.
8. Separate wiring paths must be maintained within each rack for microphone level, line level, AC, and speaker level signals. No bundling of dissimilar signal types is allowed.
9. No undue stress may be placed on any connection by a lack of support of the wiring within the rack.
10. Provide blank and/or vent panels as needed to complete each rack with no unfilled spaces, as per rack elevations or as required by alternates to equipment specified. No racks with unfilled panel spaces shall be allowed.

3.3 FINISHES & CLEANING

A. Cover and protect all equipment left or installed on site during construction.

3.4 LABELING

A. All switches, cables, wire, controls and outlets will be permanently and logically marked during installation. Permanently mark cables with an identifying label at each end, in a consistent logical manner. Submit to the consultant for approval a listing of intended nomenclature.

B. On metal panels and plates where possible engrave directly upon the plates and assemblies. Where disassembly of the equipment would be required to achieve engraving the use of adhesive or screw on engraved labels will suffice. Engravings will be paint filled for best contrast with black or white paint.

C. Do not use Dymo style labels or hand lettering. No cables will be labeled with masking tape, Gaffer tape, or other material subject to degradation. Such labeling may be done on a temporary basis during installation so long as all such labels are removed and their adhesive cleaned off when final labeling is applied. Self-laminating labels are preferable such as laser printed labels by Panduit.

D. Color-coding of the entire system will be logical and adhere to accepted industry standards.

3.5 ROUGH-IN

A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, etc. Verify final locations for rough-ins with field measurements and with the equipment being connected. Verify exact location and elevations at work site prior to any rough in work. DO NOT SCALE PLANS. If field conditions, details, changes in equipment or shop drawing information require a significant change to the original documents, contact the Owner's representative for approval before proceeding.

B. CUTTING AND PATCHING

1. Each trade shall include their required cutting and patching work unless shown as part of the General Construction work on the architectural drawings.

3.6 INITIAL POST COMPLETION TESTS & SET UP

A. Test and verify all wiring and patch panels.

3.7 WARRANTY AND SERVICE

A. The contractor guarantees all equipment, materials, and workmanship to be free from defects for a period two years from the date of owner acceptance. This warranty supersedes all manufacturers' warranties for the one year period. Any manufacturer's warranty that exceeds the one year will continue to be applicable. The contractor will replace any defective materials at no charge to owner. Any equipment replaced during the one year warranty will have a new one year warranty to the owner.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

3.9 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

3.10 OCCUPANCY ADJUSTMENTS

A. When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

B. The contractor guarantees all equipment, materials, and workmanship to be free from defects for a period of one year from the date of owner acceptance. This warranty supersedes all manufacturers warranties for the one year period. Any manufacturer's warranty that exceeds the one year will continue to be applicable.

C. The contractor will replace any defective materials at no charge to owner. Any equipment replaced during the two year warranty will have a new two year warranty to the owner.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and verify all wiring and patch panels.Any component will be considered defective if it does not pass tests and inspections.
2. Prepare test and inspection reports.

3.12 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.13 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

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SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backboards.
2. Boxes, enclosures, and cabinets.
3. Power strips.

B. Related Requirements:

1. Section 271313 "Communications Copper Backbone Cabling" for copper data cabling associated with system panels and devices.
2. Section 271323 "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
3. Section 271523 "Communications Optical Fiber Horizontal Cabling" for coaxial data cabling associated with system panels and devices.
4. Section 271533 "Communications Coaxial Horizontal Cabling" for coaxial data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. RCDD: Registered communications distribution designer.

D. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

E. TGB: Telecommunications grounding bus bar.

F. TMGB: Telecommunications main grounding bus bar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

B. Backboard Paint: Pre-painted Light-colored fire-retardant paint.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Crouse-Hinds; Eaton, Electrical Sector.
2. Hoffman; nVent.
3. Hubbell Incorporated.
4. Wiremold; Legrand North America, LLC.
5. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets shall be listed and labeled for intended location and use.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting, with integral flanges.
3. Height: 1 RU..
4. Housing: Metal.
5. Eight, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
6. Rear-facing receptacles.
7. LED indicator lights for power and protection status.
8. LED indicator lights for reverse polarity and open outlet ground.
9. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
10. Cord connected with 15-foot line cord.
11. Rocker-type on-off switch, illuminated when in on position.
12. Surge Protection: UL 1449, Type 3.

    a. Maximum Surge Current, Line to Neutral: 27 kA.
    b. Protection modes shall be line to neutral, line to ground, and neutral to ground.
    c. UL 1449 Voltage Protection Rating for line to neutral and line to ground shall be 600 V and 500 V. for neutral to ground.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground and buried pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in tracks and in room. Coordinate service entrance configuration with service provider.

1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Backboards:

1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

END OF SECTION 271100

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SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. 23-inch wall-mounted equipment racks.
2. Grounding.
3. Labeling.

B. Related Requirements:

1. Section 271110 "Communications Equipment Room Fittings" for backboards and accessories.
2. Section 270526 "Grounding and Bonding for Telecommunications Equipment" for TMGBs and TGBs.
3. Section 270536 "Cable Trays for Communications Systems" for cable trays and cable tray accessories.
4. Section 271313 "Communications Copper Backbone Cabling" for copper data cabling associated with system panels and devices.
5. Section 271323 "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
6. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.
7. Section 271523 "Communications Optical Fiber Horizontal Cabling" for optical-fiber data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. TGB: Telecommunications grounding bus bar.

G. TMGB: Telecommunications main grounding bus bar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL listed.

B. RoHS compliant.

C. Compliant with requirements of the Payment Card Industry Data Security Standard.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.3 23-INCH EQUIPMENT RACKS

A. Description: Two- and four- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with 23-inch panel mounting.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line; Eaton, Electrical Sector.
2. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
3. Leviton Manufacturing Co., Inc.
4. Middle Atlantic Products; Legrand North America, LLC.

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded steel.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Wall-Mounted Racks:

1. Height: As indicated on Drawings.
2. Depth: 23 inches.
3. Load Rating: 150 lb.

4. Number of Rack Units: As indicated on Drawings.
5. Threads: 10-32.
6. Wall Attachment: Four pre-punched holes.
7. Equipment Access: Integral swing.

E. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatsworth Products, Inc.
2. Harger Lightning & Grounding.
3. Panduit Corp.

C. Rack and Cabinet SBBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
2. Rack-Mounted Horizontal TGB: Designed for mounting in 19- or 23-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical TGB: 72 or 36 inches long, with stainless-steel or copper-plated hardware for attachment to rack.

2.5 LABELING

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.2 GROUNDING

A. Comply with NECA/BICSI 607.

B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.

C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.

1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

3.3 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Labels shall be machine printed. Type shall be 3/16 inch in height.

END OF SECTION 271116

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SECTION 271313 - COMMUNICATIONS COPPER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Category 6a twisted pair cable.
2. Twisted pair cable hardware, including plugs, jacks, patch panels, and cross-connects.
3. Grounding provisions for twisted pair cable.
4. Cabling identification.
5. Source quality control requirements for twisted pair cable.

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. F/FTP: Overall foil screened cable with foil screened twisted pair.

D. FTP: Shielded twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. Jack: Also commonly called an "outlet," it is the fixed, female connector.

H. LAN: Local area network.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. S/FTP: Overall braid screened cable with foil screened twisted pair.

M. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.4 COPPER BACKBONE CABLING DESCRIPTION

A. Copper backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration Drawings and printouts.
4. Wiring diagrams to show typical wiring schematics, including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications pathways.
    c. Telecommunications system access points.
    d. Telecommunications grounding system
    e. Cross-connects.
    f. Patch panels.
    g. Patch cords.

5. Cross-Connects and Patch Panels: Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Twisted pair cable testing plan.

D. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for lead content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Connecting Blocks: [**One**] <**Insert number**> of each type.
2. Patch-Panel Units: [**One**] <**Insert number**> of each type.
3. Plugs: [**Ten**] <**Insert number**> of each type.
4. Jacks: [**Ten**] <**Insert number**> of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as a Technician to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
1. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

2. Communications, Riser Rated: Type CMP or Type CMR in listed plenum or riser communications raceway.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 6a TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. Belden.
3. CommScope, Inc.
4. Genesis Cable Products; Honeywell International, Inc.

C. Standard: Comply with TIA-568-C.2 for Category 6a cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded balanced twisted pairs (UTP).

F. Cable Rating: Plenum.

G. Jacket: Gray thermoplastic.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Genesis Cable Products; Honeywell International, Inc.
4. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.

C. General Requirements for Cable Connecting Hardware:

1. Twisted pair cable hardware shall meet the performance requirements of Category 6a.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.
4. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

D. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair twisted pair cable indicated.

G. Plugs and Plug Assemblies:

1. Male; eight position (8P8C); color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

H. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

I. Patch Cords: Factory-made, four-pair cables in 36-inchlengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2. Patch cords shall have color-coded boots for circuit identification.

J. Faceplates:

1. Two port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
3. For use with snap-in jacks accommodating any combination of twisted pair, optical-fiber, and coaxial work-area cords.

2.5 CABLING IDENTIFICATION

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA-568-C.1.

C. Factory test cables according to TIA-568-C.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions

where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install cables parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."

B. Comply with Section 260529 "Hangers and Supports for Electrical Systems."

C. Drawings indicate general arrangement of pathways and fittings.

3.4 INSTALLATION OF COPPER BACKBONE CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM)," Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section Use lacing bars and distribution spools.

9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.6 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling" for cable and asset management software.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271313

SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. 850 nanometer laser-optimized 50/125 micrometer multimode optical fiber cable (OM4).
2. 9/125 micrometer single-mode, outside plant optical fiber cable (OS1).
3. Optical fiber cable connecting hardware, patch panels, and cross-connects.
4. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. RCDD: Registered Communications Distribution Designer.

1.4 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications system access points.
    c. Telecommunications grounding system.
    d. Cross-connects.
    e. Patch panels.
    f. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Optical fiber cable testing plan.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Plugs: Ten of each type.
3. Jacks: Ten of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-B.

2.2 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, MULTIMODE OPTICAL FIBER CABLE (OM4)

A. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Belden.
2. CommScope, Inc.
3. Corning Cable Systems.

C. Standards:

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAD for detailed specifications.

D. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.

E. Minimum Overfilled Modal Bandwidth-length Product: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

F. Minimum Effective Modal Bandwidth-length Product: 4700 MHz-km at 850 nm.

G. Jacket:

1. Jacket Color: Aqua.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

H. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262; Type OFNP in listed plenum communications raceway; or Type OFN, Type OFNG, Type OFNP, or Type OFNR in metallic conduit.
2. Riser Rated, Nonconductive: Type OFNP, or Type OFNR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

2.3 9/125 MICROMETER SINGLE-MODE, OUTSIDE PLANT OPTICAL FIBER CABLE (OS1)

A. Description: Single mode, 9/125-micrometer, 24 fibers, tight buffered, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Belden.
4. CommScope, Inc.

C. Standards:

1. Comply with TIA-492CAAA for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-87-640 for mechanical properties.

D. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.

E. Jacket:

1. Jacket Color: Black.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.4 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Technology Systems Industries, Inc.
2. Belden.
3. Corning Cable Systems.
4. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.

B. Standards:

1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568-C.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

E. Connector Type: Type ST complying with TIA-604-2-B, connectors.

F. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Designed to snap-in to a patch panel or faceplate.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

C. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

B. General Requirements for Optical Fiber Cabling Installation:

1. Comply with TIA-568-C.1 and TIA-568-C.3.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, provide a 10-foot-long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.5 GROUNDING

A. Install grounding according to BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:

      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.

2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

F. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

G. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

H. End-to-end cabling will be considered defective if it does not pass tests and inspections.

I. Prepare test and inspection reports.

END OF SECTION 271323

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Category 6a twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Cabling identification products.
4. Grounding provisions for twisted pair cable.
5. Source quality control requirements for twisted pair cable.

B. Related Requirements:

1. Section 270513 "Conductors and Cables for Communications Systems" for data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. Jack: Also commonly called an "outlet," it is the fixed, female connector.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.4 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration Drawings and printouts.
3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications system access points.
    c. Telecommunications grounding system.

d. Telecommunications conductor drop locations.

C. Samples: For telecommunications jacks and plugs, in specified finish, one for each type and configuration and faceplates for color selection and evaluation of technical features.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faceplates: Five of each type.
2. Jacks: Ten of each type.
3. Patch-Panel Units: One of each type.
4. Plugs: Ten of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway or Type CMP in listed cable routing assembly.
2. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 6a TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. Belden.
3. CommScope, Inc.
4. Genesis Cable Products; Honeywell International, Inc.

C. Standard: Comply with TIA-568-C.2 for Category 6a cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP).

F. Cable Rating: Plenum.

G. Jacket: Thermoplastic
1. Color to be as specified on drawings or PART 3 - EXECUTION

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
4. Leviton Manufacturing Co., Inc.

C. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6a.

2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

E. Connecting Blocks:

1. 110-style IDC for Category 6a.
2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

H. Patch Cords: Factory-made, four-pair cables in 36-inchlengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

I. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.

J. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.

3. Standard: Comply with TIA-568-C.2.

K. Faceplate:

1. Two port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

   a. Flush mounting jacks, positioning the cord at a 45-degree angle.

L. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.7 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA-568-C.1.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions

where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 260528 "Pathways for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."

B. Comply with Section 260529 "Hangers and Supports for Electrical Systems."

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.

8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
13. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Cable Colors: Provide cables in colors complying with the following:

Application	**Color**
Security Systems (CCTV, Access Control, etc)	Yellow
Telephone	Grey

General Network/Data	Blue

B. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

   a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
   b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271513

SECTION 271523 - COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. 850 nanometer laser-optimized 50/125 micrometer multimode optical fiber cable (OM4).
2. 9/125 micrometer single-mode, outside plant optical fiber cable (OS1).
3. Optical fiber cable connecting hardware, patch panels, and cross-connects.
4. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. RCDD: Registered Communications Distribution Designer.

1.4 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:

    a. Telecommunications rooms plans and elevations.
    b. Telecommunications system access points.
    c. Telecommunications grounding system.
    d. Cross-connects.
    e. Patch panels.
    f. Patch cords.

5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Optical fiber cable testing plan.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Product Certificates: For each type of product.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Plugs: Ten of each type.
3. Jacks: Ten of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-B.

2.2 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, MULTIMODE OPTICAL FIBER CABLE (OM4)

A. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Belden.
2. CommScope, Inc.
3. Corning Cable Systems.

C. Standards:

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAD for detailed specifications.

D. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.

E. Minimum Overfilled Modal Bandwidth-length Product: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

F. Minimum Effective Modal Bandwidth-length Product: 4700 MHz-km at 850 nm.

G. Jacket:

1. Jacket Color: Aqua.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

H. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262; Type OFNP in listed plenum communications raceway; or Type OFN, Type OFNG, Type OFNP, or Type OFNR in metallic conduit.
2. Riser Rated, Nonconductive: Type OFNP, or Type OFNR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

2.3 9/125 MICROMETER SINGLE-MODE, OUTSIDE PLANT OPTICAL FIBER CABLE (OS1)

A. Description: Single mode, 9/125-micrometer, 24 fibers, tight buffered, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Belden.
4. CommScope, Inc.

C. Standards:

1. Comply with TIA-492CAAA for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-87-640 for mechanical properties.

D. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.

E. Jacket:

1. Jacket Color: Black.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.4 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Technology Systems Industries, Inc.
2. Belden.
3. Corning Cable Systems.
4. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.

B. Standards:

1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568-C.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

E. Connector Type: Type ST complying with TIA-604-2-B, connectors.

F. Plugs and Plug Assemblies:

1. Male; color-coded modular telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.

G. Jacks and Jack Assemblies:

1. Female; quick-connect, simplex and duplex; fixed telecommunications connector designed for termination of a single optical fiber cable.
2. Insertion loss not more than 0.25 dB.
3. Designed to snap-in to a patch panel or faceplate.

2.5 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

C. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

B. General Requirements for Optical Fiber Cabling Installation:

1. Comply with TIA-568-C.1 and TIA-568-C.3.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, provide a 10-foot-long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.5 GROUNDING

A. Install grounding according to BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:

      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.

2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

F. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

G. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

H. End-to-end cabling will be considered defective if it does not pass tests and inspections.

I. Prepare test and inspection reports.

END OF SECTION 271523

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit (FACU).
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Duct smoke detectors.
5. Heat detectors.
6. Fire-alarm notification appliances.
7. Fire-alarm remote annunciators.
8. Fire-alarm addressable interface devices.
9. Digital alarm communicator transmitters (DACTs).

1.3 DEFINITIONS

A. DACT: Digital alarm communicator transmitter.

B. EMT: Electrical metallic tubing.

C. FACU: Fire-alarm control unit.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Annunciator panel details as required by authorities having jurisdiction.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within airflow range of air-sampling detector.
12. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring and equipment required for HVAC unit shutdown on alarm.
    c. Locate detectors in accordance with manufacturer's written instructions.
13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Qualification Statements: For Installer.

C. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

   a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
   b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
   c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
   d. Riser diagram.
   e. Device addresses.
   f. Record copy of site-specific software.
   g. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

      1) Equipment tested.
      2) Frequency of testing of installed components.
      3) Frequency of inspection of installed components.
      4) Requirements and recommendations related to results of maintenance.
      5) Manufacturer's user training manuals.

   h. Manufacturer's required maintenance related to system warranty requirements.
   i. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
   2. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
   3. Keys and Tools: One extra set for access to locked or tamperproofed components.
   4. Audible and Visual Notification Appliances: One of each type installed.
   5. Fuses: Two of each type installed in system. Provide in box or cabinet with compartments marked with fuse types and sizes.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire-alarm Level III technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ADDRESSABLE FIRE-ALARM SYSTEM

A. Description:

1. Noncoded, addressable system, with multiplexed signal transmission and horn-and-strobe notification for evacuation.

B. Performance Criteria:

1. Regulatory Requirements:

a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.

2. General Characteristics:

a. Automatic sensitivity control of certain smoke detectors.
b. Fire-alarm signal initiation must be by one or more of the following devices and systems:

1) Manual stations.
2) Heat detectors.
3) Smoke detectors.
4) Carbon monoxide detectors.
5) Automatic sprinkler system water flow.
6) Fire-extinguishing system operation.

c. Fire-alarm signal must initiate the following actions:

1) Continuously operate alarm notification appliances.
2) Identify alarm and specific initiating device at FACU, connected network control panels, off-premises network control panels, and remote annunciators.
3) Transmit alarm signal to remote alarm receiving station.
4) Close smoke dampers in air ducts of designated air-conditioning duct systems.
5) Recall elevators to primary or alternate recall floors.
6) Activate elevator power shunt trip.
Record events in system memory.

d. Supervisory signal initiation must be by one or more of the following devices and actions:

1) Valve supervisory switch.
2) Elevator shunt-trip supervision.
3) Independent fire-detection and -suppression systems.
4) Carbon monoxide detector.
5) Duct-type smoke detector.
6) Zones or individual devices have been disabled.
7) FACU has lost communication with network.

e. System trouble signal initiation must be by one or more of the following devices and actions:

1) Open circuits, shorts, and grounds in designated circuits.
2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4) Loss of primary power at FACU.
5) Ground or single break in internal circuits of FACU.
6) Abnormal ac voltage at FACU.
7) Break in standby battery circuitry.
8) Failure of battery charging.
9) Abnormal position of switch at FACU or annunciator.

f. System Supervisory Signal Actions:

1) Identify specific device initiating event at FACU, connected network control panels, off-premises network control panels, and remote annunciators.
2) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
3) Transmit system status to building management system.
4) Display system status on graphic annunciator.

g. Network Communications:

1) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
2) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.

h. Device Guards:

1) Description: Welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.

a) Factory fabricated and furnished by device manufacturer.
b) Finish: Paint of color to match protected device.

i. Document Storage Box:

1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
3) Color: Red powder-coat epoxy finish.
4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.2 FIRE-ALARM CONTROL UNIT (FACU)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: (Design Basis: United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

1. Fire-Lite Alarms; Honeywell International, Inc.
2. Gamewell-FCI; Honeywell International, Inc.
3. Notifier; Honeywell International, Inc.
4. United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

C. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics:

a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
b. Include real-time clock for time annotation of events on event recorder and printer.
c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
d. FACU must be listed for connection to central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.

    1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.

g. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.

    1) Annunciator and Display: LCD, 80 characters, minimum.
    2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.

h. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.

    1) Annunciator and Display: LCD, two line(s) of 40 characters, minimum.
    2) Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into system for control of smoke-detector sensitivity and other parameters.

i. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

    1) Pathway Class Designations: NFPA 72, Class B Class C Class D Class E.
    2) Pathway Survivability: Level 0.
    3) Install no more than 50 addressable devices on each signaling-line circuit.
    4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.

j. Serial Interfaces:

    1) One dedicated RS 485 port for central-station operation using point ID DACT.

2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
3) One USB port for PC configuration.

k. Notification-Appliance Circuit:

1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.

l. Elevator Recall: Initiate by one of the following alarm-initiating devices:

1) Elevator lobby detectors except lobby detector on designated floor.
2) Smoke detectors in elevator machine room.
3) Smoke detectors in elevator hoistway.

m. Elevator controller must be programmed to move cars to alternate recall floor if lobby detectors located on designated recall floors are activated.
n. Water-flow alarm connected to sprinkler in elevator shaft and elevator machine room must shut down elevators associated with location without time delay.

1) Water-flow switch associated with sprinkler in elevator pit may have delay to allow elevators to move to designated floor.

o. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls must not be connected to fire-alarm system.
p. Remote Smoke-Detector Sensitivity Adjustment: Controls must select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out final adjusted values on system printer.
q. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.
r. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and must be powered by 24 V(dc) source.
s. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
t. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.
u. Batteries: Sealed lead calcium.

D. Accessories:

1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.
2. Preaction System Functionality:

    a. Initiate Presignal Alarm: This function must cause audible and visual alarm and indication to be provided at FACU. Activation of initiation device connected as part of preaction system must be annunciated at FACU only, without activation of general evacuation alarm.

2.3 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: (Design Basis: United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

1. Fire-Lite Alarms; Honeywell International, Inc.
2. Gamewell-FCI; Honeywell International, Inc.
3. Notifier; Honeywell International, Inc.
4. United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate alarm, breaking-glass or plastic-rod pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm. Lifting cover actuates integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
5. Able to perform at up to 90 percent relative humidity at 90 deg F.
6. Able to be used in indoor areas.

2.4 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Fire-Lite Alarms; Honeywell International, Inc.
b. Gamewell-FCI; Honeywell International, Inc.
c. Notifier; Honeywell International, Inc.
d. United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

2. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 268.

b. General Characteristics:

1) Detectors must be two-wire type.
2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:

a) Primary status.
b) Device type.
c) Present average value.
d) Present sensitivity selected.
e) Sensor range (normal, dirty, etc.).

8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
9) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.
10) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
11) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
12) Multiple levels of detection sensitivity for each sensor.
13) Sensitivity levels based on time of day.

2.5 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Notifier; Honeywell International, Inc.
   b. United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

2. Description: Horns, bells, or other notification devices that cannot output voice messages.
3. Performance Criteria:

   a. Regulatory Requirements:

      1) NFPA 72.

   b. General Characteristics:

      1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
      2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
      3) Sounders, High Volume 24 V(dc): Less than 6 mA of alarm current.
      4) Sounders, Low Volume 24 V(dc): Less than 4 mA of alarm current.
      5) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
      6) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. from horn, using coded signal prescribed in UL 464 test protocol.
      7) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Visible Notification Appliances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Notifier; Honeywell International, Inc.
   b. United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

2. Performance Criteria:

   a. Regulatory Requirements:

1) NFPA 72.
2) UL 1971.

b. General Characteristics:

1) Rated Light Output:

a) 15/30/75/110 cd, selectable in field.

2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
3) Mounting: Wall mounted unless otherwise indicated.
4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
5) Flashing must be in temporal pattern, synchronized with other units.
6) Strobe Leads: Factory connected to screw terminals.
7) Mounting Faceplate: Factory finished, red.

2.6 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms; Honeywell International, Inc.
b. Gamewell-FCI; Honeywell International, Inc.
c. Notifier; Honeywell International, Inc.
d. United Technologies Corporation (UTC Climate, Controls & Security - Edwards).

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. Include address-setting means on module.
b. Store internal identifying code for control panel use to identify module type.
c. Listed for controlling HVAC fan motor controllers.
d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
e. Integral Relay: Capable of providing direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1) Allow control panel to switch relay contacts on command.
2) Have minimum of two normally open and two normally closed contacts available for field wiring.

f. Control Module:

1) Operate notification devices.
2) Operate solenoids for use in sprinkler service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EQUIPMENT

A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before other trades have completed cleanup must be replaced.
2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of building.
2. Connect new equipment to existing monitoring equipment at supervising station.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
2. Mount manual fire-alarm box on background of contrasting color.
3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.

E. Smoke- and Heat-Detector Spacing:

1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing must not exceed 30 ft..
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex Ain NFPA 72.
5. HVAC: Locate detectors not closer than 36 inch from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

I. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

J. Visible and Combination Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and Entire lens shall be between 80” and 96” above finished floor and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near device they monitor.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.5 PATHWAYS

A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inch above floor must be installed in EMT.

B. Pathways must be installed in EMT.

C. Exposed EMT must be painted red enamel.

3.6 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Magnetically held-open doors.
5. Alarm-initiating connection to elevator recall system and components.
6. Supervisory connections at valve supervisory switches.
7. Supervisory connections at elevator shunt-trip breaker.
8. Data communication circuits for connection to building management system.

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in location visible from FACU.

3.8 GROUNDING

A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.9 FIELD QUALITY CONTROL

A. Field tests must be witnessed by Architect.

B. Administrant for Tests and Inspections:

1. Administer and perform tests and inspections.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
   b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Allow Owner to record training.

3.11 MAINTENANCE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

END OF SECTION 284621.11

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SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes temporary excavation support and protection systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Terminal B Redevelopment, 901 Fuhrmann Blvd, Buffalo, NY 14203.

1.3 ACTION SUBMITTALS

A. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

1.5 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.6 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility withoutConstruction Manager's and Owner's written permission.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks, and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
3. Compliance with requirements of authorities having jurisdiction.
4. Compliance with utility company requirements.
5. Compliance with railroad requirements.

2.2 MATERIALS

A. Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A36/A36M, ASTM A690/A690M, or ASTM A992/A992M.

C. Steel Sheet Piling: ASTM A328/A328M, ASTM A572/A572M, or ASTM A690/A690M; with continuous interlocks.

1. Corners: Site-fabricated mechanical interlock and/or Roll-formed corner shape with continuous interloc].

D. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

G. Tiebacks: Steel bars, ASTM A722/A722M.

H. Tiebacks: Steel strand, ASTM A416/A416M.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation.

1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.
3. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds.

1. Trim excavation as required to install lagging.
2. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback, and replace and retest deficient tiebacks.

1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.4 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 MAINTENANCE

A. Monitor and maintain excavation support and protection system.

B. Prevent surface water from entering excavations by grading, dikes, or other means.

C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

3.6 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.

1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.
2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.7 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.

1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
2. Remove excavation support and protection systems to a minimum depth of 48 (1200) inches (mm) below overlying construction, and abandon remainder.
3. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
4. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

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SECTION 316216 - STEEL PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes steel H piles.

1.3 UNIT PRICES

A. General: See Division 1 Section “Unit Prices” for piles affected by unit prices.

B. Contract Sum: Base Contract Sum on number and dimensions of piles indicated from tip to cutoff, plus not less than 12 inches (305 mm) of overlength for cutting piles at cutoff elevations.

C. Provide unit price for full scale load tests as directed by the owner’s Geotechnical Engineer.

D. Work of this Section is affected as follows:

1. Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, is calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by Architect and measured to nearest 12 inches (305 mm).

    a. Additional payment for splices required to extend pile lengths in excess of that indicated is calculated at unit prices stated in the Contract.
2. Unit prices include labor, materials, tools, equipment, and incidentals for furnishing, driving, cutting off, capping, and disposing of cutoffs.
3. Test piles that become part of permanent foundation system are considered as an integral part of the Work.
4. No payment is made for rejected piles, including piles driven out of tolerance, defective piles, or piles damaged during handling or driving.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For steel H piles. Show fabrication and installation details for piles, including details of driving points, splices, and pile caps.

1. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
2. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, professional engineer, and testing agency.

B. Welding certificates.

C. Mill Test Reports: For steel H piles, signed by manufacturer.

D. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.

E. Static Pile Test Reports: Submit within three days of completing each test.

F. Pile-Driving Records: (to be kept by the Geotechnical Engineer) submit within three days of driving each pile.

G. Certified Piles Survey: Submit within seven days of pile driving completion.

H. Field quality-control reports.

I. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Installer's responsibility includes providing a qualified professional engineer to conduct Dynamic Testing and coordinate gathering of driving records with the Owner's Special Inspector.

2. Test first six (6) piles dynamically at initial driving and 24-hour restricted to locations selected by the Geotechnical Engineer.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Special inspector: Owner's Special Inspector, acceptable to authorities having jurisdiction.

D. Comply with requirements of the following publications:
   1. AISC 360 "Specification for Structural Steel Buildings."

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 PRECONSTRUCTION TESTING

A. General: Static pile tests are used to verify driving criteria and pile lengths and to confirm allowable load of piles.

   1. Furnish test piles 60 inches longer than production piles.
   2. Determination of actual length of piles is based on results of static pile tests.

B. Pile Tests: Arrange and perform the following pile tests:

   1. Axial Compressive Static Load Test: ASTM D1143/D1143M. Procedure A, Quick Test[and the following Procedures:

      a. Procedure B, Maintained Test.
      b. Procedure C, Loading in Excess of Maintained Test.
      c. Procedure G, Cyclic Loading Test.

   2. Axial Tension Static Load Test: ASTM D3689.
   3. Lateral Load Test: ASTM D3966.

C. Equip each test pile with two telltale rods, according to ASTM D1143/D1143M, for measuring deformation during load test.

D. Provide pile reaction frame, anchor piles, equipment, and instrumentation with enough reaction capacity to perform tests. Notify Architect at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.

   1. Allow a minimum of seven days to elapse after driving test piles before starting pile testing.
   2. Number of Test Piles: One pile

E. Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project, and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.

F. Approval Criteria: Allowable load shall be the load acting on the test pile when the lesser of the following criteria are met, divided by a factor of safety of 2:

1. Net settlement, after deducting rebound, of not more than 0.01 inch/ton (0.25 mm/907 kg) of test load.
2. Total settlement exceeds the pile elastic compression by 0.15 inch (4 mm), plus 1.0 percent of the tip diagonal dimension.
3. A plunging failure or sharp break in the load settlement curve.

G. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer. Include same data as required for driving records of permanent piles.

H. Test piles that comply with requirements, including location tolerances, may be used on Project.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent buckling or physical damage.

1. Painted Piles: Protect finish and touch up paint damage before driving piles.

1.10 FIELD CONDITIONS

A. Protect structures, underground utilities, and other construction from damage caused by pile driving.

B. Site Information: A geotechnical report has been prepared for this Project and is included elsewhere in the Project Manual for information only.

C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Document conditions that might be misconstrued as damage caused by pile driving. Comply with Section 013233 "Photographic Documentation."

PART 2 - PRODUCTS

2.1 STEEL H PILES

A. High-Strength, Low-Alloy, Columbium-Vanadium Structural Steel: ASTM A572/A572M, Grade 50.

2.2 PILE ACCESSORIES

A. Driving Points: Manufacturer's standard one-piece driving point, fabricated from steel castings as follows to provide full bearing of web and flange of pile tip:

1. Carbon-Steel Castings: ASTM A27/A27M, Grade 65-35 (Grade 450-240), heat treated.
2. High-Strength Steel Castings: ASTM A148/A148M, Grade 80-40 (Grade 550-275) or Grade 90-60 (Grade 620-415).

B. Splice Unit: Manufacturer's standard splice unit, fabricated from two connected steel plates, of same material as steel H pile or material of equal strength, shaped to encase web and part of each flange.

2.3 FABRICATION

A. Fabricate and assemble piles in shop to greatest extent possible.

B. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch (305-mm) intervals; label the distance from pile tip at 60-inch (1524-mm) intervals. Maintain markings on piles until driven.

C. Fabricate full-length piles by splicing lengths of steel H pile together. Accurately mill meeting ends of piles and bevel for welding. Maintain axial alignment of pile lengths. Maintain structural properties of pile across splice.

1. Splice Units: Notch web of pile, fit splice unit into position, and weld according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
2. Continuously Welded Splices: Splice piles by continuously welding according to AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.
3. Splice piles during fabrication or field installation.

D. Fit and weld driving points to tip of pile according to manufacturer's written instructions and AWS D1.1/D1.1M for procedures, appearance and quality of welds, and methods used in correcting welding work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches (152 to 305 mm) above bottom of footing or pile cap.

3.2 DRIVING EQUIPMENT

A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.

1. Rated Energy: Pile driving hammer shall deliver a minimum of at least 18,000 to 25,000 ft-lbs. of energy.

2. Provide sufficient boiler or compressor capacity at all times to maintain the rated hammer speed during the full time of driving a pile. The valve mechanism and other parts of the hammer shall be maintained in first class condition so that the length of the stroke for a single acting hammer and the number of blows per minute for a double acting hammer, for which the hammer is designed, will be maintained. Any hammer not operating at the rated hammer speed specified in the manufactures catalog will be deemed unsatisfactory and shall be removed from the site

B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.

C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.3 DRIVING PILES

A. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.

B. Predrilling: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.

1. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.

C. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.

D. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:

1. Location: 4 inches (102 mm) from location indicated after initial driving, and 6 inches (152 mm) after pile driving is completed.
2. Plumb: Maintain 1 inch (25 mm) in 48 inches (1219 mm) from vertical, or a maximum of 4 inches (102 mm), measured when pile is aboveground in leads.
3. Batter Angle: Maximum 1 inch (25 mm) in 48 inches (1219 mm) from required angle, measured when pile is aboveground in leads.

E. Abandon and cut off rejected piles as directed by Architect. Leave rejected piles in place, and install new piles in locations as directed by Architect.

F. Cut off tops of driven piles square with pile axis and at elevations indicated.

G. Pile-Driving Records: Maintain accurate driving records for each pile**,** compiled and attested to by a qualified professional engineer. Include the following data:

1. Project name and number.
2. Name of Contractor.

3. Pile location in pile group and designation of pile group.
4. Sequence of driving in pile group.
5. Pile dimensions.
6. Ground elevation.
7. Elevation of tips after driving.
8. Final tip and cutoff elevations of piles after driving pile group.
9. Records of redriving.
10. Elevation of splices.
11. Type, make, model, and rated energy of hammer.
12. Weight and stroke of hammer.
13. Type of pile-driving cap used.
14. Cushion material and thickness.
15. Actual stroke and blow rate of hammer.
16. Pile-driving start and finish times, and total driving time.
17. Time, pile-tip elevation, and reason for interruptions.
18. Number of blows for every 12 inches (305 mm) of penetration, and number of blows per 1 inch (25 mm) for the last 6 inches (152 mm) of driving.
19. Pile deviations from location and plumb.
20. Preboring, jetting, or special procedures used.
21. Unusual occurrences during pile driving.

H. Certified Piles Survey: Engage a land surveyor to prepare a piles survey showing final location of piles in relation to the property survey and existing benchmarks.

1. Notify Architect when deviations from locations exceed allowable tolerances.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Pile foundations.
2. Refer to “Statement of Special Inspections” for specific requirements.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Tests and Inspections:

1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D4945 during initial driving and during restriking on five single piles.
2. Weld Testing: In addition to visual inspection, welds shall be tested and inspected according to AWS D1.1/D1.1M and inspection procedures listed below, at testing agency's option. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

   a. Liquid Penetrant Inspection: ASTM E165.
   b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

c. Radiographic Inspection: ASTM E94, minimum quality level "2-2T."
d. Ultrasonic Inspection: ASTM E164.

D. Steel H piles will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 TOUCHUP PAINTING

A. Clean field welds, splices, and abraded painted areas and field-apply paint according to SSPC-PA 1. Use same paint and apply same number of coats as specified for shop painting.

1. Apply touchup paint before driving piles to surfaces that are immersed or inaccessible after driving.

3.6 DISPOSAL

A. Remove withdrawn piles and cutoff sections of piles from site, and legally dispose of them off Owner's property.

END OF SECTION 316216

SECTION 321723 - PAVEMENT MARKINGS (ALTERNATE 2)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Painted markings applied to concrete surfaces.

B. Related Requirements:

1. Section 033543 "Polished Concrete Finishing" for whole areas of building floors with coatings having an integral wearing surface.
2. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement markings.
3. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement markings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking concrete surfaces including, but not limited to, the following:

a. Concrete-surface aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, acrylic.

B. Shop Drawings:

1. Indicate pavement markings, colors, and dimensions to adjacent work.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches (200 mm) square.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than 45 minutes.

1. Color: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

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SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review required testing, inspecting, and certifying procedures.
2. Review methods of anchorage at various locations and conditions.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch (150-mm) lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Product Certificates: For each type of chain-link fence, and gate.

C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of manual gate operators and controls.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

1. Design Wind Load: As indicated on Drawings.

    a. Minimum Post Size: Determine according to ASTM F1043 for post spacing not to exceed 10 feet (3 m) for Material Group IA, ASTM F1043, Schedule 40 steel pipe.
    b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: 96 inches (2440 mm) .
2. Steel Wire for Fabric: Wire diameter of 0.148 inch (3.76 mm).

    a. Mesh Size: 2 inches (50 mm).
    b. Zinc-Coated Fabric: ASTM A392, Type II, Class 2, 2.0 oz./sq. ft. (610 g/sq. m) with zinc coating applied before weaving.

    c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Twisted top and knuckled bottom.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 based on the following:

1. Fence Height: 96 inches (2440 mm).

2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.

    a. Line Post: 4.0 inches (102 mm) in diameter.
    b. End, Corner, and Pull Posts: 4.0 inches (102 mm) in diameter.

3. Horizontal Framework Members: Intermediate top and bottom rails according to ASTM F1043.

    a. Top Rail: 1.66 inches (42 mm) in diameter.

4. Brace Rails: ASTM F1043.
5. Metallic Coating for Steel Framework:

a. Type A: Not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating according to ASTM A653/A653M.
b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.
d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) coating.
e. Coatings: Any coating above.

2.4 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire according to ASTM A817 or ASTM A824, with the following metallic coating:
1. Type II: Zinc coated (galvanized) by hot-dip or electrolytic process, with the following minimum coating weight:
   a. Matching chain-link fabric coating weight.

2. Type III: Zn-5-Al-MM alloy with the following minimum coating weight:
   a. Matching chain-link fabric coating weight.

2.5 SWING GATES

A. General: ASTM F900 for gate posts and double swing gate types.

1. Gate Leaf Width: As indicated.
2. Framework Member Sizes and Strength: Based on gate fabric height of more than 72 inches (1830 mm).

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded or assembled with corner fittings.

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.6 FITTINGS

A. Provide fittings according to ASTM F626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of zinc.

a. Polymer coating over metallic coating.

2.7 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure

without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts anchored to concrete or by mechanically driving into soil at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Concealed Concrete: Place top of concrete 2 inches (50 mm) below gradeto allow covering with surface material.

3. Mechanically Driven Posts: Drive into soil to depth of 36 inches (914 mm). Protect post top to prevent distortion.
4. Concrete anchors: Install using epoxy expansion anchors drilled into concrete support.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet (152 m), space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch (25-mm) bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches (380 mm) o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach

other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet (450 m).
3. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
4. Ground fence on each side of gates and other fence openings.

   a. Bond metal gates to gate posts.
   b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (457 mm) below finished grade.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (152 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

D. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

E. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

F. Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."

C. Prepare test reports.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

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SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SEATING

A. Manufacturers: Basis of design product: Concrete Bench TF5021 by Belson Outdoors. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Forms + Surfaces.
2. Landscape Forms.
3. Fashion Furniture Co.

B. Frame: Precast Concrete.

C. Seat:

1. Material:

a. Precast Concrete.

2. Seat Height: 18” to 19”.
3. Seat Surface Shape: Flat.
4. Overall Width: 60” Minimum.
5. Overall Depth: 25” Minimum.
6. Arms: None.
7. Seating Configuration: Multiple units.

a. Straight shape.
b. Closed around a.

D. Concrete Finish: Acid wash stain.

1. Color: As selected by Architect from manufacturer's full range.

2.2 MATERIALS

A. Precast Concrete: Surfaced smooth on all sides with eased edges and no cracking.

1. Reinforcing: Complying with ASTM standards, minimum 3/8” steel rebar.

2.3 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

C. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.4 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and positioned at locations indicated on Drawings.

END OF SECTION 323300

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SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. CPVC: Chlorinated polyvinyl chloride plastic.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D2235.
2. CPVC Piping: ASTM F493.
3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
4. PVC to ABS Piping Transition: ASTM D3138.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:
1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:
1. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:
1. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
1. Description: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
1. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.

a. Pressure Rating: 150 psig (1035 kPa) minimum at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:
1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.

a. Pressure Rating: 150 psig (1035 kPa) minimum.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.

a. Pressure Rating: 150 psig (1035 kPa) minimum.
b. Gasket: Neoprene or phenolic.
c. Bolt Sleeves: Phenolic or polyethylene.
d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
1. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.

a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
b. End Connections: Threaded.

F. Dielectric Nipples:
1. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.

1. Material: Fiberboard or Brass.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

D. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

F. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

G. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

H. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

I. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch- (0.8-mm-) thick, polished brass or aluminum.
2. Material: 0.0375-inch- (1-mm-) thick stainless steel.
3. Material: 3/32-inch- (2.4-mm-) thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

K. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft. (1840- to 2325-kg/cu. m).
3. Aggregates: ASTM C33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C33, natural sand, fine.
5. Admixture: ASTM C618, fly-ash mineral.
6. Water: Comply with ASTM C94/C94M.
7. Strength: 100 to 200 psig (690 to 1380 kPa) at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
3. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping to permit valve servicing.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. Sleeves are not required for core-drilled holes.

I. Permanent sleeves are not required for holes formed by removable PE sleeves.

J. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

   a. Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

K. Verify final equipment locations for roughing-in.

L. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
5. PVC Nonpressure Piping: Join according to ASTM D2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
3. Locate pipe markers on exposed piping according to the following:

   a. Near each valve and control device.
   b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
   c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
   d. At manholes and similar access points that permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 330500

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RAVI ENGINEERING
& LAND SURVEYING, P.C.

October 28, 2020

Bergmann
280 East Broad Street
Rochester, New York 14604

Attention: Ariadna Cheremeteff

Subject: Geotechnical Engineering Investigation Report
Proposed Terminal B Redevelopment
901 Fuhrmann Boulevard
City of Buffalo, Erie County, New York

Dear Ms. Cheremeteff:

Ravi Engineering & Land Surveying, P.C. is pleased to submit the Geotechnical Engineering Report for the above referenced project. If you require additional information please contact us at (585) 223-3660. Thank you.

Respectfully submitted,

RAVI ENGINEERING & LAND SURVEYING, P.C.

James D. MacKecknie, P.G.
Project Manager

Attachment: Geotechnical Engineering Investigation Report

REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED TERMINAL B REDEVELOPMENT

901 FUHRMANN BOULEVARD

CITY OF BUFFALO, ERIE COUNTY, NEW YORK

For

Bergmann

October 2020

October 28, 2020

Bergmann
280 East Broad Street
Rochester, New York 14604

Attention: Ariadna Cheremeteff

Subject: Geotechnical Engineering Investigation
Proposed Terminal B Redevelopment
901 Fuhrmann Boulevard
City of Buffalo, Erie County, New York

Readers:

This report presents the results of a geotechnical engineering investigation for the project identified above. Information regarding the proposed construction was provided to us by Bergmann.

New column and wall foundations are proposed, within and near the outline of the existing warehouse. Most or all of the existing roof and wall panels will be removed, leaving only the existing warehouse frame in place.

SUBSURFACE EXPLORATIONS

Subsurface explorations for this investigation consisted of ten test borings, identified as B-1-20 through B-10-20. The quantity and locations of the borings were determined by Bergmann. The as-drilled locations of the borings are shown on the plan in Appendix A.

Borings B-1-20, B-2-20, and B-3-20 were performed primarily for geotechnical engineering purposes. Borings B-5-20 and B-6-20 were performed for both geotechnical and environmental purposes. Borings, B-4-20, B-7-20, B-8-20, B-9-20, and B-10-20 were performed primarily for environmental purposes. Borings B-1-20 and B-2-20 were performed within the existing warehouse, and the remaining eight borings were performed outside.

The borings were performed by Earth Dimensions, Inc., using rotary drilling equipment, between 8/27/20 and 9/1/20.

The logs of all ten borings, as prepared by Earth Dimensions, Inc., are presented in Appendix B. Detailed descriptions of the subsurface conditions encountered, as well as a concise summary, are presented on the log of each boring. Also provided on the logs are the approximate ground surface elevations at the boring locations.

COMMENTS ON SUBSURFACE CONDITIONS

All of the borings encountered random fill materials, to depths as great as approximately 22 feet below the ground or floor surface. Greater depths of random fill may be present at other locations. The quality of the random fill is variable, both horizontally and vertically.

The natural soils, underlying the random fill, are variable both horizontally and vertically. Much of this material is relatively weak and compressible.

Varying amounts of organic matter are present, at various locations and depths, in both the random fill and the underlying natural soils.

Borings B-5-20 and B-6-20 were each advanced to a depth of approximately 66 feet below the ground surface, where they encountered refusal at the top of apparent bedrock.

Observations of down-hole groundwater and sample moisture were made during the test boring program. It should be noted that short-term observations may not be representative of actual groundwater levels, and that groundwater levels will vary with factors including location, time, precipitation, season, and site activities. In general, it is likely that groundwater will be encountered near or above the level of nearby Lake Erie.

It should be noted that objects too large to be retrieved by the sampling equipment (including cobbles, boulders, and concrete fragments) are likely to be present. Such objects are especially likely to be present in the random fill.

More detailed descriptions of the subsurface conditions, as encountered by the borings, are provided on the logs in Appendix B.

DESIGN AND CONSTRUCTION

General

All design and construction should meet or exceed the requirements of all applicable codes.

With regard to the International Building Code, a seismic Site Class of “E” should be applied to this project. This corresponds to a “Soft soil profile.”

Suitability of Existing Fill for Support of Conventional Footings

Because of the potential for excessive differential settlement, the existing slag and other random fill materials are not considered suitable for the support of conventional footings.

New column and wall loads should be supported by deep foundations, advanced to or into bedrock.

Driven Pile Foundations

Driven piles are a feasible option. These could be H piles, open-end pipe piles, or closed-end pipe piles filled with concrete.

H piles and open-end pipe piles may be designed for a maximum allowable axial stress of 35 percent of the yield strength, or 17,500 pounds per square inch, whichever is less.

Closed-end pipe piles, if driven to refusal and filled with good-quality concrete (at least 4,000 psi), may be designed for an allowable load of 1,200 pounds per square inch of total pile cross-sectional area.

Piles should be driven, using a suitable hammer, to practical refusal on or in bedrock.

The ultimate capacity of each pile should be at least twice the allowable load. Pile capacities should be verified by the use of a pile-driving analyzer (PDA), by load testing, or by a combination of the two. Applicable code requirements should be followed.

The minimum center-to-center spacing of piles should be 30 inches or 2.5 pile widths, whichever is greater.

Piles should be installed by a contractor experienced in this specialized work. Obstructions and other installation difficulties should be anticipated. All piles should be installed in such a way that they are not overstressed or otherwise damaged during installation.

Drilled-In Micropile Foundations

Drilled-in micropiles are another option, which may be especially attractive within and near the outline of the existing warehouse. Micropiles could be used alone, or in combination with driven piles.

All of the following requirements should be satisfied:

- Micropiles should be designed and installed by a contractor experienced in this specialized work.

- Micropiles should be advanced into sound bedrock, and the grouted bond zone should be entirely within sound bedrock.

- Grout should have a seven-day unconfined compressive strength of at least 3,500 pounds per square inch.

- The maximum allowable rock-to-grout bond or shear stress should not be greater than 50 pounds per square inch.

- The ultimate capacity of each micropile should be at least twice the allowable load.

- Micropile capacities should be verified by load testing.

- The minimum center-to-center spacing between micropiles should be 30 inches or 2.5 micropile diameters, whichever is greater.

Potential Effects of New Foundations on Existing Bulkhead

As previously noted, the existing slag and other random fill materials are not considered suitable for the support of conventional footings. It has been recommended that new column and wall loads be supported by deep foundations, advanced to or into bedrock. The generation of increased lateral loads, on the existing bulkhead, is therefore not a concern. Care should be taken, however, to ensure that the existing anchors, tie rods, and other structural elements are not damaged during construction.

Capacities of Existing H Pile Foundations

Assuming that the existing structure has performed well, it would be reasonable to assume that the existing H pile foundations can carry the loads for which they were originally designed.

Depending on the availability and reliability of as-built construction documents, it may be possible to recommend even greater allowable loads.

In no case should the axial stress exceed 35 percent of the yield strength, or 17,500 pounds per square inch, whichever is less.

The acceptability of existing pile caps and grade beams would have to be confirmed by the structural engineer.

New Floor Slabs on Grade

At least 6 inches of compacted granular fill should be placed beneath all new floor slabs on grade. Drained, unsaturated conditions should be maintained within the granular fill. Compacted common fill may be placed as required below the granular fill. Subgrades should be prepared, and fill should be placed and compacted, as described elsewhere in this report.

Floor slabs should be designed and constructed in accordance with ACI recommendations. It is also recommended that the design be based on a subgrade modulus (K) not exceeding 50 pounds per cubic inch.

Because the complete or even extensive removal of the existing random fill materials would be impractical, it will be necessary for the owner to accept some risk of floor slab settlement and cracking. Additional settlements are likely in areas where grades will be increased, and these settlements are discussed in a subsequent section of this report.

If the risk of settlement can not be accepted, or if unusually heavy floor loads are anticipated, consideration should be given to structural floor slabs. These structural slabs would be supported by pile caps and/or grade beams, which in turn would be supported by deep foundations.

Grade Increases

Grade increases are likely to cause compression of the underlying soft soils, resulting in settlement. It is estimated that a settlement of roughly 1 inch per each foot of grade increase is possible. These settlements are likely to occur slowly, and may continue after the completion of construction. Grade increases should be achieved as early as possible in the construction sequence.

Pavement

A practical pavement design is based on factors including subgrade quality, frost action, traffic loads, traffic frequency, design life, and the relative importance of initial costs versus future maintenance.

At this site, the subgrade quality for flexible pavement should be represented using a California Bearing Ratio (CBR) not exceeding 5.

For auto parking areas, the recommended minimum flexible pavement section consists of a 1-inch asphaltic top course, a 2-inch asphaltic binder course, and a 12-inch subbase course of compacted granular fill.

For areas subjected to more frequent and/or heavier vehicles, the minimum combined thickness of asphaltic top and binder courses should be increased to 5 inches. The minimum thickness of the granular subbase should be increased to 16 inches.

The subgrade quality for rigid pavement should be represented using a subgrade modulus (K) not exceeding 75 pounds per cubic inch. The rigid section should consist of reinforced concrete, and should be at least 6 inches thick. At least 12 inches of compacted granular fill should be placed below the slab.

For all pavement sections, compacted common fill may be placed as required below the granular fill.

No existing topsoil or other unsuitable materials should be left in place. Complete removal of the existing fill materials, however, should not be necessary. Subgrades should be prepared, and fill should be placed and compacted, as described elsewhere in this report.

Drained, unsaturated conditions should be maintained within all pavement sections. Surface water should be conducted away from paved areas and structures.

The project designers may wish to consider pavement sections that are more or less conservative than those presented. This could depend on the traffic and cost factors described above, as well as the performance of existing and previous pavement sections at the site.

Excavation and Construction Dewatering

Excavation should be performed in accordance with all applicable local, state, and federal requirements. The sides of all excavations should be sloped or supported as required by safety regulations. Existing structures, utilities, and other property should be protected.

With regard to the current OSHA regulations, Type C soil should be assumed. This would apply to adequately dewatered soil.

To minimize subgrade disturbance, excavation should be performed with increasing care as subgrade levels are approached.

All work should be performed in the dry. In addition, the dewatering should be sufficient to permit suitable preparation of the subgrade and compaction of any subsequent fill materials.

The contractor should be prepared to dewater as necessary, and should choose and employ an appropriate type of dewatering system. Any dewatering system should be operated in such a way that disturbance or removal of the subgrade soil does not occur.

Subgrade Preparation

It is cautioned that the soils at this site contain fine-grained material, and that they will be sensitive to disturbance. Subgrades should be kept free of water, subjected to a minimum amount of construction traffic, exposed no longer than necessary, and not permitted to freeze.

Subgrades should be carefully prepared and thoroughly examined by qualified personnel. Subgrades should also be tamped using vibratory equipment, to the greatest extent possible without loosening or softening the subgrade soils.

Where space permits, subgrades should be thoroughly proofrolled with both a large vibratory roller and a fully-loaded ten-wheel dump truck. The primary objective of this additional effort is to identify and/or compact any voids or loose zones in the existing random fill materials.

No new fill or foundation concrete should be placed over material that is loose, soft, wet, frozen, or otherwise unsuitable with respect to the design recommendations. No more than trace amounts of organic matter should be left in place.

Fill and Backfill

Granular fill should consist of a durable sand and gravel or crusher-run stone, free of any organic matter. The plasticity index should be less than 5. Granular fill should have 100 percent finer than 3 inches, 20 to 60 percent finer than the Number 4 sieve, and no more than 10 percent finer than the Number 200 sieve.

Granular fill could also be specified as meeting the NYSDOT requirements for Subbase Course Type 1, 2, or 4.

Common fill should consist of durable soil material, free of any organic matter. The plasticity index should be less than 15. Common fill should have 100 percent finer than 6 inches, at least 90 percent finer than 3 inches, and at least 20 percent finer than the Number 4 sieve.

It should be noted that granular fill meets all of the requirements of common fill, and that granular fill can generally be placed and compacted with less difficulty.

All load-bearing fill should be compacted, in lifts of 9 inches or less, to at least 95 percent of the maximum dry density determined by ASTM D 1557.

The in-place density and water content of compacted fill should be determined by ASTM D 6938. At least one test should be performed per 2,500 square feet, per lift.

CLOSING COMMENTS AND RECOMMENDATIONS

Professional services for this investigation were performed in accordance with generally accepted geotechnical engineering practices, exclusively for the subject project. No warranty, expressed or implied, is made.

It should be noted that subsurface conditions are inferred from the logs of subsurface explorations; that each subsurface exploration is performed at a specific location and time; that conditions between, beyond, and below explorations are likely to vary; that conditions are often described on the basis of visual examinations of recovered samples; that visual descriptions may not always agree well with descriptions made on the basis of laboratory tests; that the distinction between fill and naturally-deposited soil can not always be readily determined on the basis of recovered samples; and that conditions can be changed by excavation and/or filling, performed after the exploration. If subsurface conditions are subsequently revealed that appear to be significantly different or less favorable than those described, we should be given the opportunity to revise the statements in this report.

Designers and contractors are advised that this report was prepared primarily for design purposes, and that it may not contain sufficient information for bidding. Contractors should visit the site, review this report and the related exploration logs, and evaluate potential construction difficulties on the basis of their own knowledge and experience.

It is recommended that qualified personnel be retained to review the geotechnical portions of the contract drawings and specifications, and to provide monitoring services during construction.

If you have questions or comments regarding this report, please contact the undersigned.

Yours truly,

RAVI ENGINEERING & LAND SURVEYING, P.C.

Nagappa Ravindra, P.E.
President

Ray M. Teeter, P.E.
Geotechnical Engineer

Attachments: Appendix A – Test Boring Location Plan

Appendix B – Test Boring Logs

Appendix A

Test Boring Location Plan

Test Boring Location Plan
Buffalo Outer Harbor Terminal B - Phase 2
Fuhrmann Boulevard
City of Buffalo, Erie County, New York

DWG # 40–20–118	Scale : 1"=80'	Date : 9/21/20	Drawn By : ARK

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Appendix B

Test Boring Logs

EARTH DIMENSIONS, INC.
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(716) 655-1717 • EDI@earthdimensions.com

13E96c HOLE NO. B-1-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	27	16	28	20	66		Reinforced steel mesh concrete. 0.5	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	2	14	20	32	34			Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, very dense, massive soil structure, (SW), (GW). 1.0	Steel mesh reinforced concrete floor to 0.5 feet over sand and gravel fill with trace silt to 1.0 feet over sand and gravel fill with trace silt, slag, and concrete debris to 16.0 feet over sand and gravel fill with trace silt, concrete debris, and slag to 21.0 feet over silty slack water sediment with little clay, trace sand, gravel, and organic matter to end of boring.
5	3	16	21	23	30	56		Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, slag, and concrete debris, dense to very dense, massive soil structure, (SW), (GW).	
	4	16	16	22	33	46			
	5	12	13	18	36	40			
10	6	18	17	43	24	62		11.0	
	7	16	17	23	19	50		Extremely moist to wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, slag, and concrete debris, dense to very dense, massive soil structure, (SW), (GW).	Water level at 11.2 feet below ground surface at completion.
15	8	14	12	15	29	34			Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 24.0 feet and 5.0-foot interval sampling to end of boring at 27.0 feet. Bore hole was backfilled with cuttings and ground surface repaired with concrete at completion.
	9	4	10	5	26	10		16.0	
	10	4	4	4	19	14		Wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, concrete debris, and slag, loose to compact, massive soil structure, (SW), (GW).	
20				10	18				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-1-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	11	4				2		Wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, concrete debris, and slag, loose to compact, massive soil structure, (SW), (GW).	
	1		1						
				1					
					1				
	12	3						21.0	
	13		2			3		Extremely moist gray (CLAYEY-SILT) with 3 to 7% gravel, trace sand and organic matter, little clay, very soft to soft, thinly laminated with very thin coarse silt lenses, (ML-CL).	
				1					
					2				
25	13	1							
	16		2			3			
				1					
					1			27.0	
								Boring completed at 27.0 feet.	
30									
35									
40									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 2 OF 2

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13E96c HOLE NO. B-2-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	26				57		Reinforced steel mesh concrete. 0.5	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	10		47					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, concrete debris, and slag, dense to very dense, massive soil structure, (SW), (GW). 2.0	Steel mesh reinforced concrete to 0.5 feet over sand and gravel fill with trace silt, concrete debris, and slag to 2.0 feet over coarse silty soil fill with little sand and gravel, trace slag to 4.5 feet over clayey soil fill with trace sand to 5.3 feet over coarse silty soil fill with little sand and gravel, trace clay, brick fragments, concrete debris, and glass fragments to 12.0 feet over sandy soil fill with some gravel, little silt, trace slag, brick fragments, and wood fiber to 22.0 feet over water sorted and
				42					
	2	24							
	23		27						
				30					
					28				
	3	4				4		Moist dark gray (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace slag, very dense, massive soil structure, (ML). 4.5	
5	20		1						
				3					
					4				
	4	2				17		Extremely moist brown to grayish brown (SILTY-CLAY) fill with trace sand, soft, massive soil structure, (CL). 5.3	
	24		9						
				8					
					5				
	5	4				24		Moist to extremely moist dark gray (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace clay, concrete debris, and brick and glass fragments, loose to compact, massive soil structure, (ML). 12.0	Water level at 8.9 feet below ground surface at completion.
	12		10						
				14					
10					6				
	6	9							
	24		17			30			deposited sand with little silt to 25.0 feet over coarse silty slack water sediment with little sand, trace clay and organic matter to end of boring.
				13					
					10				
	7	5				7		Wet dark gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, little silt, trace slag, brick fragments, and wood fiber, compact, massive soil structure, (ML).	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 24.0 feet and 5.0-foot interval sampling to end of boring at 27.0 feet. Bore hole was backfilled with cuttings and ground surface repaired with concrete at completion.
	15		4						
				3					
					2				
	8	4				17			
15	12		9						
				8					
					7				
	9	6				14			
	15		6						
				8					
					9				
	10	10				19			
	8		10						
				9					
20					5				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-2-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN	REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	11	9				14		Wet dark gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, little silt, trace slag, brick fragments, and wood fiber, compact, massive soil structure, (ML).	WH: Sampler penetration with weight of rods and hammer.
	2	4		7						
	3				7					
	4					4				
	5	12	WH				4		22.0	
	6	14		2					Wet gray (SILTY-SAND) with mostly fine size sand, little silt, very loose, thinly bedded, (SM).	
	7				2					
	8					2				
									grades downward to 25.0	
25	9	13	1				4		Extremely moist dark gray (SANDY-SILT) with 3 to 7% gravel, little sand, trace clay and organic matter, very loose, (ML).	
	10	22		1						
	11				3					
	12					3			27.0	
									Boring completed at 27.0 feet.	
30										
35										
40										

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-3-20 SURF. ELEVATION 584 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	33						Asphalt pavement. 0.4	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	12		32					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, dense to very dense, massive soil structure, (SW), (GW).	Asphalt pavement to 0.4 feet over sand and gravel fill with trace silt and slag to spoon refusal.
				24					
	2	18							
	18		27			58			Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to spoon refusal at 9.1 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
				31					
					61				
	3	14							
5	17		14			30			
				16					
					26				
	4	28							
	19		37			57			No water at completion.
				20					
					33				
	5	18							
	10		52					9.1	
				50/1				Boring completed at 9.1 feet.	
10									
15									
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-4-20 SURF. ELEVATION 586 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	49						Asphalt pavement. 0.3	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	16		20					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, dense to very dense, massive soil structure, (SW), (GW). 2.0	Asphalt pavement to 0.3 feet over sand and gravel fill with trace silt and slag to 2.0 feet over sandy soil fill with some gravel, trace to little silt, trace slag and wood fiber to 6.0 feet over water sorted and deposited sand with trace to little silt to 10.7 feet over coarse silty slack water sediment with little sand, trace to little gravel, trace clay and wood fiber to end of boring.
				22					
	2	6							
	20		5			12			
				7					
					9				
	3	3						Moist gray to grayish brown gravelly (SILTY-SAND) fill with 20 to 40% gravel, trace to little silt, trace slag, wood fiber, and glass fragments, compact, massive soil structure, (SM). 6.0	
5	13		1			7			
				6					
					4				
	4	6						Extremely moist to wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, loose, thinly bedded, (SM). 8.0	
	18		3			9			
				6					
					8				
	5	6						Wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, compact, thinly bedded, (SM). 10.7	
	17		8			15			
				7					
10					4				
	6	1							
	12		1			2		Wet gray (SANDY-SILT) with 5 to 15% gravel, little sand, trace clay and wood fiber, very loose, thinly bedded, (ML). 16.0	Water level at 12.2 feet below ground surface at completion.
				1					
					1				
	7	1							
	5		1			6			
				5					
					3				
	8	1							
15	6		2			4			
				2					
					5				
								Boring completed at 16.0 feet.	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	16						Concrete. 0.7	Note: Sample number 1 taken from 0.7 to 2.0 feet.
	10		39					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, very dense, massive soil structure, (SW), (GW).	Concrete to 0.7 feet over sand and gravel fill with trace silt and slag to 4.0 feet over sand and gravel fill with trace slag to 6.0 feet over water sorted and deposited sand with trace to little silt to 9.6 feet over silty slack water sediment with little to some clay, trace sand to 12.0 feet over clayey slack water sediment with trace sand and gravel to 15.3 feet over silty slack water sediment with little clay, trace sand and organic matter to 18.0 feet over clayey slack water sediment with trace sand to 19.5 feet over water sorted and deposited sand with trace to little silt to 23.0 feet over water sorted and deposited sand with trace to little silt to 28.0 feet over clayey lake sediment with trace sand and gravel to 38.0 feet over water sorted and deposited sand with trace to little silt, trace clay to 43.0 feet over clayey lake sediment with trace sand and gravel to auger refusal.
				50/3					
	2	22							
	19		21			34			
				13					
					15			4.0	
	3	9						Wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace slag, compact, massive soil structure, (SW), (GW).	
5	11		7			14			
				7					
					9			6.0	
	4	8						Extremely moist to wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, compact, thinly bedded, (SM).	
	12		5			10			
				5					
					5				
	5	4							
	16		6			10			
				4				9.6	
10					4			Extremely moist gray (CLAYEY-SILT) with little to some clay, trace sand, firm, thinly laminated with very thin coarse silt lenses, (ML-CL).	
	6	2							
	16		1			2			
				1					
					1			grades downward to 12.0	
	7	1/12						Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	
	12					<2			
				1					
					1				
	8	1/12							
15	19					<2		grades downward to 15.3	
				1/12				Extremely moist dark gray to gray (CLAYEY-SILT) with little clay, trace sand and organic matter, thinly laminated with very thin coarse silt lenses, (ML-CL).	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 16.0 feet and 5.0-foot interval sampling to auger refusal at 65.5 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
								grades downward to 18.0	
	9	1/12						Extremely moist gray (SILTY-CLAY) with trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	No water at completion.
	24					<2			
				1					
20					3				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Extremely moist gray (SILTY-CLAY) with trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL). 19.5	WR: Sampler penetration with weight of rods.
	10	WR						Extremely moist to wet gray (SILTY-SAND) with trace to little silt, loose, stratified, (SM).	
	24		WR			<1		grades downward to 23.0	
				WR					
25					2			Wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, very loose, thinly bedded, (SM).	
								grades downward to 28.0	
	11	4						Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, soft to firm, thinly laminated with very thin coarse silt lenses, (CL).	
	22		3			7			
				4					
30					4				
	12	2							
	20		2			3			
				1					
35					1				
								grades downward to 38.0	
	13	5						Wet gray (SILTY-SAND) with trace to little silt, trace clay , compact, thinly bedded, (SM).	
	14		6			13			
				7					
40					7				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Wet gray (SILTY-SAND) with trace to little silt, trace clay, compact, thinly bedded, (SM).	
								grades downward to 43.0	
	14	2						Extremely moist gray (SILTY-CLAY) with 5 to 7% gravel, trace sand, soft to firm, very soft below 53.0 feet, thinly laminated with very thin coarse silt lenses, (CL).	
	22		2			7			
				5					
45					5				
	15	1							
	20		2			3			
				1					
50					2				
	16	1/12							
	24					<2			
				1/12					
55									
	17	1							
	24		1			2			
				1					
60					1				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	18 / 24	WH	WH	WH	WH	<1		Extremely moist gray (SILTY-CLAY) with 5 to 7% gravel, trace sand, soft to firm, very soft below 53.0 feet, thinly laminated with very thin coarse silt lenses, (CL).	WH: Sampler penetration with weight of rods and hammer.
65								65.5	
								Advanced augers to refusal at 65.5 feet.	
70									
75									
80									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 4 OF 4

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	22						Asphalt pavement. 0.4	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	18		34					Moist gray to dark gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, dense to very dense, massive soil structure, (SW), (GW). 2.0	Asphalt pavement to 0.4 feet over sand and gravel fill with trace silt and slag to 2.0 feet over sandy soil fill with some gravel, trace to little silt, trace brick fragments, glass fragments, and slag to 4.0 feet over sandy soil fill with little gravel and silt, trace wood fiber and slag to 12.0 feet over coarse silty soil fill with little sand and gravel, trace clay to 14.0 feet over water sorted and deposited sand, trace to little silt, trace clay to 19.3 feet over water sorted and deposited sand with little gravel, trace to little silt to 28.0 feet over clayey lake sediment with trace sand and gravel to 38.0 feet over silty slack water sediment with trace sand to 43.0 feet over clayey lake sediment with trace sand to auger refusal.
				48					
	2	5							
	12		6			9			
				3					
					3				
	3	4						Moist dark gray to brownish gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, trace to little silt, trace brick fragments, glass fragments, and slag, loose to compact, massive soil structure, (SM). 4.0	
5	17		5			12			
				7					
					4				
	4	2							
	8		1			2			
				1					
					6			Moist, extremely moist below 10.0 feet, dark gray (SILTY-SAND) fill with 10 to 20% gravel, little silt, trace wood fiber and slag, compact, massive soil structure, (SM). 12.0	
	5	2							
	13		8			18			
				10					
10					4				
	6	2							
	18		2			7			
				5					
					4				
	7	5						Extremely moist gray to dark gray (SANDY-SILT) fill with 15 to 20% gravel, little sand, trace clay, loose, massive soil structure, (ML). 14.0	
	17		3			9			
				6					
					7				
	8	2							
15	7		1			2		Wet gray to dark gray (SILTY-SAND) with mostly fine size sand, trace to little silt, trace clay, very loose, thinly bedded, (SM).	
				1					
					1				
	9	1							
	18		2			4		grades downward to 19.3	
				2					
20					1			See next sheet	

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 16.0 feet and 5.0-foot interval sampling to auger refusal at 66.4 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	10	5				9		Wet dark gray to gray (SILTY-SAND) with 10 to 20% gravel, trace to little silt, very loose, stratified, (SM).	
	16		6						
				3					
25					3				
								grades downward to 28.0	
	11	8				7		Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL).	
	15		3						
				4					
30					3				
	12	2				4			
	16		2						
				2					
35					2				
								grades downward to 38.0	
	13	8				49		Wet gray (SILT) with trace sand, dense to very dense, thinly bedded, (ML).	
	16		23						
				26					
40					25				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Wet gray (SILT) with trace sand, dense to very dense, thinly bedded, (ML).	WH: Sampler penetration with weight of rods and hammer.
									WR: Sampler penetration with weight of rods.
								grades downward to 43.0	
	14	4						Extremely moist gray (SILTY-CLAY) with trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL).	
	12		3			6			
				3					
45					4				
	15	1							
	15		2			4			
				2					
50					2				
	16	WH							
	24		WH			<1			
				WH					
55					WH				
	17	WR							
	24		WH			<1			
				WH					
60					WH				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	18 / 24	WR	WR	WR	WH	<1		Extremely moist gray (SILTY-CLAY) with trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL). 66.4	WH: Sampler penetration with weight of rods and hammer. WR: Sampler penetration with weight of rods.
65								Advanced augers to refusal at 66.4 feet.	
70									
75									
80									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-7-20 SURF. ELEVATION 581 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	9						Asphalt pavement. 0.5	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	18		13					Moist gray to brownish gray gravelly (SAND) fill with 20 to 40% gravel, trace silt, slag, and glass fragments, compact to dense, massive soil structure, (SW).	Asphalt pavement to 0.5 feet over sandy soil fill with some gravel, trace silt, slag, and glass fragments to 6.4 feet over silty slack water sediment with trace to little clay, trace sand to 11.0 feet over clayey slack water sediment with trace sand and gravel to end of boring.
				13					
	2	12							
	16		17			28			
				11					
					10				
	3	11							
5	13		55			81			
				26					
					18			6.4	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
	4	16						Extremely moist gray (CLAYEY-SILT) with trace to little clay, trace sand, very soft to soft, thinly laminated with very thin coarse silt lenses, (ML-CL).	
	17		2			3			
				1					
					1				
	5	1							
	10		1			2			
				1					
10					1				
	6	1						grades downward to 11.0	No water at completion.
	17		1			2			WH: Sampler penetration with weight of rods and hammer.
				1				Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	
					1				
	7	WH							
	24		1/18			<2			
	8	WH							
15	24		1/12			<2			
								16.0	
					2			Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-8-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	17						Asphalt pavement. 0.3	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	14		29					Moist gray to light gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, trace to little silt, trace slag, compact to dense, massive soil structure, (SM). 4.5	Asphalt pavement to 0.3 feet over sandy soil fill with some gravel, trace to little silt, trace slag to 4.5 feet over silty slack water sediment with trace to little sand and clay to 14.2 feet over water sorted and deposited sand trace to little silt to 15.1 feet over water sorted and deposited sand with some gravel, trace silt to end of boring.
				30					
	2	18							
	17		20			42			
				22					
					24				
	3	2							
5	3		1			<2		Extremely moist to wet gray (SAND-SILT-CLAY) with 3 to 7% gravel, trace to little sand and clay, very soft, thinly laminated to thinly bedded, (ML-CL).	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
				1/12					
	4	1							
	13		1			2			
				1					
					1				
	5	WR							
	16		WR			<2			No water at completion.
				1/12					
10									
	6	1							
	20		1			2			WR: Sampler penetration with weight of rods.
				1					
					1				
	7	WR							
	20		WH			<1			WH: Sampler penetration with weight of rods and hammer.
				WH					
					WH			grades downward to 14.2	
	8	4						Wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, loose, thinly bedded, (SM).	
15	17		1			2			
				1					
					1			grades downward to 15.1	
								Wet gray gravelly (SAND) with 20 to 40% gravel, trace silt, very loose, stratified, (SW). 16.0	
								Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-9-20 SURF. ELEVATION 580 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Asphalt pavement. 0.4	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	1	8						Moist brownish gray to brown gravelly (SAND) fill with 20 to 40% gravel, trace silt and slag, compact, massive soil structure, (SW). 2.3	Asphalt pavement to 0.4 feet over sandy soil fill with some gravel, trace silt and slag to 2.3 feet over water sorted and deposited sand with trace to little silt to 4.5 feet over silty slack water sediment with little to some sand, trace clay to 6.6 feet over clayey slack water sediment with little clay, trace sand to end of boring.
	12		6						
				11					
	2	6							
	18		8			14			
				6					
					8				
	3	5						Moist brown to light brown (SILTY-SAND) with mostly fine size sand, trace to little silt, compact, thinly bedded, (SM). grades downward to 4.5	
5	15		4			7			
				3					
					2				
	4	1/18						Extremely moist to wet gray (SANDY-SILT) with little to some sand, trace clay, loose, thinly bedded, (ML). grades downward to 6.6	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
	20					<1			
					1				
	5	1/12							
	16					<2		Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	No water at completion.
				1/12					
10									
	6	1/12							WH: Sampler penetration with weight of rods and hammer.
	10					<2			
				1/12					
	7	WH							
	20		WH			<1			
				WH					
					WH			grades downward to 14.0	
	8	WH						Extremely moist to wet gray to dark gray (CLAYEY-SILT) with little clay, trace sand, thinly laminated with very thin coarse silt lenses, (ML-CL). 16.0	
15	22		WH			<1			
				WH					
					WH				
								Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

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13E96c HOLE NO. B-10-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	8							Coarse silty soil fill with little sand and gravel, trace slag and clay to 1.9 feet over water sorted and deposited sand, trace to little silt to 5.7 feet over clayey slack water sediment with trace sand to 7.1 feet over water sorted and deposited sand with trace to little silt, trace organic matter to 11.8 feet over sandy soil fill with little to some silt, trace gravel, paper fiber, brick fragments, and wood fiber to 14.1 feet over water sorted and deposited sand with trace to little silt to end of boring.
	16		9			26		Moist brown to grayish brown (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace slag and clay, compact, massive soil structure, (ML).	
				17					
					10				
	2	7						1.9	
	16		4			10		Moist gray (SILTY-SAND) with trace to little silt, compact, thinly bedded, (SM).	
				6					
					6				
	3	6							
5	12		7			13		grades downward to 5.7	
				6					
					6				
	4	2						Extremely moist gray (SILTY-CLAY) with trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL).	
	19		1			3			
				2				grades downward to 7.1	
					2				
	5	WH						Extremely moist to wet dark gray (SILTY-SAND) with trace to little silt, trace organic matter, firm, thinly bedded, (CL).	
	23		1			2			
				1					
10					1				
	6	WH							
	15		WH			<1			
				WH				11.8	
					WH				
	7	3						Moist to extremely moist brown (SILTY-SAND) fill with 3 to 7% gravel, little to some silt, trace paper fiber, brick fragments, and wood fiber, compact, massive soil structure, (ML). Slight petroliferous odor.	
	16		4			15			
				11					
					5				
	8	3							
15	20		2			4		14.1	
				2				Wet gray (SILTY-SAND) with trace to little silt, compact, thinly bedded, (SM).	
					2				
								16.0	
								Boring completed at 16.0 feet.	
20									

Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.

No water at completion.

WH: Sampler penetration with weight of rods and hammer.

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

April 12, 2021

DRAFT

PRELIMINARY

Bergmann
280 East Broad Street
Rochester, New York 14604

Attention: Ariadna Cheremeteff

Subject: Proposed Green Room Structure, Storage Room Structure, and Stage
Terminal B Redevelopment
901 Fuhrmann Boulevard
City of Buffalo, Erie County, New York

Readers:

This letter is supplemental to our report dated 10/28/20. It provides additional comments and recommendations regarding the proposed green room structure, storage room structure, and stage. It is applicable only to those features. All other comments and recommendations, in our report dated 10/28/20, remain applicable and unchanged. Information regarding the existing and proposed construction has been provided to us by Bergmann.

Understanding of Proposed Construction

The green room structure will be located entirely within the limits of the existing warehouse. It will be a light and settlement-tolerant structure. Wall loads will not exceed 2,500 pounds per foot, and there will be no column loads. The floor elevation will be the same as the floor elevation of the existing warehouse, which is approximately 583.

The storage room structure will be located partially within and partially beyond the limits of the existing warehouse. It will be a light and settlement-tolerant structure. Wall loads will not exceed 2,500 pounds per foot, and there will be no column loads. The floor elevation will be the same as the floor elevation of the existing warehouse, which is approximately 583. Grade increases as great as approximately 4 feet will be necessary, beyond the limits of the existing warehouse.

The stage will be located partially within and partially beyond the limits of the existing warehouse. The floor elevation will be the same as the floor elevation of the existing warehouse, which is approximately 583. Grade increases as great as approximately 4 feet will be necessary, beyond the limits of the existing warehouse. A low retaining wall is planned.

Understanding of Existing Loading Dock Wall

This letter is based heavily on our understanding that the existing loading dock wall is not supported by a deep foundation system, that it is supported by a conventional footing, and that the performance of this foundation system has been acceptable.

Nearest and Most Applicable Test Boring

It is understood that the nearest and most applicable test boring is B-5-20.

Footings for Green Room Structure, Storage Room Structure, and Low Retaining Wall

Conventional footings, as opposed to a deep foundation system, will be feasible. All of the following requirements should be satisfied:

- No existing concrete, pavement, loose or soft material, or visible organic matter should be left in place below a new footing. Any existing piles, within the outline of a new footing, should be cut off and removed at least 1 foot below the bottom of the new footing. Complete removal of the existing fill materials will not be practical. The subgrades should be thoroughly tamped using vibratory equipment.

- New footings should bear on the existing fill materials, or on compacted granular fill.

- Any granular fill below a new footing should be placed directly on the suitable existing fill materials. The granular fill should extend laterally beyond each edge of the footing, a distance at least as great as the vertical thickness of granular fill below the footing. The material and compaction requirements for granular fill are presented in our report dated 10/28/20.

- Continuous wall footings should be designed for a bearing pressure of 1,000 pounds per square foot or less, and should in no case be less than 24 inches wide.

- Any eccentrically loaded wall footings, such as may be required for the proposed retaining wall, should be designed for an edge pressure not exceeding 1,000 pounds per square foot. Suitable safety factors against overturning and sliding should be provided.

- New footings should be seated at least 4 feet below the lowest adjacent final surface exposed to freezing temperatures.

- The imaginary slope between the bottom edges of any two footings should be no steeper than 1 vertical on 2 horizontal.

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PRELIMINARY

- Any stepped wall footings should be stepped in vertical increments of 12 inches or less, and horizontal increments of 24 inches or more.

- New footings and foundation walls should consist of well reinforced concrete. This will provide additional stiffness to the foundation-wall system, and reduce the likelihood of abrupt differential settlements. The reinforcement should exceed code requirements. Horizontal reinforcement should be continuous.

New Floor Slabs on Grade

Conventional slab-on-grade floor construction will be feasible. All of the following requirements should be satisfied:

- No existing concrete pavement, asphaltic pavement, loose or soft material, or visible organic matter should be left in place below a new floor slab. (Existing floor slabs, if compatible with the planned construction, may be left in place.) Complete removal of the existing fill materials will not be practical. The subgrades should be thoroughly tamped using vibratory equipment.

- New floor slabs should bear on compacted granular fill. The granular fill should be placed directly on the suitable existing fill materials. The material and compaction requirements for granular fill are presented in our report dated 10/28/20.

- New floor slabs should be designed and constructed in accordance with ACI recommendations. It is also recommended that the design be based on a subgrade modulus (K) not exceeding 50 pounds per cubic inch.

Settlements

It is anticipated that settlements of the green room structure, storage room structure, and stage will be tolerable. The performance of the new foundations is likely to be similar to the performance of the existing loading dock wall.

It must be acknowledged that the new footings and floors will be underlain by random fill materials, weak and compressible natural soil, and varying amounts of organic matter. It will be necessary for the owner to accept the risk of some noticeable differential settlement, and to accept the fact that repairs may be necessary from time to time. It is likely that the assumption of this risk will be financially preferable to a deep foundation system.

Settlements beyond the limits of the existing warehouse are likely to be greater than those within the limits of the existing warehouse. This is because of the planned grade increases, and the fact that the weight of new fill will greatly exceed the weights of the planned structures. At depth, the stresses created by the grade increases will exceed those created by the new footings.

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PRELIMINARY

* * *

If you have questions or comments regarding this letter, please contact the undersigned.

Yours truly,

RAVI ENGINEERING & LAND SURVEYING, P.C.

Nagappa Ravindra, P.E.
President

Ray M. Teeter, P.E.
Geotechnical Engineer

DRAFT

PRELIMINARY

LIMITED PHASE II ENVIRONMENTAL SITE ASSESSMENT

BUFFALO OUTER HARBOR - TERMINAL B
901 Fuhrman Boulevard
City of Buffalo, Erie County, New York

PIN 40-20-118

PREPARED FOR:

Bergmann
280 East Broad Street, Suite 200,
Rochester, New York 14604

PREPARED BY:

RAVI ENGINEERING & LAND SURVEYING, P.C.

Ravi Engineering & Land Surveying, P.C.
2110 South Clinton Avenue
Suite 1
Rochester, New York 14618

October 29, 2020

DRAFT

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FIGURES

Figure 1 Trowbridge Wolf Site Plan
Figure 2 Test Boring Location Plan
Figure 3 Sample Location Map
Figure 4 BE3 Corp. Gamma Walkover Survey

ATTACHMENTS

Attachment A: Earth Dimension Boring Logs
Attachment B: BE3 Corp. Gamma Walkover Survey Report
Attachment C: PID Reading Summary
Attachment D: Analytical Results

1.0 INTRODUCTION

Ravi Engineering & Land Surveying, P.C. (RE&LS) was retained by Bergmann to perform a Limited Phase II Environmental Site Assessment (ESA) for the Buffalo Outer Harbor – Terminal B project in the City of Buffalo, Erie County, New York (the "Site," Figure 1). The investigation was conducted concurrently with a Geotechnical Investigation performed by Earth Dimensions Environmental Consultants and Contractors (Earth Dimensions).

The RE&LS investigation included:

- Monitoring Earth Dimensions soil borings,
- Collecting soil samples for laboratory analysis, and
- Conducting a radiological survey.

Based on the intended use of the Site for active recreational use, soil samples results were compared to New York State Department of Environmental Conservation (NYSDEC) Part 375.6 Restricted Residential Soil Cleanup Objectives (SCOs).

2.0 NOVEMBER 2017 GEOTECHNICAL REVIEW

To familiarize ourselves with Site conditions, RE&LS first reviewed the Encorus Group (Encorus) November 2017 Geotechnical Investigation of the Site. Encorus installed two soil borings and described the following subsurface conditions:

- Bedrock was encountered at 71.5 feet beneath ground surface (BGS).
- The borings encountered random fill materials to depths of approximately 18 feet BGS.
- The fill materials included slag, ash, concrete debris, and brick fragments.
- Native soils were described as sand with a traces of silt and organic matter.

3.0 DISCUSSION

As indicated on Figure 2, Earth Dimensions conducted the geotechnical investigation from 8/27 to 9/01/2020 using rotary drilling equipment.

Based on the fill materials described by Encorus in 2017, RE&LS screened the borings for organic vapors with a photoionization detector (PID) meter. As indicated on Figure 3, RE&LS collected eight soil samples and submitted them to Paradigm Environmental Services, Inc. (Paradigm) for laboratory analysis for:

- Volatile organic compounds (VOCs) by USEPA Method 8260,
- Semivolatile organic compounds (SVOCs) by Method 8270,
- RCRA metals by Method 6010/7471, and
- Polychlorinated biphenyls (PCBs) by Method 8082.

3.1 Radiological Survey

Encorus indicated that there is slag present on the Site. Historically, technically-enhanced naturally-occurring radioactive material (TENORM) in the form of rocky slag waste was generated in large quantities in western New York. Radioactive TENORM is of potential concern on the Site.

RE&LS retained BE3 Corporation to conduct a radiological survey with a gamma system to determine if the buried slag has gamma readings indicative of radioactive levels of concern (Figure 4, Attachment B).

4.0 RESULTS

4.1 Soil Investigation

Earth Dimensions installed ten (10) soil borings as indicated on Figure 2; soils encountered during the investigation consisted of the following:

- SB-1: fill consisting of gravel, silt, **slag**, and concrete debris to a depth of 21 feet BGS, native sand and clayey silt to a total depth of 27 feet BGS.
- SB-2: fill consisting of gravel, sand, **slag**, and concrete debris to a depth of 21 feet BGS, native sand and clayey silt to a total depth of 22 feet BGS.
- SB-3: fill consisting of gravel, silt, and **slag** to a total depth of 9.1 feet BGS.
- SB-4: fill consisting of gravel, silt, and **slag** to a depth of 6 feet BGS, native silty sand to a total depth of 16 feet BGS.
- SB-5: fill consisting of gravel, silt, and **slag** to a depth of 6 feet BGS, native silty sand to a total depth of 16 feet BGS, native silty sand and silty clay to **bedrock refusal at 65.5 feet BGS**.
- SB-6: fill consisting of gravel, brick and glass fragments, wood fiber, and **slag** to a total depth of 14 feet BGS, native silty sand and silty clay to **bedrock refusal at 66.4 feet BGS**.
- SB-7: fill consisting of gravel, silt, **slag,** and glass fragments to a depth of 6.4 feet BGS, native silty clay to a total depth of 16 feet BGS.
- SB-8: fill consisting of gravel, silt, and **slag** to a depth of 4.5 feet BGS, silty sand and clay to a total depth of 16 feet BGS.
- SB-9: fill consisting of gravel, silt, and **slag** to a depth of 2.3 feet BGS, native silty sand and silty clay to a total depth of 16 feet BGS.
- SB-10: fill consisting of gravel, silt, paper fiber, brick fragments, and wood fiber to a depth of 14.1 feet BGS, silty sand to a total depth of 16 feet BGS.

4.2 Soil Results

With the exception of SB10, no significant evidence of impacted soils or elevated levels of organic vapors were noted. In SB10 from 12 to 14 feet BGS, 400 parts per million (ppm) of organic vapors were measured, and 185 ppm of organic vapors registered in SB10 from 14 to 16 feet BGS (Attachment C).

RE&LS collected eight soil samples for laboratory analysis; the results are tabulated below with comparisons to the Restricted Residential SCOs. The Earth Dimensions soil boring (SB) number is indicated along with the depth from which the sample was collected:

Table 1: VOCs

Sample ID	SB1, 6-12'	SB4, 6-8.5'	SB5, 6-9'	SB6, 5-8'	SB7, 4-6'	SB8, 6-8'	SB9, 3-5'	SB10, 10-14'	Restricted-Residential Use SCOs
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	**340**	41
Isopropylbenzene	ND	ND	ND	0.115	ND	ND	ND	50	100
m,p-Xylene	ND	ND	ND	ND	ND	ND	ND	**1,050**	100
Methylcyclohexane	ND	ND	ND	0.200	ND	ND	ND	**190**	100
o-Xylene	ND	ND	ND	ND	ND	ND	ND	**345**	100
Toluene	ND	ND	ND	ND	ND	ND	ND	**140**	100

Units are in milligrams per Kilogram (mg/Kg) or parts per million (ppm).
Bolded values indicate an exceedance of the Restricted-Residential Use SCOs
ND = Non-detect

Table 2: SVOCs

Sample ID	B1, 6-12'	SB4, 6-8.5'	SB5, 6-9'	SB6, 5-8'	SB7, 4-6'	SB8, 6-8'	SB9, 3-5'	SB10, 10-14'	Restricted-Residential Use SCOs
2-Methylnapthalene	ND	ND	ND	0.553	ND	ND	ND	10.3	---
Benzo(a)anthracene	ND	ND	ND	0.751	ND	ND	ND	ND	1
Benzo(a)pyrene	ND	ND	ND	0.733	ND	ND	ND	ND	1
Benzo(b)fluoranthene	ND	ND	ND	0.612	ND	ND	ND	ND	1
Benzo(g,h,i)perylene	ND	ND	ND	0.489	ND	ND	ND	ND	100
Benzo(k)fluoranthene	ND	ND	ND	0.559	ND	ND	ND	ND	3.9
Chrysene	ND	ND	ND	0.765	ND	ND	ND	ND	3.9
Fluoranthene	ND	ND	ND	1.450	ND	0.460	0.351	ND	100
Indeno(1,2,3-cd)pyrene	ND	ND	ND	0.466	ND	ND	ND	ND	0.5
Naphthalene	ND	ND	ND	1.080	ND	ND	ND	52.5	100
Phenanthrene	ND	ND	ND	1.100	ND	ND	ND	ND	100
Pyrene	ND	ND	ND	1.350	ND	0.408	ND	ND	100

Units are in milligrams per Kilogram (mg/Kg) or parts per million (ppm).
Bolded values indicate an exceedance of the Restricted-Residential Use SCOs
ND = Non-detect
--- = No SCO

Table 3: Metals

Sample ID	B1, 6-12'	SB4, 6-8.5'	SB5, 6-9'	SB6, 5-8'	SB7, 4-6'	SB8, 6-8'	SB9, 3-5'	SB10, 10-14'	Restricted-Residential Use SCOs
Arsenic	1.81	1.41	4.45	9.57	2.83	4.52	3.27	**35.9**	16
Barium	303	10.7	54.0	244	198	60.0	22.7	**3,700**	400
Cadmium	ND	0.350	0.842	**6.09**	0.311	ND	ND	**81.8**	4.3
Chromium	10.9	6.01	17.9	25.7	13.7	19.3	12.0	77.4	180
Lead	21.5	9.13	20.8	281	14.3	20.7	14.6	**7,740**	400
Selenium	ND	ND	ND	ND	ND	ND	ND	21.9	180

Units are in milligrams per Kilogram (mg/Kg) or parts per million (ppm).
Bolded values indicate an exceedance of the Restricted-Residential Use SCOs or Protection of Ecological Resources SCOs.
ND = Non-detect
SCOs = Soil Cleanup Objectives

Table 4: Mercury

Sample ID	B1, 6-12'	SB4, 6-8.5'	SB5, 6-9'	SB6, 5-8'	SB7, 4-6'	SB8, 6-8'	SB9, 3-5'	SB10, 10-14'	Restricted-Residential Use SCOs
Mercury	ND	ND	0.0900	0.191	ND	0.235	0.0890	0.356	0.81

Units are in milligrams per Kilogram (mg/Kg) or parts per million (ppm).
Bolded values indicate an exceedance of the Restricted-Residential Use SCOs or Protection of Ecological Resources SCOs.
ND = Non-detect
SCOs = Soil Cleanup Objectives

Table 5: Pesticides

Sample ID	SB10, 10-14'	Restricted-Residential Use SCOs
Aldrin	0.00785	0.097
alpha-BHC	0.00500	0.48
delta-BHC	0.00367	100
gamma-BHC (Lindane)	0.0336	1.3
Heptachlor	0.0145	2.1

Units are in milligrams per Kilogram (mg/Kg) or parts per million (ppm).
SCOs = Soil Cleanup Objectives

4.3 Hazardous Characteristics

Because of the elevated PID readings measured in SB10 at depths of 10-14 feet BGS this sample was also submitted for hazardous characterization which is required for landfill approval.

- No PCBs were detected in soil sample SB10, 10-14'.
- No detected herbicides, reactive cyanide, or reactive sulfide in soil sample SB10, 10-14'.
- Corrosivity (as pH) = 7.26 @ 23.5 degrees Celsius for soil sample SB10, 10-14'.
- Flash Point = 46.5 degrees Celsius for soil sample SB10, 10-14'.

5.0 RADIOLOGICAL SURVEY

BE3 conducted the gamma walkover and boring surveys with a gamma scintillation system linked to a global positioning system (GPS). The Site was traversed and discreet boring locations were scanned to collect gamma radiation readings that were located with a Trimble hand-held GPS. The gamma radiation was recorded using a Ludlum model 44-10 probe coupled to a Ludlum model 2221 meter that stored values in counts per minute (cpm). The gamma readings and GPS coordinates were uploaded to a computer using mapping software and plotted on a color coordinated figure to illustrate the gamma radiation readings and trends throughout the site.

5.1 Survey Results

As indicated on Figure 4, an area in the vicinity of SB10 exhibits elevated gamma radiation readings, most likely due to the presence of slag and slag-like material. While the majority of the Site is at background gamma radiation levels or less (i.e., 7,400 cpm), this area exhibited elevated gamma readings up to approximately 17,700 cpm in close proximity to SB10.

6.0 SUMMARY

Soil samples from seven of the eight borings appear to be innocuous, with only one minor exceedance of 6.09 ppm of cadmium in SB6 at depths ranging from 5 feet to 8 feet BGS; the Restricted-Residential Use SCO for cadmium is 4.3 ppm.

The soil sample from SB10 from depths ranging from 10 feet to 14 feet BGS is grossly contaminated.

Petroleum compounds ethylbenzene, mixed Xylenes, and toluene were all detected at concentrations greater than the NYSDEC Restricted Residential Use Soil Cleanup Objective (SCO). The site owner is obligated to report this finding to the NYSDEC.

Several metals were detected in exceedance of the SCO. The most problematic may be 7,740 parts per million (ppm) of lead; the SCO for lead is 400 ppm. This high of a concentration of lead may classify the waste as "hazardous." A toxicity characteristic leaching procedure (TCLP) analysis will be required to determine whether the soil is "hazardous waste."

As indicated on Figure 4, an area in the vicinity of SB10 exhibits elevated gamma radiation readings.

7.0 OPINION

- A spill must be reported to NYSDEC relative to the contamination detected in BH10.
- The spill must be delineated to define the aerial and vertical extent of contamination.
- The delineation should include TCLP analysis of the soil to determine the hazardous classification.
- The delineation should include sampling and laboratory analysis of the slag that exhibits elevated gamma readings. The slag analysis will be used to determine disposal requirements.
- A draft Remedial Action Plan (RAP) must be submitted for NYSDEC approval to address the contamination around SB10.
- The spill will require remediation to the extent that NYSDEC closes it with "no further action required."

8.0 RECOMMENDATIONS

1. The Site owner (or owner's representative) should report these findings to NYSDEC.
2. A Work Plan should be developed for NYSDEC approval to delineate the aerial and vertical extent of the spill that will require remediation.
3. Based on the delineation a draft Remedial Action Plan (RAP) must be developed to remediate the spill and obtain NYSDEC closure with "no further action required."
4. For future subsurface disturbance during construction, the activities should be monitored with a radiation control technician (RCT) to maximize safety and waste management. Furthermore, if excess material is anticipated to be removed from the subsurface, then the RCT would allow for requisite sampling and analysis of the material to ensure proper disposal.

Sincerely,

Peter S. Morton, P.G., C.P.G.
Project Manager

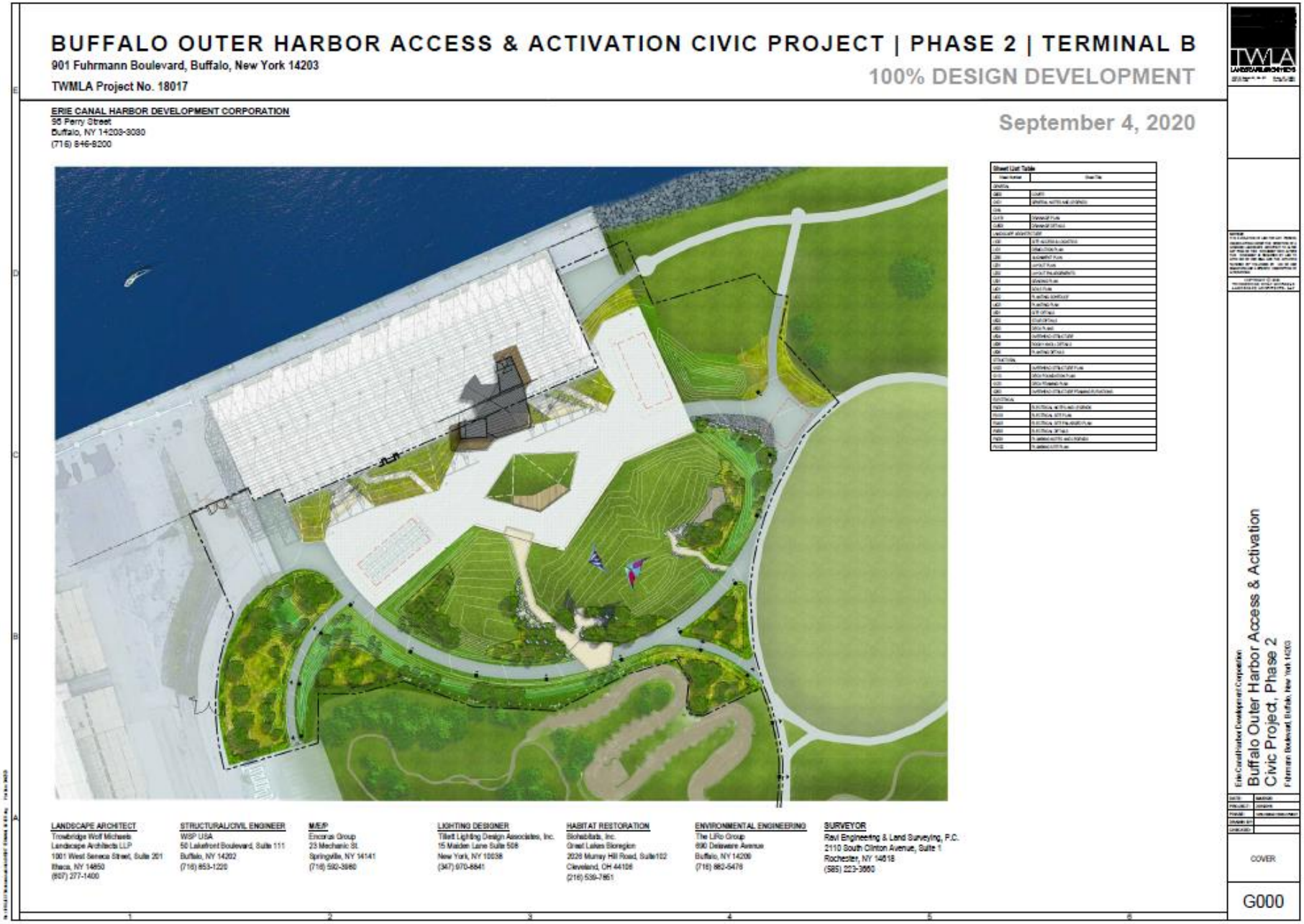

Figure 1 - Site Plan

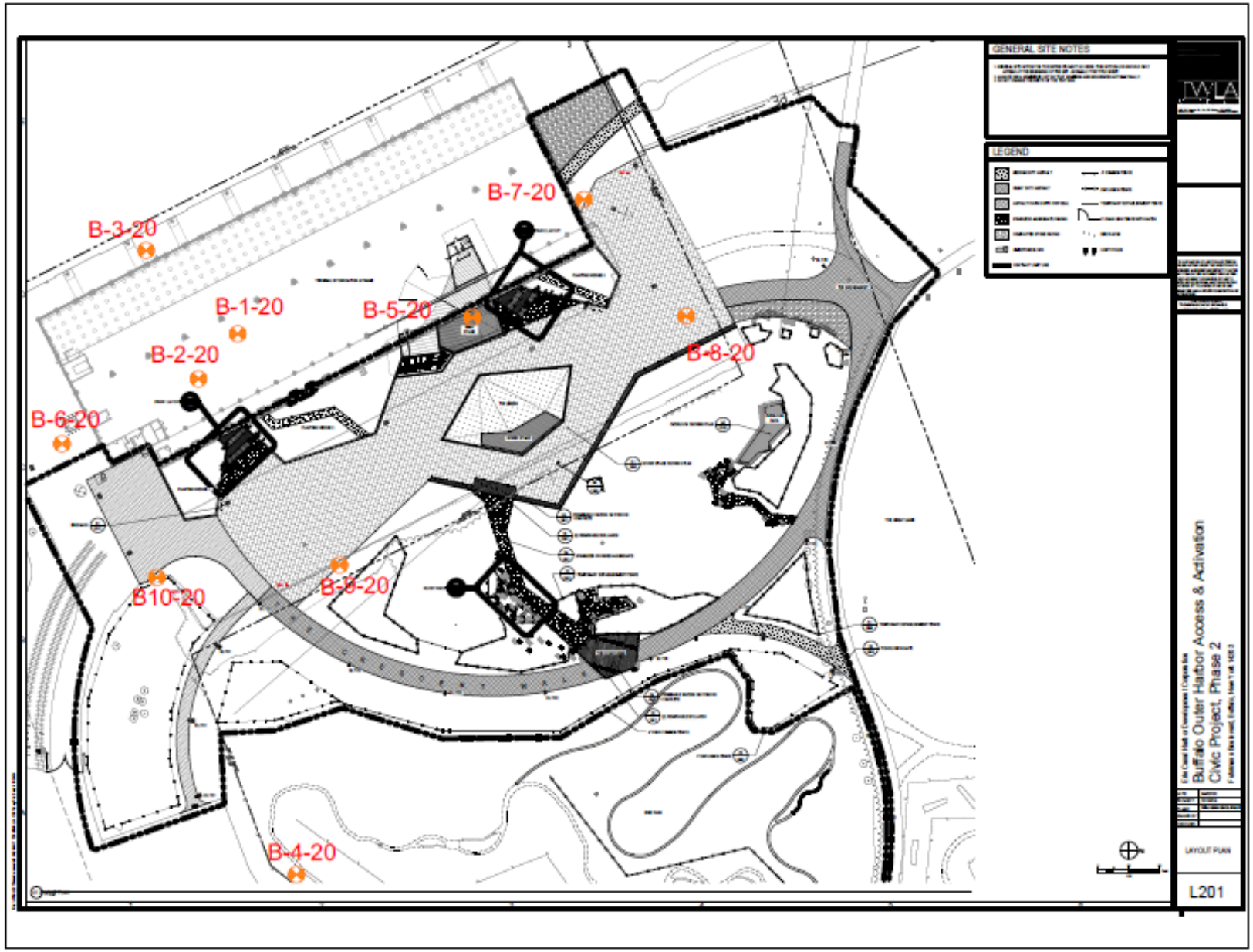

Figure 2 – Geotechnical Boring Locations

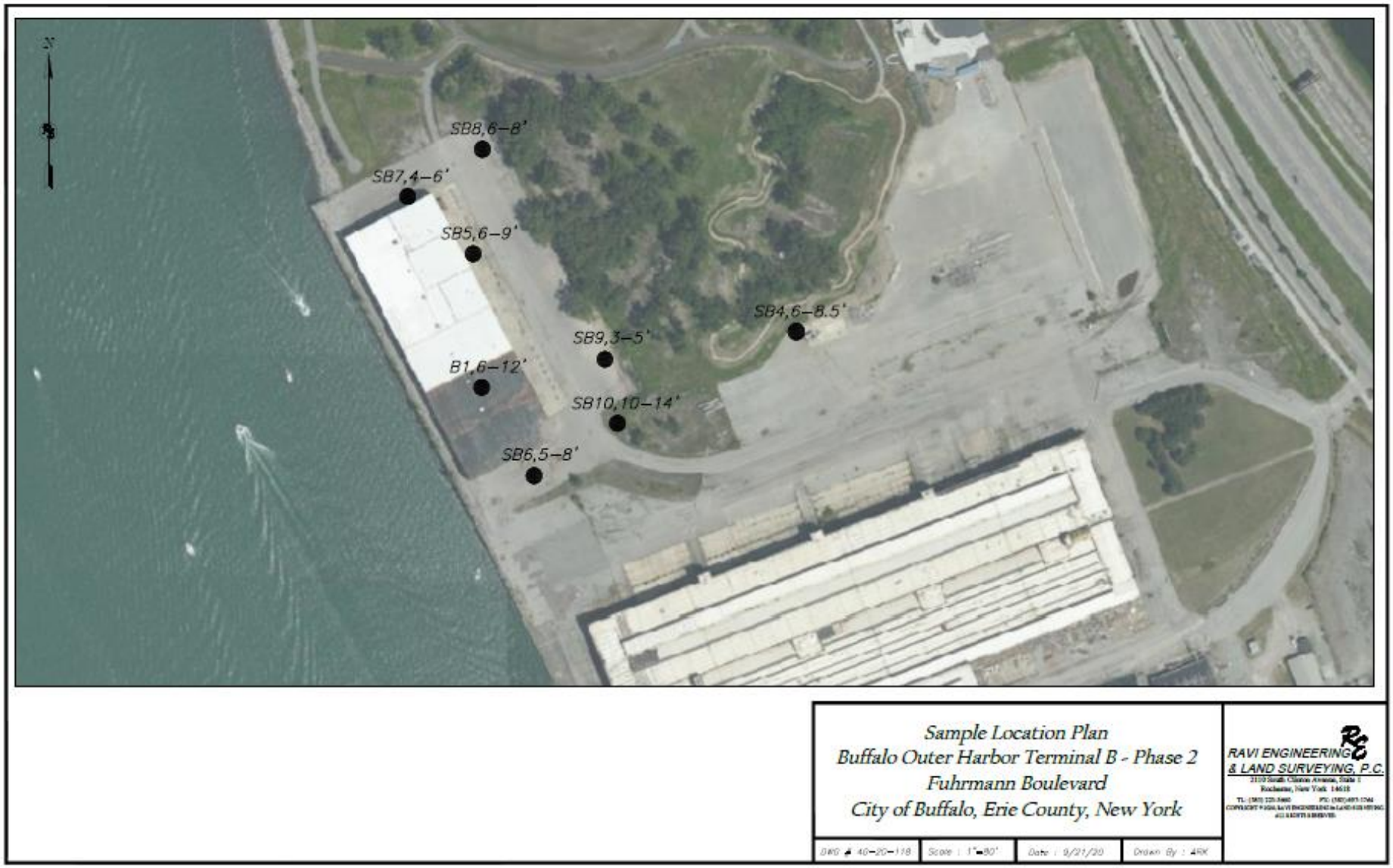

Figure 3 – Sample Location Map

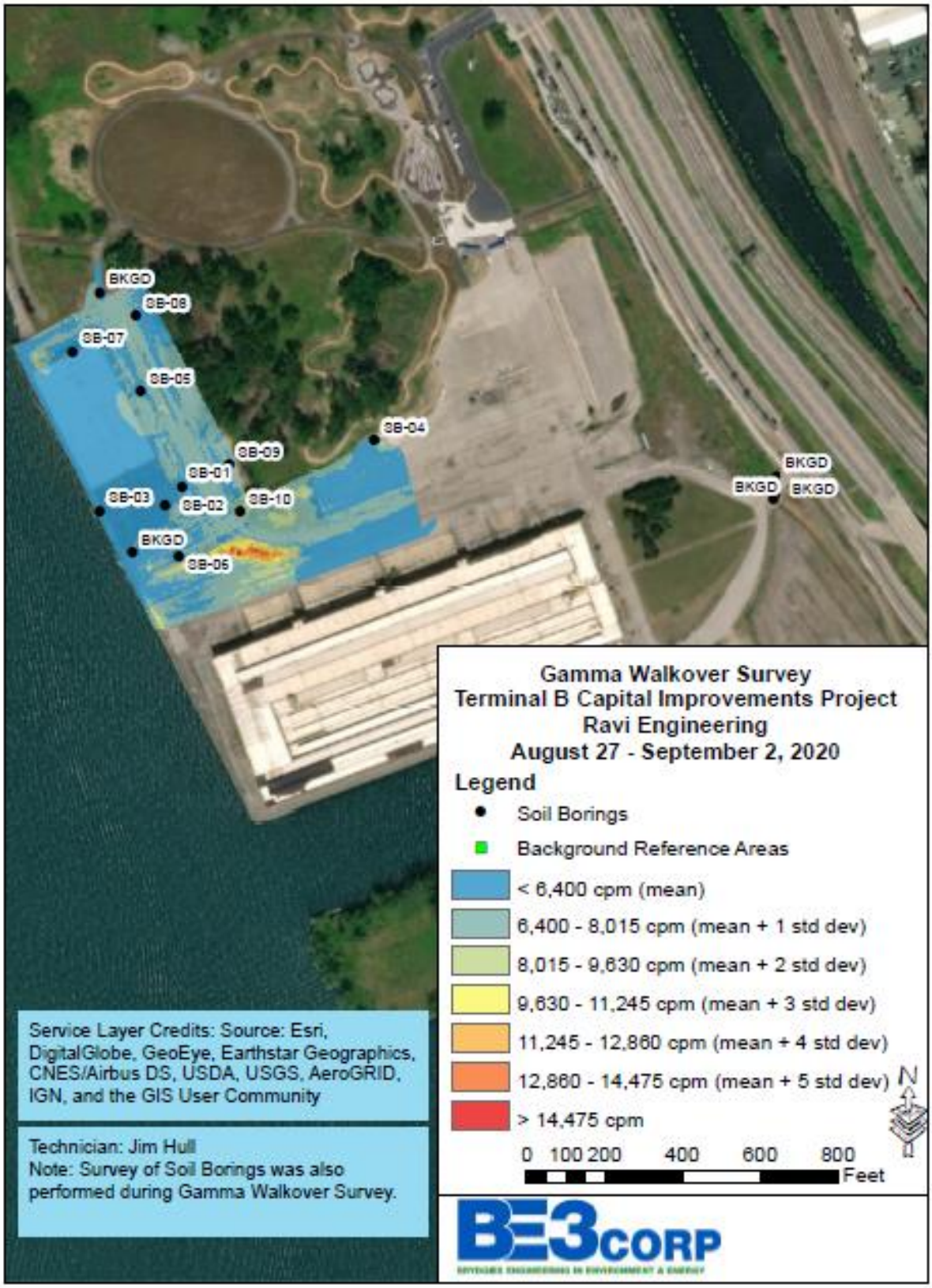

Figure 4 – Radiological Survey

Attachment A

Earth Dimension Boring Logs

EARTH DIMENSIONS, INC.
Soil and Hydrogeologic Investigations • Wetland Delineations
1091 Jamison Road • Elma, NY 14059
(716) 655-1717 • EDI@earthdimensions.com

13E96c HOLE NO. B-1-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	27						Reinforced steel mesh concrete. 0.5	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	16		28					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, very dense, massive soil structure, (SW), (GW). 1.0	Steel mesh reinforced concrete floor to 0.5 feet over sand and gravel fill with trace silt to 1.0 feet over sand and gravel fill with trace silt, slag, and concrete debris to 16.0 feet over sand and gravel fill with trace silt, concrete debris, and slag to 21.0 feet over silty slack water sediment with little clay, trace sand, gravel, and organic matter to end of boring.
				20					
	2	14							
	20		32			66			
				34					
					30				
	3	16						Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, slag, and concrete debris, dense to very dense, massive soil structure, (SW), (GW).	
5	21		23			56			
				33					
					36				
	4	16							
	16		22			46			
				24					
					50/3				
	5	12							
	13		18			40			
				22					
10					26				
	6	18						11.0	
	17		43			62		Extremely moist to wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, slag, and concrete debris, dense to very dense, massive soil structure, (SW), (GW).	Water level at 11.2 feet below ground surface at completion.
				19					
					29				
	7	16							Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 24.0 feet and 5.0-foot interval sampling to end of boring at 27.0 feet. Bore hole was backfilled with cuttings and ground surface repaired with concrete at completion.
	17		23			50			
				27					
					26				
	8	14							
15	12		15			34			
				19					
					18			16.0	
	9	4						Wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, concrete debris, and slag, loose to compact, massive soil structure, (SW), (GW).	
	10		5			10			
				5					
					3				
	10	4							
	4		4			14			
				10					
20					10				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 2

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13E96c HOLE NO. B-1-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	11	4						Wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, concrete debris, and slag, loose to compact, massive soil structure, (SW), (GW).	
	1		1			2			
				1					
					1				
	12	3						21.0	
	13		2			3		Extremely moist gray (CLAYEY-SILT) with 3 to 7% gravel, trace sand and organic matter, little clay, very soft to soft, thinly laminated with very thin coarse silt lenses, (ML-CL).	
				1					
					2				
25	13	1							
	16		2			3			
				1					
					1			27.0	
								Boring completed at 27.0 feet.	
30									
35									
40									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-2-20 SURF. ELEVATION 583 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	26						Reinforced steel mesh concrete. 0.5	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	2	10	47	42		57		Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt, concrete debris, and slag, dense to very dense, massive soil structure, (SW), (GW). 2.0	Steel mesh reinforced concrete to 0.5 feet over sand and gravel fill with trace silt, concrete debris, and slag to 2.0 feet over coarse silty soil fill with little sand and gravel, trace slag to 4.5 feet over clayey soil fill with trace sand to 5.3 feet over coarse silty soil fill with little sand and gravel, trace clay, brick fragments, concrete debris, and glass fragments to 12.0 feet over sandy soil fill with some gravel, little silt, trace slag, brick fragments, and wood fiber to 22.0 feet over water sorted and
5	3	2	24	30	28	4		Moist dark gray (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace slag, very dense, massive soil structure, (ML). 4.5	
	4	20	23	27	3	17		Extremely moist brown to grayish brown (SILTY-CLAY) fill with trace sand, soft, massive soil structure, (CL). 5.3	Water level at 8.9 feet below ground surface at completion.
10	5	4	2	8	4	24		Moist to extremely moist dark gray (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace clay, concrete debris, and brick and glass fragments, loose to compact, massive soil structure, (ML). 12.0	deposited sand with little silt to 25.0 feet over coarse silty slack water sediment with little sand, trace clay and organic matter to end of boring.
15	6	24	12	17	14	30		Wet dark gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, little silt, trace slag, brick fragments, and wood fiber, compact, massive soil structure, (ML).	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to 24.0 feet and 5.0-foot interval sampling to end of boring at 27.0 feet. Bore hole was backfilled with cuttings and ground surface repaired with concrete at completion.
20	7	9	5	10	13	7			
	8	15	4	9	3	17			
	9	8	4	6	8	14			
	10	15	10	10	9	19			
		8			5				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 2

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City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/28/20 COMPLETED 08/28/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	11	9							
	4		7			14		Wet dark gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, little silt, trace slag, brick fragments, and wood fiber, compact, massive soil structure, (ML).	WH: Sampler penetration with weight of rods and hammer.
				7					
					4				
	12	WH							
	14		2			4		22.0	
				2				Wet gray (SILTY-SAND) with mostly fine size sand, little silt, very loose, thinly bedded, (SM).	
					2				
25								grades downward to 25.0	
	13	1						Extremely moist dark gray (SANDY-SILT) with 3 to 7% gravel, little sand, trace clay and organic matter, very loose, (ML).	
	22		1			4			
				3					
					3				
								27.0	
								Boring completed at 27.0 feet.	
30									
35									
40									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 2 OF 2

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13E96c HOLE NO. B-3-20 SURF. ELEVATION 584 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	33						Asphalt pavement. 0.4	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	12		32					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, dense to very dense, massive soil structure, (SW), (GW).	Asphalt pavement to 0.4 feet over sand and gravel fill with trace silt and slag to spoon refusal.
				24					
	2	18							
	18		27			58			
				31					
					61				
	3	14							Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to spoon refusal at 9.1 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
5	17		14			30			
				16					
					26				
	4	28							
	19		37			57			No water at completion.
				20					
					33				
	5	18							
	10		52					9.1	
				50/1				Boring completed at 9.1 feet.	
10									
15									
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

EARTH DIMENSIONS, INC.

Soil and Hydrogeologic Investigations • Wetland Delineations

1091 Jamison Road • Elma, NY 14059

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13E96c HOLE NO. B-4-20 SURF. ELEVATION 586 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	49						Asphalt pavement. 0.3	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	16		20					Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, dense to very dense, massive soil structure, (SW), (GW). 2.0	Asphalt pavement to 0.3 feet over sand and gravel fill with trace silt and slag to 2.0 feet over sandy soil fill with some gravel, trace to little silt, trace slag and wood fiber to 6.0 feet over water sorted and deposited sand with trace to little silt to 10.7 feet over coarse silty slack water sediment with little sand, trace to little gravel, trace clay and wood fiber to end of boring.
				22					
	2	6							
	20		5			12			
				7					
					9				
	3	3						Moist gray to grayish brown gravelly (SILTY-SAND) fill with 20 to 40% gravel, trace to little silt, trace slag, wood fiber, and glass fragments, compact, massive soil structure, (SM). 6.0	
5	13		1			7			
				6					
					4				
	4	6							
	18		3			9		Extremely moist to wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, loose, thinly bedded, (SM). 8.0	
				6					
					8				
	5	6							
	17		8			15			
				7					
10					4			Wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, compact, thinly bedded, (SM). 10.7	
	6	1							
	12		1			2			
				1					
					1			Wet gray (SANDY-SILT) with 5 to 15% gravel, little sand, trace clay and wood fiber, very loose, thinly bedded, (ML).	▼ Water level at 12.2 feet below ground surface at completion.
	7	1							
	5		1			6			
				5					
					3				
	8	1							
15	6		2			4			
				2					
					5			16.0	
								Boring completed at 16.0 feet.	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Concrete. 0.7	Note: Sample number 1 taken from 0.7 to 2.0 feet.
	1	16							
	10		39						
				50/3				Moist gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, very dense, massive soil structure, (SW), (GW). 4.0	Concrete to 0.7 feet over sand and gravel fill with trace silt and slag to 4.0 feet over sand and gravel fill with trace slag to 6.0 feet over water sorted and deposited sand with trace to little silt to 9.6 feet over silty slack water sediment with little to some clay, trace sand to 12.0 feet over clayey slack water sediment with trace sand and gravel to 15.3 feet over silty slack water sediment with little clay, trace sand and organic matter to 18.0 feet over clayey slack water sediment with trace sand to 19.5 feet over water sorted and deposited sand with trace to little silt to 23.0 feet over water sorted and deposited sand with trace to little silt to 28.0 feet over clayey lake sediment with trace sand and gravel to 38.0 feet over water sorted and deposited sand with trace to little silt, trace clay to 43.0 feet over clayey lake sediment with trace sand and gravel to auger refusal.
	2	22							
	19		21			34			
				13					
					15				
	3	9						Wet gray very gravelly (SAND) fill with 40 to 60% gravel, trace slag, compact, massive soil structure, (SW), (GW). 6.0	
5	11		7			14			
				7					
					9				
	4	8						Extremely moist to wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, compact, thinly bedded, (SM). 9.6	
	12		5			10			
				5					
					5				
	5	4							
	16		6			10			
				4					
10					4				
	6	2						Extremely moist gray (CLAYEY-SILT) with little to some clay, trace sand, firm, thinly laminated with very thin coarse silt lenses, (ML-CL). grades downward to 12.0	
	16		1			2			
				1					
					1				
	7	1/12						Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL). grades downward to 15.3	
	12					<2			
				1					
					1				
	8	1/12							
	19					<2			
15				1/12					
								Extremely moist dark gray to gray (CLAYEY-SILT) with little clay, trace sand and organic matter, thinly laminated with very thin coarse silt lenses, (ML-CL). grades downward to 18.0	
	9	1/12						Extremely moist gray (SILTY-CLAY) with trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	No water at completion.
	24					<2			
				1					
20					3				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Extremely moist gray (SILTY-CLAY) with trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL). 19.5	WR: Sampler penetration with weight of rods.
	10	WR						Extremely moist to wet gray (SILTY-SAND) with trace to little silt, loose, stratified, (SM).	
	24		WR			<1		grades downward to 23.0	
				WR					
25					2			Wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, very loose, thinly bedded, (SM).	
								grades downward to 28.0	
	11	4						Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, soft to firm, thinly laminated with very thin coarse silt lenses, (CL).	
	22		3			7			
				4					
30					4				
	12	2							
	20		2			3			
				1					
35					1				
								grades downward to 38.0	
	13	5						Wet gray (SILTY-SAND) with trace to little silt, trace clay , compact, thinly bedded, (SM).	
	14		6			13			
				7					
40					7				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Wet gray (SILTY-SAND) with trace to little silt, trace clay, compact, thinly bedded, (SM).	
								grades downward to 43.0	
	14	2						Extremely moist gray (SILTY-CLAY) with 5 to 7% gravel, trace sand, soft to firm, very soft below 53.0 feet, thinly laminated with very thin coarse silt lenses, (CL).	
	22		2			7			
				5					
45					5				
	15	1							
	20		2			3			
				1					
50					2				
	16	1/12							
	24					<2			
				1/12					
55									
	17	1							
	24		1			2			
				1					
60					1				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-5-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/31/20 COMPLETED 08/31/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	18 / 24	WH	WH	WH	WH	<1		Extremely moist gray (SILTY-CLAY) with 5 to 7% gravel, trace sand, soft to firm, very soft below 53.0 feet, thinly laminated with very thin coarse silt lenses, (CL). 65.5	WH: Sampler penetration with weight of rods and hammer.
65								Advanced augers to refusal at 65.5 feet.	
70									
75									
80									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 4 OF 4

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	22						Asphalt pavement. 0.4	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	18		34					Moist gray to dark gray very gravelly (SAND) fill with 40 to 60% gravel, trace silt and slag, dense to very dense, massive soil structure, (SW), (GW). 2.0	Asphalt pavement to 0.4 feet over sand and gravel fill with trace silt and slag to 2.0 feet over sandy soil fill with some gravel, trace to little silt, trace brick fragments, glass fragments, and slag to 4.0 feet over sandy soil fill with little gravel and silt, trace wood fiber and slag to 12.0 feet over coarse silty soil fill with little sand and gravel, trace clay to 14.0 feet over water sorted and deposited sand, trace to little silt, trace clay to 19.3 feet over water sorted and deposited sand with little gravel, trace to little silt to 28.0 feet over clayey lake sediment with trace sand and gravel to 38.0 feet over silty slack water sediment with trace sand to 43.0 feet over clayey lake sediment with trace sand to auger refusal.
				48					
	2	5							
	12		6			9			
				3					
					3				
	3	4						Moist dark gray to brownish gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, trace to little silt, trace brick fragments, glass fragments, and slag, loose to compact, massive soil structure, (SM). 4.0	
5	17		5			12			
				7					
					4				
	4	2							
	8		1			2			
				1					
					6			Moist, extremely moist below 10.0 feet, dark gray (SILTY-SAND) fill with 10 to 20% gravel, little silt, trace wood fiber and slag, compact, massive soil structure, (SM). 12.0	
	5	2							
	13		8			18			
				10					
10					4				
	6	2							
	18		2			7			
				5					
					4				
	7	5						Extremely moist gray to dark gray (SANDY-SILT) fill with 15 to 20% gravel, little sand, trace clay, loose, massive soil structure, (ML). 14.0	
	17		3			9			
				6					
					7				
	8	2							
15	7		1			2		Wet gray to dark gray (SILTY-SAND) with mostly fine size sand, trace to little silt, trace clay, very loose, thinly bedded, (SM).	
				1					
					1				
	9	1							
	18		2			4		grades downward to 19.3	
				2					
20					1			See next sheet	

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	10	5						Wet dark gray to gray (SILTY-SAND) with 10 to 20% gravel, trace to little silt, very loose, stratified, (SM).	
	16		6			9			
				3					
25					3				
								grades downward to 28.0	
	11	8						Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL).	
	15		3			7			
				4					
30					3				
	12	2							
	16		2			4			
				2					
35					2				
								grades downward to 38.0	
	13	8						Wet gray (SILT) with trace sand, dense to very dense, thinly bedded, (ML).	
	16		23			49			
				26					
40					25				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
								Wet gray (SILT) with trace sand, dense to very dense, thinly bedded, (ML).	WH: Sampler penetration with weight of rods and hammer. WR: Sampler penetration with weight of rods.
								grades downward to 43.0	
	14	4						Extremely moist gray (SILTY-CLAY) with trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL).	
	12		3			6			
				3					
45					4				
	15	1							
	15		2			4			
				2					
50					2				
	16	WH							
	24		WH			<1			
				WH					
55					WH				
	17	WR							
	24		WH			<1			
				WH					
60					WH				

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-6-20 SURF. ELEVATION 582 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 09/01/20 COMPLETED 09/01/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	18 / 24	WR	WR	WR	WH	<1		Extremely moist gray (SILTY-CLAY) with trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL). 66.4	WH: Sampler penetration with weight of rods and hammer. WR: Sampler penetration with weight of rods.
								Advanced augers to refusal at 66.4 feet.	
65									
70									
75									
80									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns)

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13E96c HOLE NO. B-7-20 SURF. ELEVATION 581 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	9						Asphalt pavement. 0.5	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	18		13					Moist gray to brownish gray gravelly (SAND) fill with 20 to 40% gravel, trace silt, slag, and glass fragments, compact to dense, massive soil structure, (SW).	Asphalt pavement to 0.5 feet over sandy soil fill with some gravel, trace silt, slag, and glass fragments to 6.4 feet over silty slack water sediment with trace to little clay, trace sand to 11.0 feet over clayey slack water sediment with trace sand and gravel to end of boring.
				13					
	2	12							
	16		17			28			
				11					
					10				
	3	11							
5	13		55			81			
				26					
					18			6.4	
	4	16						Extremely moist gray (CLAYEY-SILT) with trace to little clay, trace sand, very soft to soft, thinly laminated with very thin coarse silt lenses, (ML-CL).	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
	17		2			3			
				1					
					1				
	5	1							
	10		1			2			
				1					
10					1				
	6	1							No water at completion.
	17		1			2		grades downward to 11.0	WH: Sampler penetration with weight of rods and hammer.
				1				Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	
					1				
	7	WH							
	24		1/18			<2			
	8	WH							
15	24		1/12			<2			
					2			16.0	
								Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

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13E96c HOLE NO. B-8-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	17						Asphalt pavement. 0.3	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	14		29					Moist gray to light gray gravelly (SILTY-SAND) fill with 20 to 40% gravel, trace to little silt, trace slag, compact to dense, massive soil structure, (SM).	Asphalt pavement to 0.3 feet over sandy soil fill with some gravel, trace to little silt, trace slag to 4.5 feet over silty slack water sediment with trace to little sand and clay to 14.2 feet over water sorted and deposited sand trace to little silt to 15.1 feet over water sorted and deposited sand with some gravel, trace silt to end of boring.
				30					
	2	18							
	17		20			42			
				22					
					24				
	3	2						4.5	
5	3		1			<2		Extremely moist to wet gray (SAND-SILT-CLAY) with 3 to 7% gravel, trace to little sand and clay, very soft, thinly laminated to thinly bedded, (ML-CL).	
				1/12					
	4	1							
	13		1			2			Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
				1					
					1				
	5	WR							
	16		WR			<2			
				1/12					
10									
	6	1							No water at completion.
	20		1			2			
				1					WR: Sampler penetration with weight of rods.
					1				
	7	WR							
	20		WH			<1			WH: Sampler penetration with weight of rods and hammer.
				WH					
					WH			grades downward to 14.2	
	8	4						Wet gray (SILTY-SAND) with mostly fine size sand, trace to little silt, loose, thinly bedded, (SM).	
15	17		1			2			
				1					
					1			grades downward to 15.1	
								Wet gray gravelly (SAND) with 20 to 40% gravel, trace silt, very loose, stratified, (SW). 16.0	
								Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

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13E96c HOLE NO. B-9-20 SURF. ELEVATION 580 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B

City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	8						Asphalt pavement. 0.4	Note: Sample number 1 taken from 0.5 to 2.0 feet.
	12		6					Moist brownish gray to brown gravelly (SAND) fill with 20 to 40% gravel, trace silt and slag, compact, massive soil structure, (SW). 2.3	Asphalt pavement to 0.4 feet over sandy soil fill with some gravel, trace silt and slag to 2.3 feet over water sorted and deposited sand with trace to little silt to 4.5 feet over silty slack water sediment with little to some sand, trace clay to 6.6 feet over clayey slack water sediment with little clay, trace sand to end of boring.
				11					
	2	6							
	18		8			14			
				6					
					8				
	3	5						Moist brown to light brown (SILTY-SAND) with mostly fine size sand, trace to little silt, compact, thinly bedded, (SM). grades downward to 4.5	
5	15		4			7			
				3					
					2				
	4	1/18						Extremely moist to wet gray (SANDY-SILT) with little to some sand, trace clay, loose, thinly bedded, (ML). grades downward to 6.6	Note: Advanced bore hole with 3 1/4" ID x 7" OD hollow stem auger casing with continuous split spoon sampling to end of boring at 16.0 feet. Bore hole was backfilled with cuttings to ground surface upon completion.
	20					<1			
					1				
	5	1/12							
	16					<2			
				1/12				Extremely moist gray (SILTY-CLAY) with 3 to 7% gravel, trace sand, very soft, thinly laminated with very thin coarse silt lenses, (CL).	
10									
	6	1/12							
	10					<2			
				1/12					
	7	WH							No water at completion.
	20		WH			<1			
				WH					WH: Sampler penetration with weight of rods and hammer.
					WH			grades downward to 14.0	
	8	WH						Extremely moist to wet gray to dark gray (CLAYEY-SILT) with little clay, trace sand, thinly laminated with very thin coarse silt lenses, (ML-CL). 16.0	
15	22		WH			<1			
				WH					
					WH				
								Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

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13E96c HOLE NO. B-10-20 SURF. ELEVATION 579 +/-

PROJECT 901 Fuhrmann Boulevard LOCATION Terminal B
City of Buffalo, Erie County, NY

CLIENT Ravi Engineering & Land Surveying, P.C. DATE STARTED 08/27/20 COMPLETED 08/27/20

DEPTH IN FT	SN / REC	0/6	6/12	12/18	18/24	N	LITH	DESCRIPTION AND CLASSIFICATION	WATER TABLE AND REMARKS
	1	8						Moist brown to grayish brown (SANDY-SILT) fill with 10 to 20% gravel, little sand, trace slag and clay, compact, massive soil structure, (ML).	Coarse silty soil fill with little sand and gravel, trace slag and clay to 1.9 feet over water sorted and deposited sand, trace to little silt to 5.7 feet over clayey slack water sediment with trace sand to 7.1 feet over water sorted and deposited sand with trace to little silt, trace organic matter to 11.8 feet over sandy soil fill with little to some silt, trace gravel, paper fiber, brick fragments, and wood fiber to 14.1 feet over water sorted and deposited sand with trace to little silt to end of boring.
	16		9			26			
				17					
					10				
	2	7						1.9	
	16		4			10		Moist gray (SILTY-SAND) with trace to little silt, compact, thinly bedded, (SM).	
				6					
					6				
	3	6							
5	12		7			13		grades downward to 5.7	
				6					
					6				
	4	2						Extremely moist gray (SILTY-CLAY) with trace sand, firm, thinly laminated with very thin coarse silt lenses, (CL).	
	19		1			3			
				2				grades downward to 7.1	
					2				
	5	WH						Extremely moist to wet dark gray (SILTY-SAND) with trace to little silt, trace organic matter, firm, thinly bedded, (CL).	
	23		1			2			
				1					
10					1				
	6	WH							
	15		WH			<1			
				WH				11.8	
					WH				
	7	3						Moist to extremely moist brown (SILTY-SAND) fill with 3 to 7% gravel, little to some silt, trace paper fiber, brick fragments, and wood fiber, compact, massive soil structure, (ML). Slight petroliferous odor.	
	16		4			15			
				11					
					5				
	8	3							
15	20		2			4		14.1	
				2				Wet gray (SILTY-SAND) with trace to little silt, compact, thinly bedded, (SM).	
					2				
								16.0	
								Boring completed at 16.0 feet.	
20									

N=NUMBER OF BLOWS TO DRIVE 2 " SPOON 12 " WITH 140 lb. WT. FALLING 30 " PER BLOW

LOGGED BY Jason Kryszak, (cns) SHEET 1 OF 1

Attachment B

BE3 Corporation Gamma Walkover Survey Report

BE3CORP
BRYDGES ENGINEERING IN ENVIRONMENT & ENERGY
960 Busti Avenue
Buffalo, NY 14213
716.249.6880 be3corp.com

September 23, 2020

James D. MacKecknie, P.G.
Project Manager
Ravi Engineering & Land Surveying, P.C.
2110 South Clinton Avenue, Suite 1
Rochester, New York 14618

RE: Summary of Findings for Gamma Walkover Survey (GWS) – Terminal B Outer Harbor

Dear Jim,

This letter presents a summary of findings for the GWS performed on August 27th through September 2nd, 2020. The survey was performed to assess whether the slag encountered at the site during a previous geotechnical investigation exhibits elevated gamma radiation, and if it does, then what is the significance of the radiation. In parallel with the GWS, additional borings were performed on-site, the material from which were also included in the gamma radiation surveys.

The approximately 10-acre area is located off Fuhrmann Blvd along the Outer Harbor in South Buffalo and consists mostly of open parking lot except for an approximately 100,000 SF building and a few small areas of greenscape (i.e., areas absent of asphalt, concrete, or other hard surface material). The focus area is a portion of a larger approximately 50-acre parcel listed as 901 Fuhrmann Blvd. The survey was performed using gamma scintillation system (GSS) equipped with GPS technology (i.e., Ludlum 2221/44-10 and Trimble Geo7X) to ensure that the results could be accurately mapped and illustrated clearly. The **attached** figures present the field data and its relation to background gamma radiation and statistical significance (e.g., mean, standard deviation, etc.). The following observations were noted:

- Source checks of the GSS were performed daily using a 1 µCi Cs-137 source. No issues were observed. The Trimble GPS worked without issue until some intermittent readings were observed on days 4 and 5. The communication issues did not affect the data.
- Background gamma radiation was performed daily on hardscape, soil, and gravel. No discernable fluctuations in readings were observed between the different media; therefore, the average site-wide background was calculated at 7400 counts per minute (cpm).
- The final gamma radiation statistics included a maximum of approximately 17,700 cpm, a mean of approximately 6300 cpm, a median of approximately 6200 cpm, and a standard deviation of approximately 1600 cpm.
- The figures illustrate that a significant majority of the site is within 2 standard deviations of the mean (i.e., 9500 cpm) and all but a few very localized areas within the greenscape are less than 2 times background (i.e., 14,800 cpm).
- The gamma radiation values of the subsurface soil at each of the 10 boring locations were similar to those values obtained proximate to the borings during the GWS; therefore, the color scheme on the figures also represents the boring in that area.
- Greenscape areas without the presence of asphalt or concrete have visible slag at the surface, and dilapidated hardscape areas have visible slag immediately below the surface. The gamma readings within these areas were noticeably higher than the rest of the site.
- The gamma radiation readings within the building were similar to or less than those readings recorded from exterior hardscape areas.

In conclusion, there are areas of the project site that exhibit elevated gamma radiation readings that are most likely due to the presence of slag and slag-like material observed during the GWS. The significance of the elevated gamma radiation readings appears to be minimal based upon more than approximately ¾ of the site is approximately at background levels or less (i.e., 7400 cpm) and even a higher fraction of the site is within 2 standard deviations of the mean cpm (i.e., 9500). Furthermore, the similar values of the median and the mean (i.e., both approximately 6200 cpm) indicate a relatively homogenous distribution of the gamma radiation at levels below approximately 9,500 cpm. However, the presence of the hardscape on the site and the radiation shielding that it provides also appears to be significant (e.g., yellow/red in greenscape vs blue/green in hardscape), which is another indication of the presence of radioactive material.

Although it is apparent that elevated gamma radiation exists at the site most likely due to the presence of slag, the impacts of the presumed radioactive material on future development cannot be comprehensively determined without (1) laboratory data on the isotopic concentrations of the radionuclides, (2) discussions with the NYSDEC regarding waste management, and (3) knowledge of the future development of the project site.

Should you have any questions or concerns, please contact me at 716 830 8636 or JBrydges@BE3corp.com. Thank you for allowing us to support your efforts.

Sincerely,

Jason M. Brydges, PE
President

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Technician: Jim Hull
Note: Survey of Soil Borings was also performed during Gamma Walkover Survey.

Walkover Statistics
Minimum - 2,431 cpm
Maximum - 17,697 cpm
Mean - 6,264 cpm
Median - 6,238 cpm
St. Dev. - 1,627 cpm

Gamma Walkover Survey
Terminal B Capital Improvements Project
Ravi Engineering
August 27 - September 2, 2020

Legend

- Soil Borings
- Background Reference Areas
- < Background (7,403 cpm)
- Background - 2x Background (14,806 cpm)
- > 2x Background (Max 17,697 cpm)

0 100 200 400 600 800 Feet

N

BE3 CORP
BRYDGES ENGINEERING IN ENVIRONMENT & ENERGY

Gamma Walkover Survey
Terminal B Capital Improvements Project
Ravi Engineering
August 27 - September 2, 2020

Legend

- Soil Borings
- Background Reference Areas
- < 6,264 cpm (mean)
- 6,264 - 7,891 cpm (mean + 1 std dev)
- 7,891 - 9,518 cpm (mean + 2 std dev)
- 9,518 - 11,145 cpm (mean + 3 std dev)
- 11,145 - 12,772 cpm (mean + 4 std dev)
- 12,772 - 14,399 cpm (mean + 5 std dev)
- > 14,399 cpm

N

0 100 200 400 600 800 Feet

BE3 CORP
BRYDGES ENGINEERING IN ENVIRONMENT & ENERGY

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Technician: Jim Hull
Note: Survey of Soil Borings was also performed during Gamma Walkover Survey.

Walkover Statistics
Minimum - 2,431 cpm
Maximum - 17,697 cpm
Mean - 6,264 cpm
Median - 6,238 cpm
St. Dev. - 1,627 cpm

Attachment C

PID Reading Summary

PID Reading Summary - Boring B-1-20
(August 28, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	5.9
2.0 – 4.0	2	71
4.0 – 6.0	3	75
6.0 – 8.0*	4	89
8-0 – 10.0*	5	16
10.0 – 12.0*	6	79
12.0 – 14.0	7	0.3
14.0 – 16.0	8	0.4
16.0 – 18.0	9	8.0
18.0 – 20.0	10	0.8
20.0 – 22.0	11	0.0
22.0 – 24.0	12	0.0
25.0 – 27.0	13	13.5

*Note: Sample retained from 6-12 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, and PCBs.

PID Reading Summary - Boring B-2-20
(August 28, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.0
2.0 – 4.0	2	1.8
4.0 – 6.0	3	0.1
6.0 – 8.0	4	0.5
8-0 – 10.0	5	0.1
10.0 – 12.0	6	1.5
12.0 – 14.0	7	0.0
14.0 – 16.0	8	15
16.0 – 18.0	9	1.8
18.0 – 20.0	10	0.0
20.0 – 22.0	11	0.0
22.0 – 24.0	12	0.0
25.0 – 27.0	13	3.5

PID Reading Summary - Boring B-3-20
(August 28, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.2
2.0 – 4.0	2	0.1
4.0 – 6.0	3	0.1
6.0 – 8.0	4	2.4
8-0 – 9.1	5	0.0

PID Reading Summary - Boring B-4-20
(August 31, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.1
2.0 – 4.0	2	0.6
4.0 – 6.0	3	0.3
6.0 – 8.0*	4	0.0
8-0 – 10.0*	5	0.1
10.0 – 12.0	6	0.1
12.0 – 14.0	7	0.1
14.0 – 16.0	8	0.0

*Note: Sample retained from 6 to 8.5 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, and PCBs.

PID Reading Summary - Boring B-5-20
(August 31, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.0
2.0 – 4.0	2	0.1
4.0 – 6.0	3	0.1
6.0 – 8.0*	4	0.0
8-0 – 10.0*	5	0.2
10.0 – 12.0	6	0.0
12.0 – 14.0	7	0.0
14.0 – 16.0	8	0.1
18.0 – 20.0	9	0.5
23.0 – 25.0	10	0.0
28.0 – 30.0	11	0.0
33.0 – 35.0	12	0.0
38.0 – 40.0	13	0.0
43.0 – 45.0	14	0.0
48.0 – 50.0	15	0.0
53.0 – 55.0	16	0.1
58.0 – 60.0	17	0.0
63.0 – 65.0	18	0.0

*Note: Sample retained from 6 to 9 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, and PCBs.

PID Reading Summary - Boring B-6-20
(September 1, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.0
2.0 – 4.0	2	0.1
4.0 – 6.0*	3	58.2
6.0 – 8.0*	4	4.1
8-0 – 10.0	5	5.6
10.0 – 12.0	6	8.9
12.0 – 14.0	7	12.4
14.0 – 16.0	8	5.2
18.0 – 20.0	9	0.0
23.0 – 25.0	10	0.0
28.0 – 30.0	11	0.1
33.0 – 35.0	12	0.0
38.0 – 40.0	13	0.0
43.0 – 45.0	14	0.0
48.0 – 50.0	15	0.0
53.0 – 55.0	16	0.0
58.0 – 60.0	17	0.0
63.0 – 65.0	18	0.0

*Note: Sample retained from 5 to 8 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, and PCBs.

PID Reading Summary - Boring B-7-20
(August 27, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.0
2.0 – 4.0	2	0.0
4.0 – 6.0*	3	0.0
6.0 – 8.0	4	0.0
8-0 – 10.0	5	0.0
10.0 – 12.0	6	0.0
12.0 – 14.0	7	0.0
14.0 – 16.0	8	0.0

*Note: Sample retained from 4 to 6 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, and PCBs.

PID Reading Summary - Boring B-8-20
(August 27, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.0
2.0 – 4.0	2	0.0
4.0 – 6.0	3	0.0
6.0 – 8.0*	4	0.0
8-0 – 10.0*	5	0.0
10.0 – 12.0	6	0.0
12.0 – 14.0	7	0.0
14.0 – 16.0	8	0.0

*Note: Sample retained from 6 to 8 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, PCBs, Reactivity, Pesticides, Corrosivity, Flash Point, and Herbicides.

PID Reading Summary - Boring B-9-20
(August 27, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
0.5 – 2.0	1	0.0
2.0 – 4.0*	2	0.0
4.0 – 6.0*	3	0.0
6.0 – 8.0	4	0.0
8-0 – 10.0	5	0.0
10.0 – 12.0	6	0.0
12.0 – 14.0	7	0.0
14.0 – 16.0	8	0.0

*Note: Sample retained from 3 to 5 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, and PCBs.

PID Reading Summary - Boring B-10-20
(August 27, 2020)

Depth (in feet)	Sample Number	PID Reading (VOCs) in ppm
1.0 – 2.0	1	0.0
2.0 – 4.0	2	0.0
4.0 – 6.0	3	0.0
6.0 – 8.0	4	0.0
8-0 – 10.0	5	0.0
10.0 – 12.0*	6	0.4
12.0 – 14.0*	7	400
14.0 – 16.0	8	185

*Note: Sample retained from 10 to 14 feet for Full VOCs (EPA 8260), SVOCs (EPA 8270), RCRA Metals, PCBs, Reactivity, Pesticides, Corrosivity, Flash Point, and Herbicides.

Attachment D

Analytical Results

PARADIGM
ENVIRONMENTAL SERVICES INC

Analytical Report For

Ravi Engineering & Land Surveying, P.C.

For Lab Project ID

204122

Referencing

Terminal B #40-20-118

Prepared

Tuesday, September 8, 2020

Any noncompliant QC parameters or other notes impacting data interpretation are flagged or documented on the final report or are noted below.

Certifies that this report has been approved by the Technical Director or Designee

179 Lake Avenue • Rochester, NY 14608 • (585) 647-2530 • Fax (585) 647-3311 • ELAP ID# 10958

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB7, 4-6'		
Lab Sample ID:	204122-01	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	<0.078	mg/Kg		9/3/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**2.83**	mg/Kg		9/3/2020 17:34
Barium	**198**	mg/Kg		9/3/2020 17:34
Cadmium	**0.311**	mg/Kg		9/3/2020 17:34
Chromium	**13.7**	mg/Kg		9/3/2020 17:34
Lead	**14.3**	mg/Kg		9/3/2020 17:34
Selenium	< 5.57	mg/Kg		9/4/2020 14:31
Silver	< 0.557	mg/Kg		9/3/2020 17:34

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1221	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1232	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1242	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1248	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1254	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1260	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1262	< 0.167	mg/Kg		9/2/2020 15:21
PCB-1268	< 0.167	mg/Kg		9/2/2020 15:21

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Report Prepared Tuesday, September 8, 2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB7, 4-6'		
Lab Sample ID:	204122-01	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**66.2**	17.8 - 74		9/2/2020 15:21

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/1/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 323	ug/Kg		9/2/2020 16:24
1,2,4,5-Tetrachlorobenzene	< 323	ug/Kg		9/2/2020 16:24
1,2,4-Trichlorobenzene	< 323	ug/Kg		9/2/2020 16:24
1,2-Dichlorobenzene	< 323	ug/Kg		9/2/2020 16:24
1,3-Dichlorobenzene	< 323	ug/Kg		9/2/2020 16:24
1,4-Dichlorobenzene	< 323	ug/Kg		9/2/2020 16:24
2,2-Oxybis (1-chloropropane)	< 323	ug/Kg		9/2/2020 16:24
2,3,4,6-Tetrachlorophenol	< 323	ug/Kg		9/2/2020 16:24
2,4,5-Trichlorophenol	< 323	ug/Kg		9/2/2020 16:24
2,4,6-Trichlorophenol	< 323	ug/Kg		9/2/2020 16:24
2,4-Dichlorophenol	< 323	ug/Kg		9/2/2020 16:24
2,4-Dimethylphenol	< 323	ug/Kg		9/2/2020 16:24
2,4-Dinitrophenol	< 1290	ug/Kg		9/2/2020 16:24
2,4-Dinitrotoluene	< 323	ug/Kg		9/2/2020 16:24
2,6-Dinitrotoluene	< 323	ug/Kg		9/2/2020 16:24
2-Chloronaphthalene	< 323	ug/Kg		9/2/2020 16:24
2-Chlorophenol	< 323	ug/Kg		9/2/2020 16:24
2-Methylnapthalene	< 323	ug/Kg		9/2/2020 16:24
2-Methylphenol	< 323	ug/Kg		9/2/2020 16:24
2-Nitroaniline	< 323	ug/Kg		9/2/2020 16:24
2-Nitrophenol	< 323	ug/Kg		9/2/2020 16:24
3&4-Methylphenol	< 323	ug/Kg		9/2/2020 16:24
3,3'-Dichlorobenzidine	< 323	ug/Kg		9/2/2020 16:24

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Report Prepared Tuesday, September 8, 2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB7, 4-6'

Lab Sample ID: 204122-01 **Date Sampled:** 8/27/2020

Matrix: Soil **Date Received:** 9/1/2020

3-Nitroaniline	< 323	ug/Kg		9/2/2020	16:24
4,6-Dinitro-2-methylphenol	< 432	ug/Kg		9/2/2020	16:24
4-Bromophenyl phenyl ether	< 323	ug/Kg		9/2/2020	16:24
4-Chloro-3-methylphenol	< 323	ug/Kg		9/2/2020	16:24
4-Chloroaniline	< 323	ug/Kg		9/2/2020	16:24
4-Chlorophenyl phenyl ether	< 323	ug/Kg		9/2/2020	16:24
4-Nitroaniline	< 323	ug/Kg		9/2/2020	16:24
4-Nitrophenol	< 323	ug/Kg	M	9/2/2020	16:24
Acenaphthene	< 323	ug/Kg		9/2/2020	16:24
Acenaphthylene	< 323	ug/Kg		9/2/2020	16:24
Acetophenone	< 323	ug/Kg		9/2/2020	16:24
Anthracene	< 323	ug/Kg		9/2/2020	16:24
Atrazine	< 323	ug/Kg		9/2/2020	16:24
Benzaldehyde	< 323	ug/Kg		9/2/2020	16:24
Benzo (a) anthracene	< 323	ug/Kg		9/2/2020	16:24
Benzo (a) pyrene	< 323	ug/Kg		9/2/2020	16:24
Benzo (b) fluoranthene	< 323	ug/Kg		9/2/2020	16:24
Benzo (g,h,i) perylene	< 323	ug/Kg		9/2/2020	16:24
Benzo (k) fluoranthene	< 323	ug/Kg		9/2/2020	16:24
Bis (2-chloroethoxy) methane	< 323	ug/Kg		9/2/2020	16:24
Bis (2-chloroethyl) ether	< 323	ug/Kg		9/2/2020	16:24
Bis (2-ethylhexyl) phthalate	< 323	ug/Kg		9/2/2020	16:24
Butylbenzylphthalate	< 323	ug/Kg		9/2/2020	16:24
Caprolactam	< 323	ug/Kg		9/2/2020	16:24
Carbazole	< 323	ug/Kg		9/2/2020	16:24
Chrysene	< 323	ug/Kg		9/2/2020	16:24
Dibenz (a,h) anthracene	< 323	ug/Kg		9/2/2020	16:24
Dibenzofuran	< 323	ug/Kg		9/2/2020	16:24
Diethyl phthalate	< 323	ug/Kg		9/2/2020	16:24
Dimethyl phthalate	< 323	ug/Kg		9/2/2020	16:24

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB7, 4-6'
Lab Sample ID: 204122-01 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 323	ug/Kg		9/2/2020	16:24
Di-n-octylphthalate	< 323	ug/Kg		9/2/2020	16:24
Fluoranthene	< 323	ug/Kg		9/2/2020	16:24
Fluorene	< 323	ug/Kg		9/2/2020	16:24
Hexachlorobenzene	< 323	ug/Kg		9/2/2020	16:24
Hexachlorobutadiene	< 323	ug/Kg		9/2/2020	16:24
Hexachlorocyclopentadiene	< 1290	ug/Kg		9/2/2020	16:24
Hexachloroethane	< 323	ug/Kg		9/2/2020	16:24
Indeno (1,2,3-cd) pyrene	< 323	ug/Kg		9/2/2020	16:24
Isophorone	< 323	ug/Kg		9/2/2020	16:24
Naphthalene	< 323	ug/Kg		9/2/2020	16:24
Nitrobenzene	< 323	ug/Kg		9/2/2020	16:24
N-Nitroso-di-n-propylamine	< 323	ug/Kg		9/2/2020	16:24
N-Nitrosodiphenylamine	< 323	ug/Kg		9/2/2020	16:24
Pentachlorophenol	< 645	ug/Kg	M	9/2/2020	16:24
Phenanthrene	< 323	ug/Kg		9/2/2020	16:24
Phenol	< 323	ug/Kg		9/2/2020	16:24
Pyrene	< 323	ug/Kg		9/2/2020	16:24

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**23.9**	37.8 - 85.8	*	9/2/2020	16:24
2-Fluorobiphenyl	**61.3**	40.4 - 80.4		9/2/2020	16:24
2-Fluorophenol	**53.5**	38.8 - 77.4		9/2/2020	16:24
Nitrobenzene-d5	**54.7**	37.4 - 75.9		9/2/2020	16:24
Phenol-d5	**59.7**	40.4 - 78		9/2/2020	16:24
Terphenyl-d14	**60.3**	40.2 - 90		9/2/2020	16:24

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49133.D

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB7, 4-6'		
Lab Sample ID:	204122-01	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 6.01	ug/Kg		9/4/2020 17:30
1,1,2,2-Tetrachloroethane	< 6.01	ug/Kg		9/4/2020 17:30
1,1,2-Trichloroethane	< 6.01	ug/Kg		9/4/2020 17:30
1,1-Dichloroethane	< 6.01	ug/Kg		9/4/2020 17:30
1,1-Dichloroethene	< 6.01	ug/Kg		9/4/2020 17:30
1,2,3-Trichlorobenzene	< 15.0	ug/Kg		9/4/2020 17:30
1,2,4-Trichlorobenzene	< 15.0	ug/Kg		9/4/2020 17:30
1,2-Dibromo-3-Chloropropane	< 30.1	ug/Kg		9/4/2020 17:30
1,2-Dibromoethane	< 6.01	ug/Kg		9/4/2020 17:30
1,2-Dichlorobenzene	< 6.01	ug/Kg		9/4/2020 17:30
1,2-Dichloroethane	< 6.01	ug/Kg		9/4/2020 17:30
1,2-Dichloropropane	< 6.01	ug/Kg		9/4/2020 17:30
1,3-Dichlorobenzene	< 6.01	ug/Kg		9/4/2020 17:30
1,4-Dichlorobenzene	< 6.01	ug/Kg		9/4/2020 17:30
1,4-Dioxane	< 60.1	ug/Kg		9/4/2020 17:30
2-Butanone	< 30.1	ug/Kg		9/4/2020 17:30
2-Hexanone	< 15.0	ug/Kg		9/4/2020 17:30
4-Methyl-2-pentanone	< 15.0	ug/Kg		9/4/2020 17:30
Acetone	< 30.1	ug/Kg		9/4/2020 17:30
Benzene	< 6.01	ug/Kg		9/4/2020 17:30
Bromochloromethane	< 15.0	ug/Kg		9/4/2020 17:30
Bromodichloromethane	< 6.01	ug/Kg		9/4/2020 17:30
Bromoform	< 15.0	ug/Kg		9/4/2020 17:30
Bromomethane	< 6.01	ug/Kg		9/4/2020 17:30
Carbon disulfide	< 6.01	ug/Kg		9/4/2020 17:30
Carbon Tetrachloride	< 6.01	ug/Kg		9/4/2020 17:30
Chlorobenzene	< 6.01	ug/Kg		9/4/2020 17:30
Chloroethane	< 6.01	ug/Kg		9/4/2020 17:30

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB7, 4-6'		
Lab Sample ID:	204122-01	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 6.01	ug/Kg	9/4/2020	17:30
Chloromethane	< 6.01	ug/Kg	9/4/2020	17:30
cis-1,2-Dichloroethene	< 6.01	ug/Kg	9/4/2020	17:30
cis-1,3-Dichloropropene	< 6.01	ug/Kg	9/4/2020	17:30
Cyclohexane	< 30.1	ug/Kg	9/4/2020	17:30
Dibromochloromethane	< 6.01	ug/Kg	9/4/2020	17:30
Dichlorodifluoromethane	< 6.01	ug/Kg	9/4/2020	17:30
Ethylbenzene	< 6.01	ug/Kg	9/4/2020	17:30
Freon 113	< 6.01	ug/Kg	9/4/2020	17:30
Isopropylbenzene	< 6.01	ug/Kg	9/4/2020	17:30
m,p-Xylene	< 6.01	ug/Kg	9/4/2020	17:30
Methyl acetate	< 6.01	ug/Kg	9/4/2020	17:30
Methyl tert-butyl Ether	< 6.01	ug/Kg	9/4/2020	17:30
Methylcyclohexane	< 6.01	ug/Kg	9/4/2020	17:30
Methylene chloride	< 15.0	ug/Kg	9/4/2020	17:30
o-Xylene	< 6.01	ug/Kg	9/4/2020	17:30
Styrene	< 15.0	ug/Kg	9/4/2020	17:30
Tetrachloroethene	< 6.01	ug/Kg	9/4/2020	17:30
Toluene	< 6.01	ug/Kg	9/4/2020	17:30
trans-1,2-Dichloroethene	< 6.01	ug/Kg	9/4/2020	17:30
trans-1,3-Dichloropropene	< 6.01	ug/Kg	9/4/2020	17:30
Trichloroethene	< 6.01	ug/Kg	9/4/2020	17:30
Trichlorofluoromethane	< 6.01	ug/Kg	9/4/2020	17:30
Vinyl chloride	< 6.01	ug/Kg	9/4/2020	17:30

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB7, 4-6'		
Lab Sample ID:	204122-01	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**91.7**	75 - 134		9/4/2020	17:30
4-Bromofluorobenzene	**71.4**	59.5 - 129		9/4/2020	17:30
Pentafluorobenzene	**99.5**	88.8 - 118		9/4/2020	17:30
Toluene-D8	**92.3**	84 - 114		9/4/2020	17:30

Internal standard outliers indicate probable matrix interference

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73089.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB8, 6-8'		
Lab Sample ID:	204122-02	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	**0.235**	mg/Kg		9/3/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**4.52**	mg/Kg		9/3/2020 17:38
Barium	**60.0**	mg/Kg		9/3/2020 17:38
Cadmium	< 0.308	mg/Kg		9/3/2020 17:38
Chromium	**19.3**	mg/Kg		9/3/2020 17:38
Lead	**20.7**	mg/Kg		9/3/2020 17:38
Selenium	< 6.16	mg/Kg		9/4/2020 14:36
Silver	< 0.616	mg/Kg		9/3/2020 17:38

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1221	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1232	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1242	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1248	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1254	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1260	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1262	< 0.152	mg/Kg		9/2/2020 16:09
PCB-1268	< 0.152	mg/Kg		9/2/2020 16:09

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB8, 6-8'		
Lab Sample ID:	204122-02	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**87.7**	17.8 - 74	*	9/2/2020 16:09

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/1/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 360	ug/Kg		9/2/2020 17:54
1,2,4,5-Tetrachlorobenzene	< 360	ug/Kg		9/2/2020 17:54
1,2,4-Trichlorobenzene	< 360	ug/Kg		9/2/2020 17:54
1,2-Dichlorobenzene	< 360	ug/Kg		9/2/2020 17:54
1,3-Dichlorobenzene	< 360	ug/Kg		9/2/2020 17:54
1,4-Dichlorobenzene	< 360	ug/Kg		9/2/2020 17:54
2,2-Oxybis (1-chloropropane)	< 360	ug/Kg		9/2/2020 17:54
2,3,4,6-Tetrachlorophenol	< 360	ug/Kg		9/2/2020 17:54
2,4,5-Trichlorophenol	< 360	ug/Kg		9/2/2020 17:54
2,4,6-Trichlorophenol	< 360	ug/Kg		9/2/2020 17:54
2,4-Dichlorophenol	< 360	ug/Kg		9/2/2020 17:54
2,4-Dimethylphenol	< 360	ug/Kg		9/2/2020 17:54
2,4-Dinitrophenol	< 1440	ug/Kg		9/2/2020 17:54
2,4-Dinitrotoluene	< 360	ug/Kg		9/2/2020 17:54
2,6-Dinitrotoluene	< 360	ug/Kg		9/2/2020 17:54
2-Chloronaphthalene	< 360	ug/Kg		9/2/2020 17:54
2-Chlorophenol	< 360	ug/Kg		9/2/2020 17:54
2-Methylnapthalene	< 360	ug/Kg		9/2/2020 17:54
2-Methylphenol	< 360	ug/Kg		9/2/2020 17:54
2-Nitroaniline	< 360	ug/Kg		9/2/2020 17:54
2-Nitrophenol	< 360	ug/Kg		9/2/2020 17:54
3&4-Methylphenol	< 360	ug/Kg		9/2/2020 17:54
3,3'-Dichlorobenzidine	< 360	ug/Kg		9/2/2020 17:54

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB8, 6-8'
Lab Sample ID: 204122-02 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

3-Nitroaniline	< 360	ug/Kg	9/2/2020	17:54
4,6-Dinitro-2-methylphenol	< 481	ug/Kg	9/2/2020	17:54
4-Bromophenyl phenyl ether	< 360	ug/Kg	9/2/2020	17:54
4-Chloro-3-methylphenol	< 360	ug/Kg	9/2/2020	17:54
4-Chloroaniline	< 360	ug/Kg	9/2/2020	17:54
4-Chlorophenyl phenyl ether	< 360	ug/Kg	9/2/2020	17:54
4-Nitroaniline	< 360	ug/Kg	9/2/2020	17:54
4-Nitrophenol	< 360	ug/Kg	9/2/2020	17:54
Acenaphthene	< 360	ug/Kg	9/2/2020	17:54
Acenaphthylene	< 360	ug/Kg	9/2/2020	17:54
Acetophenone	< 360	ug/Kg	9/2/2020	17:54
Anthracene	< 360	ug/Kg	9/2/2020	17:54
Atrazine	< 360	ug/Kg	9/2/2020	17:54
Benzaldehyde	< 360	ug/Kg	9/2/2020	17:54
Benzo (a) anthracene	< 360	ug/Kg	9/2/2020	17:54
Benzo (a) pyrene	< 360	ug/Kg	9/2/2020	17:54
Benzo (b) fluoranthene	< 360	ug/Kg	9/2/2020	17:54
Benzo (g,h,i) perylene	< 360	ug/Kg	9/2/2020	17:54
Benzo (k) fluoranthene	< 360	ug/Kg	9/2/2020	17:54
Bis (2-chloroethoxy) methane	< 360	ug/Kg	9/2/2020	17:54
Bis (2-chloroethyl) ether	< 360	ug/Kg	9/2/2020	17:54
Bis (2-ethylhexyl) phthalate	< 360	ug/Kg	9/2/2020	17:54
Butylbenzylphthalate	< 360	ug/Kg	9/2/2020	17:54
Caprolactam	< 360	ug/Kg	9/2/2020	17:54
Carbazole	< 360	ug/Kg	9/2/2020	17:54
Chrysene	< 360	ug/Kg	9/2/2020	17:54
Dibenz (a,h) anthracene	< 360	ug/Kg	9/2/2020	17:54
Dibenzofuran	< 360	ug/Kg	9/2/2020	17:54
Diethyl phthalate	< 360	ug/Kg	9/2/2020	17:54
Dimethyl phthalate	< 360	ug/Kg	9/2/2020	17:54

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier: SB8, 6-8'
Lab Sample ID: 204122-02 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 360	ug/Kg	9/2/2020	17:54
Di-n-octylphthalate	< 360	ug/Kg	9/2/2020	17:54
Fluoranthene	**460**	ug/Kg	9/2/2020	17:54
Fluorene	< 360	ug/Kg	9/2/2020	17:54
Hexachlorobenzene	< 360	ug/Kg	9/2/2020	17:54
Hexachlorobutadiene	< 360	ug/Kg	9/2/2020	17:54
Hexachlorocyclopentadiene	< 1440	ug/Kg	9/2/2020	17:54
Hexachloroethane	< 360	ug/Kg	9/2/2020	17:54
Indeno (1,2,3-cd) pyrene	< 360	ug/Kg	9/2/2020	17:54
Isophorone	< 360	ug/Kg	9/2/2020	17:54
Naphthalene	< 360	ug/Kg	9/2/2020	17:54
Nitrobenzene	< 360	ug/Kg	9/2/2020	17:54
N-Nitroso-di-n-propylamine	< 360	ug/Kg	9/2/2020	17:54
N-Nitrosodiphenylamine	< 360	ug/Kg	9/2/2020	17:54
Pentachlorophenol	< 719	ug/Kg	9/2/2020	17:54
Phenanthrene	< 360	ug/Kg	9/2/2020	17:54
Phenol	< 360	ug/Kg	9/2/2020	17:54
Pyrene	**408**	ug/Kg	9/2/2020	17:54

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**52.8**	37.8 - 85.8		9/2/2020	17:54
2-Fluorobiphenyl	**59.0**	40.4 - 80.4		9/2/2020	17:54
2-Fluorophenol	**56.4**	38.8 - 77.4		9/2/2020	17:54
Nitrobenzene-d5	**48.8**	37.4 - 75.9		9/2/2020	17:54
Phenol-d5	**59.2**	40.4 - 78		9/2/2020	17:54
Terphenyl-d14	**56.2**	40.2 - 90		9/2/2020	17:54

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49136.D

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB8, 6-8'		
Lab Sample ID:	204122-02	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 7.71	ug/Kg		9/4/2020 17:52
1,1,2,2-Tetrachloroethane	< 7.71	ug/Kg		9/4/2020 17:52
1,1,2-Trichloroethane	< 7.71	ug/Kg		9/4/2020 17:52
1,1-Dichloroethane	< 7.71	ug/Kg		9/4/2020 17:52
1,1-Dichloroethene	< 7.71	ug/Kg		9/4/2020 17:52
1,2,3-Trichlorobenzene	< 19.3	ug/Kg		9/4/2020 17:52
1,2,4-Trichlorobenzene	< 19.3	ug/Kg		9/4/2020 17:52
1,2-Dibromo-3-Chloropropane	< 38.6	ug/Kg		9/4/2020 17:52
1,2-Dibromoethane	< 7.71	ug/Kg		9/4/2020 17:52
1,2-Dichlorobenzene	< 7.71	ug/Kg		9/4/2020 17:52
1,2-Dichloroethane	< 7.71	ug/Kg		9/4/2020 17:52
1,2-Dichloropropane	< 7.71	ug/Kg		9/4/2020 17:52
1,3-Dichlorobenzene	< 7.71	ug/Kg		9/4/2020 17:52
1,4-Dichlorobenzene	< 7.71	ug/Kg		9/4/2020 17:52
1,4-Dioxane	< 77.1	ug/Kg		9/4/2020 17:52
2-Butanone	< 38.6	ug/Kg		9/4/2020 17:52
2-Hexanone	< 19.3	ug/Kg		9/4/2020 17:52
4-Methyl-2-pentanone	< 19.3	ug/Kg		9/4/2020 17:52
Acetone	< 38.6	ug/Kg		9/4/2020 17:52
Benzene	< 7.71	ug/Kg		9/4/2020 17:52
Bromochloromethane	< 19.3	ug/Kg		9/4/2020 17:52
Bromodichloromethane	< 7.71	ug/Kg		9/4/2020 17:52
Bromoform	< 19.3	ug/Kg		9/4/2020 17:52
Bromomethane	< 7.71	ug/Kg		9/4/2020 17:52
Carbon disulfide	< 7.71	ug/Kg		9/4/2020 17:52
Carbon Tetrachloride	< 7.71	ug/Kg		9/4/2020 17:52
Chlorobenzene	< 7.71	ug/Kg		9/4/2020 17:52
Chloroethane	< 7.71	ug/Kg		9/4/2020 17:52

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB8, 6-8'		
Lab Sample ID:	204122-02	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 7.71	ug/Kg	9/4/2020	17:52
Chloromethane	< 7.71	ug/Kg	9/4/2020	17:52
cis-1,2-Dichloroethene	< 7.71	ug/Kg	9/4/2020	17:52
cis-1,3-Dichloropropene	< 7.71	ug/Kg	9/4/2020	17:52
Cyclohexane	< 38.6	ug/Kg	9/4/2020	17:52
Dibromochloromethane	< 7.71	ug/Kg	9/4/2020	17:52
Dichlorodifluoromethane	< 7.71	ug/Kg	9/4/2020	17:52
Ethylbenzene	< 7.71	ug/Kg	9/4/2020	17:52
Freon 113	< 7.71	ug/Kg	9/4/2020	17:52
Isopropylbenzene	< 7.71	ug/Kg	9/4/2020	17:52
m,p-Xylene	< 7.71	ug/Kg	9/4/2020	17:52
Methyl acetate	< 7.71	ug/Kg	9/4/2020	17:52
Methyl tert-butyl Ether	< 7.71	ug/Kg	9/4/2020	17:52
Methylcyclohexane	< 7.71	ug/Kg	9/4/2020	17:52
Methylene chloride	< 19.3	ug/Kg	9/4/2020	17:52
o-Xylene	< 7.71	ug/Kg	9/4/2020	17:52
Styrene	< 19.3	ug/Kg	9/4/2020	17:52
Tetrachloroethene	< 7.71	ug/Kg	9/4/2020	17:52
Toluene	< 7.71	ug/Kg	9/4/2020	17:52
trans-1,2-Dichloroethene	< 7.71	ug/Kg	9/4/2020	17:52
trans-1,3-Dichloropropene	< 7.71	ug/Kg	9/4/2020	17:52
Trichloroethene	< 7.71	ug/Kg	9/4/2020	17:52
Trichlorofluoromethane	< 7.71	ug/Kg	9/4/2020	17:52
Vinyl chloride	< 7.71	ug/Kg	9/4/2020	17:52

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB8, 6-8'		
Lab Sample ID:	204122-02	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**88.1**	75 - 134		9/4/2020	17:52
4-Bromofluorobenzene	**73.9**	59.5 - 129		9/4/2020	17:52
Pentafluorobenzene	**104**	88.8 - 118		9/4/2020	17:52
Toluene-D8	**94.8**	84 - 114		9/4/2020	17:52

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73090.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB9, 3-5'		
Lab Sample ID:	204122-03	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	**0.0890**	mg/Kg		9/3/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**3.27**	mg/Kg		9/3/2020 17:43
Barium	**22.7**	mg/Kg		9/3/2020 17:43
Cadmium	< 0.292	mg/Kg		9/3/2020 17:43
Chromium	**12.0**	mg/Kg		9/3/2020 17:43
Lead	**14.6**	mg/Kg		9/3/2020 17:43
Selenium	< 1.17	mg/Kg		9/3/2020 17:43
Silver	< 0.584	mg/Kg		9/3/2020 17:43

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1221	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1232	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1242	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1248	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1254	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1260	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1262	< 0.151	mg/Kg		9/2/2020 16:32
PCB-1268	< 0.151	mg/Kg		9/2/2020 16:32

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Report Prepared Tuesday, September 8, 2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB9, 3-5'		
Lab Sample ID:	204122-03	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**86.3**	17.8 - 74	*	9/2/2020 16:32

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/1/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 340	ug/Kg		9/2/2020 18:23
1,2,4,5-Tetrachlorobenzene	< 340	ug/Kg		9/2/2020 18:23
1,2,4-Trichlorobenzene	< 340	ug/Kg		9/2/2020 18:23
1,2-Dichlorobenzene	< 340	ug/Kg		9/2/2020 18:23
1,3-Dichlorobenzene	< 340	ug/Kg		9/2/2020 18:23
1,4-Dichlorobenzene	< 340	ug/Kg		9/2/2020 18:23
2,2-Oxybis (1-chloropropane)	< 340	ug/Kg		9/2/2020 18:23
2,3,4,6-Tetrachlorophenol	< 340	ug/Kg		9/2/2020 18:23
2,4,5-Trichlorophenol	< 340	ug/Kg		9/2/2020 18:23
2,4,6-Trichlorophenol	< 340	ug/Kg		9/2/2020 18:23
2,4-Dichlorophenol	< 340	ug/Kg		9/2/2020 18:23
2,4-Dimethylphenol	< 340	ug/Kg		9/2/2020 18:23
2,4-Dinitrophenol	< 1360	ug/Kg		9/2/2020 18:23
2,4-Dinitrotoluene	< 340	ug/Kg		9/2/2020 18:23
2,6-Dinitrotoluene	< 340	ug/Kg		9/2/2020 18:23
2-Chloronaphthalene	< 340	ug/Kg		9/2/2020 18:23
2-Chlorophenol	< 340	ug/Kg		9/2/2020 18:23
2-Methylnapthalene	< 340	ug/Kg		9/2/2020 18:23
2-Methylphenol	< 340	ug/Kg		9/2/2020 18:23
2-Nitroaniline	< 340	ug/Kg		9/2/2020 18:23
2-Nitrophenol	< 340	ug/Kg		9/2/2020 18:23
3&4-Methylphenol	< 340	ug/Kg		9/2/2020 18:23
3,3'-Dichlorobenzidine	< 340	ug/Kg		9/2/2020 18:23

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier: SB9, 3-5'
Lab Sample ID: 204122-03 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

3-Nitroaniline	< 340	ug/Kg	9/2/2020	18:23
4,6-Dinitro-2-methylphenol	< 455	ug/Kg	9/2/2020	18:23
4-Bromophenyl phenyl ether	< 340	ug/Kg	9/2/2020	18:23
4-Chloro-3-methylphenol	< 340	ug/Kg	9/2/2020	18:23
4-Chloroaniline	< 340	ug/Kg	9/2/2020	18:23
4-Chlorophenyl phenyl ether	< 340	ug/Kg	9/2/2020	18:23
4-Nitroaniline	< 340	ug/Kg	9/2/2020	18:23
4-Nitrophenol	< 340	ug/Kg	9/2/2020	18:23
Acenaphthene	< 340	ug/Kg	9/2/2020	18:23
Acenaphthylene	< 340	ug/Kg	9/2/2020	18:23
Acetophenone	< 340	ug/Kg	9/2/2020	18:23
Anthracene	< 340	ug/Kg	9/2/2020	18:23
Atrazine	< 340	ug/Kg	9/2/2020	18:23
Benzaldehyde	< 340	ug/Kg	9/2/2020	18:23
Benzo (a) anthracene	< 340	ug/Kg	9/2/2020	18:23
Benzo (a) pyrene	< 340	ug/Kg	9/2/2020	18:23
Benzo (b) fluoranthene	< 340	ug/Kg	9/2/2020	18:23
Benzo (g,h,i) perylene	< 340	ug/Kg	9/2/2020	18:23
Benzo (k) fluoranthene	< 340	ug/Kg	9/2/2020	18:23
Bis (2-chloroethoxy) methane	< 340	ug/Kg	9/2/2020	18:23
Bis (2-chloroethyl) ether	< 340	ug/Kg	9/2/2020	18:23
Bis (2-ethylhexyl) phthalate	< 340	ug/Kg	9/2/2020	18:23
Butylbenzylphthalate	< 340	ug/Kg	9/2/2020	18:23
Caprolactam	< 340	ug/Kg	9/2/2020	18:23
Carbazole	< 340	ug/Kg	9/2/2020	18:23
Chrysene	< 340	ug/Kg	9/2/2020	18:23
Dibenz (a,h) anthracene	< 340	ug/Kg	9/2/2020	18:23
Dibenzofuran	< 340	ug/Kg	9/2/2020	18:23
Diethyl phthalate	< 340	ug/Kg	9/2/2020	18:23
Dimethyl phthalate	< 340	ug/Kg	9/2/2020	18:23

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier: SB9, 3-5'
Lab Sample ID: 204122-03 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 340	ug/Kg	9/2/2020	18:23
Di-n-octylphthalate	< 340	ug/Kg	9/2/2020	18:23
Fluoranthene	**351**	ug/Kg	9/2/2020	18:23
Fluorene	< 340	ug/Kg	9/2/2020	18:23
Hexachlorobenzene	< 340	ug/Kg	9/2/2020	18:23
Hexachlorobutadiene	< 340	ug/Kg	9/2/2020	18:23
Hexachlorocyclopentadiene	< 1360	ug/Kg	9/2/2020	18:23
Hexachloroethane	< 340	ug/Kg	9/2/2020	18:23
Indeno (1,2,3-cd) pyrene	< 340	ug/Kg	9/2/2020	18:23
Isophorone	< 340	ug/Kg	9/2/2020	18:23
Naphthalene	< 340	ug/Kg	9/2/2020	18:23
Nitrobenzene	< 340	ug/Kg	9/2/2020	18:23
N-Nitroso-di-n-propylamine	< 340	ug/Kg	9/2/2020	18:23
N-Nitrosodiphenylamine	< 340	ug/Kg	9/2/2020	18:23
Pentachlorophenol	< 680	ug/Kg	9/2/2020	18:23
Phenanthrene	< 340	ug/Kg	9/2/2020	18:23
Phenol	< 340	ug/Kg	9/2/2020	18:23
Pyrene	< 340	ug/Kg	9/2/2020	18:23

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**53.5**	37.8 - 85.8		9/2/2020	18:23
2-Fluorobiphenyl	**58.4**	40.4 - 80.4		9/2/2020	18:23
2-Fluorophenol	**56.4**	38.8 - 77.4		9/2/2020	18:23
Nitrobenzene-d5	**57.2**	37.4 - 75.9		9/2/2020	18:23
Phenol-d5	**58.2**	40.4 - 78		9/2/2020	18:23
Terphenyl-d14	**57.5**	40.2 - 90		9/2/2020	18:23

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49137.D

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB9, 3-5'		
Lab Sample ID:	204122-03	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 7.29	ug/Kg		9/4/2020 18:15
1,1,2,2-Tetrachloroethane	< 7.29	ug/Kg		9/4/2020 18:15
1,1,2-Trichloroethane	< 7.29	ug/Kg		9/4/2020 18:15
1,1-Dichloroethane	< 7.29	ug/Kg		9/4/2020 18:15
1,1-Dichloroethene	< 7.29	ug/Kg		9/4/2020 18:15
1,2,3-Trichlorobenzene	< 18.2	ug/Kg		9/4/2020 18:15
1,2,4-Trichlorobenzene	< 18.2	ug/Kg		9/4/2020 18:15
1,2-Dibromo-3-Chloropropane	< 36.5	ug/Kg		9/4/2020 18:15
1,2-Dibromoethane	< 7.29	ug/Kg		9/4/2020 18:15
1,2-Dichlorobenzene	< 7.29	ug/Kg		9/4/2020 18:15
1,2-Dichloroethane	< 7.29	ug/Kg		9/4/2020 18:15
1,2-Dichloropropane	< 7.29	ug/Kg		9/4/2020 18:15
1,3-Dichlorobenzene	< 7.29	ug/Kg		9/4/2020 18:15
1,4-Dichlorobenzene	< 7.29	ug/Kg		9/4/2020 18:15
1,4-Dioxane	< 72.9	ug/Kg		9/4/2020 18:15
2-Butanone	< 36.5	ug/Kg		9/4/2020 18:15
2-Hexanone	< 18.2	ug/Kg		9/4/2020 18:15
4-Methyl-2-pentanone	< 18.2	ug/Kg		9/4/2020 18:15
Acetone	< 36.5	ug/Kg		9/4/2020 18:15
Benzene	< 7.29	ug/Kg		9/4/2020 18:15
Bromochloromethane	< 18.2	ug/Kg		9/4/2020 18:15
Bromodichloromethane	< 7.29	ug/Kg		9/4/2020 18:15
Bromoform	< 18.2	ug/Kg		9/4/2020 18:15
Bromomethane	< 7.29	ug/Kg		9/4/2020 18:15
Carbon disulfide	< 7.29	ug/Kg		9/4/2020 18:15
Carbon Tetrachloride	< 7.29	ug/Kg		9/4/2020 18:15
Chlorobenzene	< 7.29	ug/Kg		9/4/2020 18:15
Chloroethane	< 7.29	ug/Kg		9/4/2020 18:15

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB9, 3-5'		
Lab Sample ID:	204122-03	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 7.29	ug/Kg	9/4/2020	18:15
Chloromethane	< 7.29	ug/Kg	9/4/2020	18:15
cis-1,2-Dichloroethene	< 7.29	ug/Kg	9/4/2020	18:15
cis-1,3-Dichloropropene	< 7.29	ug/Kg	9/4/2020	18:15
Cyclohexane	< 36.5	ug/Kg	9/4/2020	18:15
Dibromochloromethane	< 7.29	ug/Kg	9/4/2020	18:15
Dichlorodifluoromethane	< 7.29	ug/Kg	9/4/2020	18:15
Ethylbenzene	< 7.29	ug/Kg	9/4/2020	18:15
Freon 113	< 7.29	ug/Kg	9/4/2020	18:15
Isopropylbenzene	< 7.29	ug/Kg	9/4/2020	18:15
m,p-Xylene	< 7.29	ug/Kg	9/4/2020	18:15
Methyl acetate	< 7.29	ug/Kg	9/4/2020	18:15
Methyl tert-butyl Ether	< 7.29	ug/Kg	9/4/2020	18:15
Methylcyclohexane	< 7.29	ug/Kg	9/4/2020	18:15
Methylene chloride	< 18.2	ug/Kg	9/4/2020	18:15
o-Xylene	< 7.29	ug/Kg	9/4/2020	18:15
Styrene	< 18.2	ug/Kg	9/4/2020	18:15
Tetrachloroethene	< 7.29	ug/Kg	9/4/2020	18:15
Toluene	< 7.29	ug/Kg	9/4/2020	18:15
trans-1,2-Dichloroethene	< 7.29	ug/Kg	9/4/2020	18:15
trans-1,3-Dichloropropene	< 7.29	ug/Kg	9/4/2020	18:15
Trichloroethene	< 7.29	ug/Kg	9/4/2020	18:15
Trichlorofluoromethane	< 7.29	ug/Kg	9/4/2020	18:15
Vinyl chloride	< 7.29	ug/Kg	9/4/2020	18:15

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB9, 3-5'		
Lab Sample ID:	204122-03	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**88.6**	75 - 134		9/4/2020	18:15
4-Bromofluorobenzene	**73.8**	59.5 - 129		9/4/2020	18:15
Pentafluorobenzene	**104**	88.8 - 118		9/4/2020	18:15
Toluene-D8	**93.3**	84 - 114		9/4/2020	18:15

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73091.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB10, 10-14'		
Lab Sample ID:	204122-04	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Corrosivity as pH

Analyte	Result	Units	Qualifier	Date Analyzed
Corrosivity (as pH)	7.26 @ 23.5 C	S.U.		9/8/2020 11:30

Method Reference(s): EPA 9045D

Flash Point

Analyte	Result	Units	Qualifier	Date Analyzed
Flash Point, Celsius	**46.5**	C		9/4/2020

Method Reference(s): EPA 1010A

Herbicides

Analyte	Result	Units	Qualifier	Date Analyzed
2,4,5-T	<4330	ug/Kg		9/3/2020
2,4,5-TP (Silvex)	<4330	ug/Kg		9/3/2020
2,4-D	<4330	ug/Kg		9/3/2020

Method Reference(s): EPA 8151A
Subcontractor ELAP ID: 11148

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	**0.356**	mg/Kg		9/3/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**35.9**	mg/Kg		9/3/2020 17:47
Barium	**3700**	mg/Kg		9/4/2020 14:40
Cadmium	**81.8**	mg/Kg		9/3/2020 17:47
Chromium	**77.4**	mg/Kg		9/3/2020 17:47
Lead	**7740**	mg/Kg		9/4/2020 14:40

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB10, 10-14'
Lab Sample ID: 204122-04 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

Selenium	**21.9**	mg/Kg		9/3/2020 17:47
Silver	< 0.626	mg/Kg		9/3/2020 17:47

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1221	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1232	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1242	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1248	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1254	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1260	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1262	< 0.0359	mg/Kg		9/2/2020 15:45
PCB-1268	< 0.0359	mg/Kg		9/2/2020 15:45

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**32.7**	17.8 - 74		9/2/2020 15:45

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/1/2020

Chlorinated Pesticides

Analyte	Result	Units	Qualifier	Date Analyzed
4,4-DDD	< 3.59	ug/Kg		9/2/2020 10:52
4,4-DDE	< 3.59	ug/Kg		9/2/2020 10:52
4,4-DDT	< 3.59	ug/Kg		9/2/2020 10:52
Aldrin	**7.85**	ug/Kg	P	9/2/2020 10:52
alpha-BHC	**5.00**	ug/Kg	P	9/2/2020 10:52
beta-BHC	< 3.59	ug/Kg		9/2/2020 10:52
cis-Chlordane	< 3.59	ug/Kg		9/2/2020 10:52

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB10, 10-14'
Lab Sample ID: 204122-04 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

delta-BHC	**3.67**	ug/Kg	P	9/2/2020	10:52
Dieldrin	< 3.59	ug/Kg		9/2/2020	10:52
Endosulfan I	< 3.59	ug/Kg		9/2/2020	10:52
Endosulfan II	< 3.59	ug/Kg		9/2/2020	10:52
Endosulfan Sulfate	< 3.59	ug/Kg		9/2/2020	10:52
Endrin	< 3.59	ug/Kg		9/2/2020	10:52
Endrin Aldehyde	< 3.59	ug/Kg		9/2/2020	10:52
Endrin Ketone	< 3.59	ug/Kg		9/2/2020	10:52
gamma-BHC (Lindane)	**33.6**	ug/Kg	P	9/2/2020	10:52
Heptachlor	**14.5**	ug/Kg	P	9/2/2020	10:52
Heptachlor Epoxide	< 3.59	ug/Kg		9/2/2020	10:52
Methoxychlor	< 3.59	ug/Kg		9/2/2020	10:52
Toxaphene	< 35.9	ug/Kg		9/2/2020	10:52
trans-Chlordane	< 3.59	ug/Kg		9/2/2020	10:52

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
Decachlorobiphenyl (1)	**41.6**	27.3 - 111		9/2/2020	10:52
Tetrachloro-m-xylene (1)	**35.6**	28.5 - 102		9/2/2020	10:52

Method Reference(s): EPA 8081B
EPA 3546
Preparation Date: 9/1/2020

Reactive Cyanide

Analyte	Result	Units	Qualifier	Date Analyzed
Reactivity, Cyanide	<100	mg/Kg		8/30/2020

Method Reference(s): EPA 7.3.3.2
Subcontractor ELAP ID: 11148
ELAP does not offer this test for approval as part of their laboratory certification program.

Reactive Sulfide

Analyte	Result	Units	Qualifier	Date Analyzed
Reactivity, Sulfide	<100	mg/Kg		8/30/2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	SB10, 10-14'		
Lab Sample ID:	204122-04	**Date Sampled:**	8/27/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Method Reference(s): EPA 7.3.4.2
Subcontractor ELAP ID: 11148
ELAP does not offer this test for approval as part of their laboratory certification program.

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 3590	ug/Kg		9/4/2020 12:18
1,2,4,5-Tetrachlorobenzene	< 3590	ug/Kg		9/4/2020 12:18
1,2,4-Trichlorobenzene	< 3590	ug/Kg		9/4/2020 12:18
1,2-Dichlorobenzene	< 3590	ug/Kg		9/4/2020 12:18
1,3-Dichlorobenzene	< 3590	ug/Kg		9/4/2020 12:18
1,4-Dichlorobenzene	< 3590	ug/Kg		9/4/2020 12:18
2,2-Oxybis (1-chloropropane)	< 3590	ug/Kg		9/4/2020 12:18
2,3,4,6-Tetrachlorophenol	< 3590	ug/Kg		9/4/2020 12:18
2,4,5-Trichlorophenol	< 3590	ug/Kg		9/4/2020 12:18
2,4,6-Trichlorophenol	< 3590	ug/Kg		9/4/2020 12:18
2,4-Dichlorophenol	< 3590	ug/Kg		9/4/2020 12:18
2,4-Dimethylphenol	< 3590	ug/Kg		9/4/2020 12:18
2,4-Dinitrophenol	< 14300	ug/Kg		9/4/2020 12:18
2,4-Dinitrotoluene	< 3590	ug/Kg		9/4/2020 12:18
2,6-Dinitrotoluene	< 3590	ug/Kg		9/4/2020 12:18
2-Chloronaphthalene	< 3590	ug/Kg		9/4/2020 12:18
2-Chlorophenol	< 3590	ug/Kg		9/4/2020 12:18
2-Methylnapthalene	**10300**	ug/Kg		9/4/2020 12:18
2-Methylphenol	< 3590	ug/Kg		9/4/2020 12:18
2-Nitroaniline	< 3590	ug/Kg		9/4/2020 12:18
2-Nitrophenol	< 3590	ug/Kg		9/4/2020 12:18
3&4-Methylphenol	< 3590	ug/Kg		9/4/2020 12:18
3,3'-Dichlorobenzidine	< 3590	ug/Kg		9/4/2020 12:18
3-Nitroaniline	< 3590	ug/Kg		9/4/2020 12:18
4,6-Dinitro-2-methylphenol	< 4800	ug/Kg		9/4/2020 12:18

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB10, 10-14'
Lab Sample ID: 204122-04 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

4-Bromophenyl phenyl ether	< 3590	ug/Kg	9/4/2020	12:18
4-Chloro-3-methylphenol	< 3590	ug/Kg	9/4/2020	12:18
4-Chloroaniline	< 3590	ug/Kg	9/4/2020	12:18
4-Chlorophenyl phenyl ether	< 3590	ug/Kg	9/4/2020	12:18
4-Nitroaniline	< 3590	ug/Kg	9/4/2020	12:18
4-Nitrophenol	< 3590	ug/Kg	9/4/2020	12:18
Acenaphthene	< 3590	ug/Kg	9/4/2020	12:18
Acenaphthylene	< 3590	ug/Kg	9/4/2020	12:18
Acetophenone	< 3590	ug/Kg	9/4/2020	12:18
Anthracene	< 3590	ug/Kg	9/4/2020	12:18
Atrazine	< 3590	ug/Kg	9/4/2020	12:18
Benzaldehyde	< 3590	ug/Kg	9/4/2020	12:18
Benzo (a) anthracene	< 3590	ug/Kg	9/4/2020	12:18
Benzo (a) pyrene	< 3590	ug/Kg	9/4/2020	12:18
Benzo (b) fluoranthene	< 3590	ug/Kg	9/4/2020	12:18
Benzo (g,h,i) perylene	< 3590	ug/Kg	9/4/2020	12:18
Benzo (k) fluoranthene	< 3590	ug/Kg	9/4/2020	12:18
Bis (2-chloroethoxy) methane	< 3590	ug/Kg	9/4/2020	12:18
Bis (2-chloroethyl) ether	< 3590	ug/Kg	9/4/2020	12:18
Bis (2-ethylhexyl) phthalate	< 3590	ug/Kg	9/4/2020	12:18
Butylbenzylphthalate	< 3590	ug/Kg	9/4/2020	12:18
Caprolactam	< 3590	ug/Kg	9/4/2020	12:18
Carbazole	< 3590	ug/Kg	9/4/2020	12:18
Chrysene	< 3590	ug/Kg	9/4/2020	12:18
Dibenz (a,h) anthracene	< 3590	ug/Kg	9/4/2020	12:18
Dibenzofuran	< 3590	ug/Kg	9/4/2020	12:18
Diethyl phthalate	< 3590	ug/Kg	9/4/2020	12:18
Dimethyl phthalate	< 3590	ug/Kg	9/4/2020	12:18
Di-n-butyl phthalate	< 3590	ug/Kg	9/4/2020	12:18
Di-n-octylphthalate	< 3590	ug/Kg	9/4/2020	12:18

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier: SB10, 10-14'
Lab Sample ID: 204122-04 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

Fluoranthene	< 3590	ug/Kg	9/4/2020	12:18
Fluorene	< 3590	ug/Kg	9/4/2020	12:18
Hexachlorobenzene	< 3590	ug/Kg	9/4/2020	12:18
Hexachlorobutadiene	< 3590	ug/Kg	9/4/2020	12:18
Hexachlorocyclopentadiene	< 14300	ug/Kg	9/4/2020	12:18
Hexachloroethane	< 3590	ug/Kg	9/4/2020	12:18
Indeno (1,2,3-cd) pyrene	< 3590	ug/Kg	9/4/2020	12:18
Isophorone	< 3590	ug/Kg	9/4/2020	12:18
Naphthalene	**52500**	ug/Kg	9/4/2020	12:18
Nitrobenzene	< 3590	ug/Kg	9/4/2020	12:18
N-Nitroso-di-n-propylamine	< 3590	ug/Kg	9/4/2020	12:18
N-Nitrosodiphenylamine	< 3590	ug/Kg	9/4/2020	12:18
Pentachlorophenol	< 7170	ug/Kg	9/4/2020	12:18
Phenanthrene	< 3590	ug/Kg	9/4/2020	12:18
Phenol	< 3590	ug/Kg	9/4/2020	12:18
Pyrene	< 3590	ug/Kg	9/4/2020	12:18

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	NC	37.8 - 85.8		9/4/2020	12:18
2-Fluorobiphenyl	NC	40.4 - 80.4		9/4/2020	12:18
2-Fluorophenol	NC	38.8 - 77.4		9/4/2020	12:18
Nitrobenzene-d5	NC	37.4 - 75.9		9/4/2020	12:18
Phenol-d5	NC	40.4 - 78		9/4/2020	12:18
Terphenyl-d14	NC	40.2 - 90		9/4/2020	12:18

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49228.D

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed	
1,1,1-Trichloroethane	< 17500	ug/Kg		9/4/2020	15:38
1,1,2,2-Tetrachloroethane	< 17500	ug/Kg		9/4/2020	15:38

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB10, 10-14'
Lab Sample ID: 204122-04 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

1,1,2-Trichloroethane	< 17500	ug/Kg	9/4/2020	15:38
1,1-Dichloroethane	< 17500	ug/Kg	9/4/2020	15:38
1,1-Dichloroethene	< 17500	ug/Kg	9/4/2020	15:38
1,2,3-Trichlorobenzene	< 43700	ug/Kg	9/4/2020	15:38
1,2,4-Trichlorobenzene	< 43700	ug/Kg	9/4/2020	15:38
1,2-Dibromo-3-Chloropropane	< 87500	ug/Kg	9/4/2020	15:38
1,2-Dibromoethane	< 17500	ug/Kg	9/4/2020	15:38
1,2-Dichlorobenzene	< 17500	ug/Kg	9/4/2020	15:38
1,2-Dichloroethane	< 17500	ug/Kg	9/4/2020	15:38
1,2-Dichloropropane	< 17500	ug/Kg	9/4/2020	15:38
1,3-Dichlorobenzene	< 17500	ug/Kg	9/4/2020	15:38
1,4-Dichlorobenzene	< 17500	ug/Kg	9/4/2020	15:38
1,4-Dioxane	< 175000	ug/Kg	9/4/2020	15:38
2-Butanone	< 87500	ug/Kg	9/4/2020	15:38
2-Hexanone	< 43700	ug/Kg	9/4/2020	15:38
4-Methyl-2-pentanone	< 43700	ug/Kg	9/4/2020	15:38
Acetone	< 87500	ug/Kg	9/4/2020	15:38
Benzene	< 17500	ug/Kg	9/4/2020	15:38
Bromochloromethane	< 43700	ug/Kg	9/4/2020	15:38
Bromodichloromethane	< 17500	ug/Kg	9/4/2020	15:38
Bromoform	< 43700	ug/Kg	9/4/2020	15:38
Bromomethane	< 17500	ug/Kg	9/4/2020	15:38
Carbon disulfide	< 17500	ug/Kg	9/4/2020	15:38
Carbon Tetrachloride	< 17500	ug/Kg	9/4/2020	15:38
Chlorobenzene	< 17500	ug/Kg	9/4/2020	15:38
Chloroethane	< 17500	ug/Kg	9/4/2020	15:38
Chloroform	< 17500	ug/Kg	9/4/2020	15:38
Chloromethane	< 17500	ug/Kg	9/4/2020	15:38
cis-1,2-Dichloroethene	< 17500	ug/Kg	9/4/2020	15:38
cis-1,3-Dichloropropene	< 17500	ug/Kg	9/4/2020	15:38

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier: SB10, 10-14'
Lab Sample ID: 204122-04 **Date Sampled:** 8/27/2020
Matrix: Soil **Date Received:** 9/1/2020

Cyclohexane	< 87500	ug/Kg	9/4/2020	15:38
Dibromochloromethane	< 17500	ug/Kg	9/4/2020	15:38
Dichlorodifluoromethane	< 17500	ug/Kg	9/4/2020	15:38
Ethylbenzene	**340000**	ug/Kg	9/4/2020	15:38
Freon 113	< 17500	ug/Kg	9/4/2020	15:38
Isopropylbenzene	**50000**	ug/Kg	9/4/2020	15:38
m,p-Xylene	**1050000**	ug/Kg	9/4/2020	15:38
Methyl acetate	< 17500	ug/Kg	9/4/2020	15:38
Methyl tert-butyl Ether	< 17500	ug/Kg	9/4/2020	15:38
Methylcyclohexane	**190000**	ug/Kg	9/4/2020	15:38
Methylene chloride	< 43700	ug/Kg	9/4/2020	15:38
o-Xylene	**345000**	ug/Kg	9/4/2020	15:38
Styrene	< 43700	ug/Kg	9/4/2020	15:38
Tetrachloroethene	< 17500	ug/Kg	9/4/2020	15:38
Toluene	**140000**	ug/Kg	9/4/2020	15:38
trans-1,2-Dichloroethene	< 17500	ug/Kg	9/4/2020	15:38
trans-1,3-Dichloropropene	< 17500	ug/Kg	9/4/2020	15:38
Trichloroethene	< 17500	ug/Kg	9/4/2020	15:38
Trichlorofluoromethane	< 17500	ug/Kg	9/4/2020	15:38
Vinyl chloride	< 17500	ug/Kg	9/4/2020	15:38

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**80.2**	75 - 134		9/4/2020	15:38
4-Bromofluorobenzene	**123**	59.5 - 129		9/4/2020	15:38
Pentafluorobenzene	**93.3**	88.8 - 118		9/4/2020	15:38
Toluene-D8	**111**	84 - 114		9/4/2020	15:38

Method Reference(s): EPA 8260C
EPA 5035A -- H
Data File: x73084.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	B1, 6-12		
Lab Sample ID:	204122-05	**Date Sampled:**	8/28/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	<0.073	mg/Kg		9/3/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11148

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**1.81**	mg/Kg	M	9/4/2020 14:44
Barium	**303**	mg/Kg	M	9/3/2020 17:51
Cadmium	< 0.275	mg/Kg	M	9/3/2020 17:51
Chromium	**10.9**	mg/Kg	M	9/3/2020 17:51
Lead	**21.5**	mg/Kg	M,D	9/3/2020 17:51
Selenium	< 1.10	mg/Kg	M	9/3/2020 17:51
Silver	< 0.551	mg/Kg	M	9/3/2020 17:51

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200904B

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1221	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1232	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1242	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1248	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1254	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1260	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1262	< 0.121	mg/Kg		9/2/2020 16:57
PCB-1268	< 0.121	mg/Kg		9/2/2020 16:57

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	B1, 6-12		
Lab Sample ID:	204122-05	**Date Sampled:**	8/28/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**80.0**	17.8 - 74	*	9/2/2020 16:57

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/1/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 323	ug/Kg		9/2/2020 19:22
1,2,4,5-Tetrachlorobenzene	< 323	ug/Kg		9/2/2020 19:22
1,2,4-Trichlorobenzene	< 323	ug/Kg		9/2/2020 19:22
1,2-Dichlorobenzene	< 323	ug/Kg		9/2/2020 19:22
1,3-Dichlorobenzene	< 323	ug/Kg		9/2/2020 19:22
1,4-Dichlorobenzene	< 323	ug/Kg		9/2/2020 19:22
2,2-Oxybis (1-chloropropane)	< 323	ug/Kg		9/2/2020 19:22
2,3,4,6-Tetrachlorophenol	< 323	ug/Kg		9/2/2020 19:22
2,4,5-Trichlorophenol	< 323	ug/Kg		9/2/2020 19:22
2,4,6-Trichlorophenol	< 323	ug/Kg		9/2/2020 19:22
2,4-Dichlorophenol	< 323	ug/Kg		9/2/2020 19:22
2,4-Dimethylphenol	< 323	ug/Kg		9/2/2020 19:22
2,4-Dinitrophenol	< 1290	ug/Kg		9/2/2020 19:22
2,4-Dinitrotoluene	< 323	ug/Kg		9/2/2020 19:22
2,6-Dinitrotoluene	< 323	ug/Kg		9/2/2020 19:22
2-Chloronaphthalene	< 323	ug/Kg		9/2/2020 19:22
2-Chlorophenol	< 323	ug/Kg		9/2/2020 19:22
2-Methylnapthalene	< 323	ug/Kg		9/2/2020 19:22
2-Methylphenol	< 323	ug/Kg		9/2/2020 19:22
2-Nitroaniline	< 323	ug/Kg		9/2/2020 19:22
2-Nitrophenol	< 323	ug/Kg		9/2/2020 19:22
3&4-Methylphenol	< 323	ug/Kg		9/2/2020 19:22
3,3'-Dichlorobenzidine	< 323	ug/Kg		9/2/2020 19:22

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier: B1, 6-12
Lab Sample ID: 204122-05 **Date Sampled:** 8/28/2020
Matrix: Soil **Date Received:** 9/1/2020

3-Nitroaniline	< 323	ug/Kg	9/2/2020	19:22
4,6-Dinitro-2-methylphenol	< 432	ug/Kg	9/2/2020	19:22
4-Bromophenyl phenyl ether	< 323	ug/Kg	9/2/2020	19:22
4-Chloro-3-methylphenol	< 323	ug/Kg	9/2/2020	19:22
4-Chloroaniline	< 323	ug/Kg	9/2/2020	19:22
4-Chlorophenyl phenyl ether	< 323	ug/Kg	9/2/2020	19:22
4-Nitroaniline	< 323	ug/Kg	9/2/2020	19:22
4-Nitrophenol	< 323	ug/Kg	9/2/2020	19:22
Acenaphthene	< 323	ug/Kg	9/2/2020	19:22
Acenaphthylene	< 323	ug/Kg	9/2/2020	19:22
Acetophenone	< 323	ug/Kg	9/2/2020	19:22
Anthracene	< 323	ug/Kg	9/2/2020	19:22
Atrazine	< 323	ug/Kg	9/2/2020	19:22
Benzaldehyde	< 323	ug/Kg	9/2/2020	19:22
Benzo (a) anthracene	< 323	ug/Kg	9/2/2020	19:22
Benzo (a) pyrene	< 323	ug/Kg	9/2/2020	19:22
Benzo (b) fluoranthene	< 323	ug/Kg	9/2/2020	19:22
Benzo (g,h,i) perylene	< 323	ug/Kg	9/2/2020	19:22
Benzo (k) fluoranthene	< 323	ug/Kg	9/2/2020	19:22
Bis (2-chloroethoxy) methane	< 323	ug/Kg	9/2/2020	19:22
Bis (2-chloroethyl) ether	< 323	ug/Kg	9/2/2020	19:22
Bis (2-ethylhexyl) phthalate	< 323	ug/Kg	9/2/2020	19:22
Butylbenzylphthalate	< 323	ug/Kg	9/2/2020	19:22
Caprolactam	< 323	ug/Kg	9/2/2020	19:22
Carbazole	< 323	ug/Kg	9/2/2020	19:22
Chrysene	< 323	ug/Kg	9/2/2020	19:22
Dibenz (a,h) anthracene	< 323	ug/Kg	9/2/2020	19:22
Dibenzofuran	< 323	ug/Kg	9/2/2020	19:22
Diethyl phthalate	< 323	ug/Kg	9/2/2020	19:22
Dimethyl phthalate	< 323	ug/Kg	9/2/2020	19:22

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Sample Identifier: B1, 6-12
Lab Sample ID: 204122-05 **Date Sampled:** 8/28/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 323	ug/Kg	9/2/2020	19:22
Di-n-octylphthalate	< 323	ug/Kg	9/2/2020	19:22
Fluoranthene	< 323	ug/Kg	9/2/2020	19:22
Fluorene	< 323	ug/Kg	9/2/2020	19:22
Hexachlorobenzene	< 323	ug/Kg	9/2/2020	19:22
Hexachlorobutadiene	< 323	ug/Kg	9/2/2020	19:22
Hexachlorocyclopentadiene	< 1290	ug/Kg	9/2/2020	19:22
Hexachloroethane	< 323	ug/Kg	9/2/2020	19:22
Indeno (1,2,3-cd) pyrene	< 323	ug/Kg	9/2/2020	19:22
Isophorone	< 323	ug/Kg	9/2/2020	19:22
Naphthalene	< 323	ug/Kg	9/2/2020	19:22
Nitrobenzene	< 323	ug/Kg	9/2/2020	19:22
N-Nitroso-di-n-propylamine	< 323	ug/Kg	9/2/2020	19:22
N-Nitrosodiphenylamine	< 323	ug/Kg	9/2/2020	19:22
Pentachlorophenol	< 646	ug/Kg	9/2/2020	19:22
Phenanthrene	< 323	ug/Kg	9/2/2020	19:22
Phenol	< 323	ug/Kg	9/2/2020	19:22
Pyrene	< 323	ug/Kg	9/2/2020	19:22

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**37.5**	37.8 - 85.8	*	9/2/2020	19:22
2-Fluorobiphenyl	**62.2**	40.4 - 80.4		9/2/2020	19:22
2-Fluorophenol	**58.8**	38.8 - 77.4		9/2/2020	19:22
Nitrobenzene-d5	**62.1**	37.4 - 75.9		9/2/2020	19:22
Phenol-d5	**63.6**	40.4 - 78		9/2/2020	19:22
Terphenyl-d14	**64.6**	40.2 - 90		9/2/2020	19:22

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49139.D

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	B1, 6-12		
Lab Sample ID:	204122-05	**Date Sampled:**	8/28/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 12.7	ug/Kg		9/4/2020 17:08
1,1,2,2-Tetrachloroethane	< 12.7	ug/Kg		9/4/2020 17:08
1,1,2-Trichloroethane	< 12.7	ug/Kg		9/4/2020 17:08
1,1-Dichloroethane	< 12.7	ug/Kg		9/4/2020 17:08
1,1-Dichloroethene	< 12.7	ug/Kg		9/4/2020 17:08
1,2,3-Trichlorobenzene	< 31.8	ug/Kg		9/4/2020 17:08
1,2,4-Trichlorobenzene	< 31.8	ug/Kg		9/4/2020 17:08
1,2-Dibromo-3-Chloropropane	< 63.5	ug/Kg		9/4/2020 17:08
1,2-Dibromoethane	< 12.7	ug/Kg		9/4/2020 17:08
1,2-Dichlorobenzene	< 12.7	ug/Kg		9/4/2020 17:08
1,2-Dichloroethane	< 12.7	ug/Kg		9/4/2020 17:08
1,2-Dichloropropane	< 12.7	ug/Kg		9/4/2020 17:08
1,3-Dichlorobenzene	< 12.7	ug/Kg		9/4/2020 17:08
1,4-Dichlorobenzene	< 12.7	ug/Kg		9/4/2020 17:08
1,4-Dioxane	< 127	ug/Kg		9/4/2020 17:08
2-Butanone	< 63.5	ug/Kg		9/4/2020 17:08
2-Hexanone	< 31.8	ug/Kg		9/4/2020 17:08
4-Methyl-2-pentanone	< 31.8	ug/Kg		9/4/2020 17:08
Acetone	< 63.5	ug/Kg		9/4/2020 17:08
Benzene	< 12.7	ug/Kg		9/4/2020 17:08
Bromochloromethane	< 31.8	ug/Kg		9/4/2020 17:08
Bromodichloromethane	< 12.7	ug/Kg		9/4/2020 17:08
Bromoform	< 31.8	ug/Kg		9/4/2020 17:08
Bromomethane	< 12.7	ug/Kg		9/4/2020 17:08
Carbon disulfide	< 12.7	ug/Kg		9/4/2020 17:08
Carbon Tetrachloride	< 12.7	ug/Kg		9/4/2020 17:08
Chlorobenzene	< 12.7	ug/Kg		9/4/2020 17:08
Chloroethane	< 12.7	ug/Kg		9/4/2020 17:08

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	B1, 6-12		
Lab Sample ID:	204122-05	**Date Sampled:**	8/28/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 12.7	ug/Kg	9/4/2020 17:08
Chloromethane	< 12.7	ug/Kg	9/4/2020 17:08
cis-1,2-Dichloroethene	< 12.7	ug/Kg	9/4/2020 17:08
cis-1,3-Dichloropropene	< 12.7	ug/Kg	9/4/2020 17:08
Cyclohexane	< 63.5	ug/Kg	9/4/2020 17:08
Dibromochloromethane	< 12.7	ug/Kg	9/4/2020 17:08
Dichlorodifluoromethane	< 12.7	ug/Kg	9/4/2020 17:08
Ethylbenzene	< 12.7	ug/Kg	9/4/2020 17:08
Freon 113	< 12.7	ug/Kg	9/4/2020 17:08
Isopropylbenzene	< 12.7	ug/Kg	9/4/2020 17:08
m,p-Xylene	< 12.7	ug/Kg	9/4/2020 17:08
Methyl acetate	< 12.7	ug/Kg	9/4/2020 17:08
Methyl tert-butyl Ether	< 12.7	ug/Kg	9/4/2020 17:08
Methylcyclohexane	< 12.7	ug/Kg	9/4/2020 17:08
Methylene chloride	< 31.8	ug/Kg	9/4/2020 17:08
o-Xylene	< 12.7	ug/Kg	9/4/2020 17:08
Styrene	< 31.8	ug/Kg	9/4/2020 17:08
Tetrachloroethene	< 12.7	ug/Kg	9/4/2020 17:08
Toluene	< 12.7	ug/Kg	9/4/2020 17:08
trans-1,2-Dichloroethene	< 12.7	ug/Kg	9/4/2020 17:08
trans-1,3-Dichloropropene	< 12.7	ug/Kg	9/4/2020 17:08
Trichloroethene	< 12.7	ug/Kg	9/4/2020 17:08
Trichlorofluoromethane	< 12.7	ug/Kg	9/4/2020 17:08
Vinyl chloride	< 12.7	ug/Kg	9/4/2020 17:08

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204122

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Sample Identifier:	B1, 6-12		
Lab Sample ID:	204122-05	**Date Sampled:**	8/28/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**88.3**	75 - 134		9/4/2020	17:08
4-Bromofluorobenzene	**113**	59.5 - 129		9/4/2020	17:08
Pentafluorobenzene	**104**	88.8 - 118		9/4/2020	17:08
Toluene-D8	**101**	84 - 114		9/4/2020	17:08

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73088.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: Ravi Engineering & Land Surveying, P.C.
Project Reference: Terminal B #40-20-118
Lab Project ID: 204122
Matrix: Soil

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed	
Arsenic	<0.476	mg/Kg		9/3/2020	17:19
Barium	<4.76	mg/Kg		9/3/2020	17:19
Cadmium	<0.238	mg/Kg		9/3/2020	17:19
Chromium	<0.476	mg/Kg		9/3/2020	17:19
Lead	<0.476	mg/Kg		9/3/2020	17:19
Selenium	<0.952	mg/Kg		9/3/2020	17:19
Silver	<0.476	mg/Kg		9/3/2020	17:19

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B
QC Batch ID: QC200902Soil
QC Number: Blk 1

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Report Prepared Tuesday, September 8, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC

QC Report for Laboratory Control Sample and Control Sample Duplicate

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Lab Project ID: 204122

Matrix: Soil

RCRA Metals (ICP)

Analyte	LCS Added	LCSD Added	Spike Units	LCS Result	LCSD Result	LCS % Recovery	LCSD % Recovery	% Rec Limits	LCS Outliers	LCSD Outliers	Relative % Difference	RPD Limit	RPD Outliers	Date Analyzed
Arsenic	116	125	mg/Kg	107	115	92.4	92.2	80 - 120			0.208	20		9/3/2020
Barium	116	125	mg/Kg	119	128	102	102	80 - 120			0.360	20		9/3/2020
Cadmium	46.3	50.0	mg/Kg	48.6	52.2	105	104	80 - 120			0.555	20		9/3/2020
Chromium	116	125	mg/Kg	117	125	101	100	80 - 120			0.364	20		9/3/2020
Lead	116	125	mg/Kg	118	128	102	102	80 - 120			0.311	20		9/3/2020
Selenium	116	125	mg/Kg	99.9	108	86.3	86.7	80 - 120			0.412	20		9/3/2020
Silver	11.6	12.5	mg/Kg	10.8	11.7	93.7	93.2	80 - 120			0.478	20		9/3/2020

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B
QC Number: 1
QC Batch ID: QC200902Soil

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Report Prepared Tuesday, September 8, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC

QC Report for Sample Spike and Sample Duplicate

Client: Ravi Engineering & Land Surveying, P.C. **Lab Project ID:** 204122

Project Reference: Terminal B #40-20-118

Lab Sample ID: 204122-05 **Date Sampled:** 8/28/2020
Sample Identifier: B1, 6-12 **Date Received:** 9/1/2020
Matrix: Soil

RCRA Metals (ICP)

Analyte	Sample Results	Result Units	Spike Added	Spike Result	Spike % Recovery	% Rec Limits	Spike Outliers	Duplicate Result	Relative % Difference	RPD Limit	RPD Outliers	Date Analyzed
Arsenic	**1.81**	mg/Kg	138	72.3	51.2	75 - 125	*	2.03	11.5	20		9/3/2020
Barium	**303**	mg/Kg	138	397	68.5	75 - 125	*	355	16.0	20		9/3/2020
Cadmium	< 0.275	mg/Kg	55.1	24.6	44.7	75 - 125	*	<0.281	NC	20		9/3/2020
Chromium	**10.9**	mg/Kg	138	68.8	42.1	75 - 125	*	10.1	7.23	20		9/3/2020
Lead	**21.5**	mg/Kg	138	66.9	33.0	75 - 125	*	12.2	55.7	20	*	9/3/2020
Selenium	< 1.10	mg/Kg	138	62.8	45.6	75 - 125	*	<3.37	NC	20		9/3/2020
Silver	< 0.551	mg/Kg	13.8	7.52	54.6	75 - 125	*	<0.561	NC	20		9/3/2020

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/2/2020
Data File: 200903B
200904B
200904B
QC Batch ID: QC200902Soil

NC = Not Calculable. Applicable to RPD if sample or duplicate result is non-detect or estimated (see primary report for data flags). Applicable to MS if sample is greater or equal to ten times the spike added.

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Report Prepared Tuesday, September 8, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Lab Project ID: 204122

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed	
1,1-Biphenyl	<279	ug/Kg		9/2/2020	15:24
1,2,4,5-Tetrachlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,2,4-Trichlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,2-Dichlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,3-Dichlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,4-Dichlorobenzene	<279	ug/Kg		9/2/2020	15:24
2,2-Oxybis (1-chloropropane)	<279	ug/Kg		9/2/2020	15:24
2,3,4,6-Tetrachlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4,5-Trichlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4,6-Trichlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4-Dichlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4-Dimethylphenol	<279	ug/Kg		9/2/2020	15:24
2,4-Dinitrophenol	<1120	ug/Kg		9/2/2020	15:24
2,4-Dinitrotoluene	<279	ug/Kg		9/2/2020	15:24
2,6-Dinitrotoluene	<279	ug/Kg		9/2/2020	15:24
2-Chloronaphthalene	<279	ug/Kg		9/2/2020	15:24
2-Chlorophenol	<279	ug/Kg		9/2/2020	15:24
2-Methylnapthalene	<279	ug/Kg		9/2/2020	15:24
2-Methylphenol	<279	ug/Kg		9/2/2020	15:24
2-Nitroaniline	<279	ug/Kg		9/2/2020	15:24
2-Nitrophenol	<279	ug/Kg		9/2/2020	15:24
3&4-Methylphenol	<279	ug/Kg		9/2/2020	15:24
3,3'-Dichlorobenzidine	<279	ug/Kg		9/2/2020	15:24
3-Nitroaniline	<279	ug/Kg		9/2/2020	15:24
4,6-Dinitro-2-methylphenol	<559	ug/Kg		9/2/2020	15:24
4-Bromophenyl phenyl ether	<279	ug/Kg		9/2/2020	15:24
4-Chloro-3-methylphenol	<279	ug/Kg		9/2/2020	15:24
4-Chloroaniline	<279	ug/Kg		9/2/2020	15:24

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PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B #40-20-118

Lab Project ID: 204122

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed	
4-Chlorophenyl phenyl ether	<279	ug/Kg		9/2/2020	15:24
4-Nitroaniline	<279	ug/Kg		9/2/2020	15:24
4-Nitrophenol	<279	ug/Kg		9/2/2020	15:24
Acenaphthene	<279	ug/Kg		9/2/2020	15:24
Acenaphthylene	<279	ug/Kg		9/2/2020	15:24
Acetophenone	<279	ug/Kg		9/2/2020	15:24
Anthracene	<279	ug/Kg		9/2/2020	15:24
Atrazine	<279	ug/Kg		9/2/2020	15:24
Benzaldehyde	<279	ug/Kg		9/2/2020	15:24
Benzo (a) anthracene	<279	ug/Kg		9/2/2020	15:24
Benzo (a) pyrene	<279	ug/Kg		9/2/2020	15:24
Benzo (b) fluoranthene	<279	ug/Kg		9/2/2020	15:24
Benzo (g,h,i) perylene	<279	ug/Kg		9/2/2020	15:24
Benzo (k) fluoranthene	<279	ug/Kg		9/2/2020	15:24
Bis (2-chloroethoxy) methane	<279	ug/Kg		9/2/2020	15:24
Bis (2-chloroethyl) ether	<279	ug/Kg		9/2/2020	15:24
Bis (2-ethylhexyl) phthalate	<279	ug/Kg		9/2/2020	15:24
Butylbenzylphthalate	<279	ug/Kg		9/2/2020	15:24
Caprolactam	<279	ug/Kg		9/2/2020	15:24
Carbazole	<279	ug/Kg		9/2/2020	15:24
Chrysene	<279	ug/Kg		9/2/2020	15:24
Dibenz (a,h) anthracene	<279	ug/Kg		9/2/2020	15:24
Dibenzofuran	<279	ug/Kg		9/2/2020	15:24
Diethyl phthalate	<279	ug/Kg		9/2/2020	15:24
Dimethyl phthalate	<279	ug/Kg		9/2/2020	15:24
Di-n-butyl phthalate	<279	ug/Kg		9/2/2020	15:24
Di-n-octylphthalate	<279	ug/Kg		9/2/2020	15:24
Fluoranthene	<279	ug/Kg		9/2/2020	15:24

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PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Lab Project ID: 204122

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed	
Fluorene	<279	ug/Kg		9/2/2020	15:24
Hexachlorobenzene	<279	ug/Kg		9/2/2020	15:24
Hexachlorobutadiene	<279	ug/Kg		9/2/2020	15:24
Hexachlorocyclopentadiene	<1120	ug/Kg		9/2/2020	15:24
Hexachloroethane	<279	ug/Kg		9/2/2020	15:24
Indeno (1,2,3-cd) pyrene	<279	ug/Kg		9/2/2020	15:24
Isophorone	<279	ug/Kg		9/2/2020	15:24
Naphthalene	<279	ug/Kg		9/2/2020	15:24
Nitrobenzene	<279	ug/Kg		9/2/2020	15:24
N-Nitroso-di-n-propylamine	<279	ug/Kg		9/2/2020	15:24
N-Nitrosodiphenylamine	<279	ug/Kg		9/2/2020	15:24
Pentachlorophenol	<559	ug/Kg		9/2/2020	15:24
Phenanthrene	<279	ug/Kg		9/2/2020	15:24
Phenol	<279	ug/Kg		9/2/2020	15:24
Pyrene	<279	ug/Kg		9/2/2020	15:24

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**61.1**	37.8 - 85.8		9/2/2020	15:24
2-Fluorobiphenyl	**62.8**	40.4 - 80.4		9/2/2020	15:24
2-Fluorophenol	**62.8**	38.8 - 77.4		9/2/2020	15:24
Nitrobenzene-d5	**61.9**	37.4 - 75.9		9/2/2020	15:24
Phenol-d5	**65.5**	40.4 - 78		9/2/2020	15:24
Terphenyl-d14	**66.9**	40.2 - 90		9/2/2020	15:24

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49131.D
QC Batch ID: QC200902ABNS
QC Number: 1

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PARADIGM ENVIRONMENTAL SERVICES, INC

QC Report for Laboratory Control Sample

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B #40-20-118

Lab Project ID: 204122

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Spike Added	Spike Units	LCS Result	LCS % Recovery	% Rec Limits	LCS Outliers	Date Analyzed
1,2,4-Trichlorobenzene	2790	ug/Kg	1670	59.9	45.7 - 73.3		9/2/2020
1,4-Dichlorobenzene	2790	ug/Kg	1610	57.7	43.1 - 68.3		9/2/2020
2,4-Dinitrotoluene	2790	ug/Kg	1910	68.2	44.4 - 83.4		9/2/2020
2-Chlorophenol	4190	ug/Kg	2650	63.4	48.8 - 77.3		9/2/2020
4-Chloro-3-methylphenol	4190	ug/Kg	2750	65.7	50 - 82.5		9/2/2020
4-Nitrophenol	4190	ug/Kg	2670	63.7	42.7 - 85.9		9/2/2020
Acenaphthene	2790	ug/Kg	1860	66.5	46.4 - 78.8		9/2/2020
N-Nitroso-di-n-propylamine	2790	ug/Kg	1810	64.8	43.2 - 78.2		9/2/2020
Pentachlorophenol	4190	ug/Kg	2600	62.0	32.1 - 116		9/2/2020
Phenol	4190	ug/Kg	2580	61.5	47.5 - 78		9/2/2020
Pyrene	2790	ug/Kg	2040	72.9	47.1 - 88.4		9/2/2020

Method Reference(s): EPA 8270D
EPA 3546

Preparation Date: 9/2/2020
Data File: B49132.D
QC Number: 1
QC Batch ID: QC200902ABNS

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Report Prepared Thursday, September 03, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC

QC Report for Matrix Spike and Matrix Spike Duplicate

Client: Ravi Engineering & Land Surveying, P.C.

Lab Project ID: 204122

Project Reference: Terminal B #40-20-118

Lab Sample ID: 204122-01
Sample Identifier: SB7, 4-6'
Matrix: Soil

Date Sampled: 8/27/2020
Date Received: 9/1/2020
Date Analyzed: 9/2/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Sample Result	Result Units	MS Added	MS Result	MS % Recovery	MSD Added	MSD Result	MSD % Recovery	% Rec. Limits	MS Outlier	MSD Outlier	Relative % Diff.	RPD Limit	RPD Outlier
1,2,4-Trichlorobenzene	< 323	ug/Kg	3260	1660	51.0	3120	1780	57.2	45.7 - 73.3			11.3	28.2	
1,4-Dichlorobenzene	< 323	ug/Kg	3260	1440	44.1	3120	1540	49.4	43.1 - 68.3			11.5	27.9	
2,4-Dinitrotoluene	< 323	ug/Kg	3260	1800	55.1	3120	1970	63.0	44.4 - 83.4			13.4	42.9	
2-Chlorophenol	< 323	ug/Kg	4890	2540	51.9	4680	2700	57.8	48.8 - 77.3			10.8	26.4	
4-Chloro-3-methylphenol	< 323	ug/Kg	4890	2780	56.8	4680	3030	64.8	50 - 82.5			13.1	30.2	
4-Nitrophenol	< 323	ug/Kg	4890	1600	32.6	4680	1880	40.1	42.7 - 85.9	*	*	20.5	34.2	
Acenaphthene	< 323	ug/Kg	3260	1830	56.2	3120	2000	64.2	46.4 - 78.8			13.3	29.7	
N-Nitroso-di-n-propylamine	< 323	ug/Kg	3260	1770	54.4	3120	1900	60.8	43.2 - 78.2			11.2	33.8	
Pentachlorophenol	< 645	ug/Kg	4890	728	14.9	4680	900	19.2	32.1 - 116	*	*	25.5	43.9	
Phenol	< 323	ug/Kg	4890	2570	52.5	4680	2720	58.2	47.5 - 78			10.2	27	
Pyrene	< 323	ug/Kg	3260	2120	64.8	3120	2340	75.0	47.1 - 88.4			14.5	33.9	

Any estimated values are displayed, and derived values calculated, based on numeric result only. See primary analytical report for data flags.

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Report Prepared Thursday, September 03, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC.

QC Report for Matrix Spike and Matrix Spike Duplicate

Client: Ravi Engineering & Land Surveying, P.C.

Lab Project ID: 204122

Project Reference: Terminal B #40-20-118

Lab Sample ID: 204122-01
Sample Identifier: SB7, 4-6'
Matrix: Soil

Date Sampled: 8/27/2020
Date Received: 9/1/2020
Date Analyzed: 9/2/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Sample Result	Result Units	MS Added	MS Result	MS % Recovery	MSD Added	MSD Result	MSD % Recovery	% Rec. Limits	MS Outlier	MSD Outlier	Relative % Diff.	RPD Limit	RPD Outlier

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File(s): B49134.D
B49135.D
B49133.D
1
QC Batch ID: QC200902ABNS

Any estimated values are displayed, and derived values calculated, based on numeric result only. See primary analytical report for data flags.

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Report Prepared Thursday, September 03, 2020

Analytical Report Appendix

The reported results relate only to the samples as they have been received by the laboratory.

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All soil/sludge samples have been reported on a dry weight basis, unless qualified "reported as received". Other solids are reported as received.

Low level Volatiles blank reports for soil/solid matrix are based on a nominal 5 gram weight. Sample results and reporting limits are based on actual weight, which may be more or less than 5 grams.

The Chain of Custody provides additional information, including compliance with sample condition requirements upon receipt. Sample condition requirements are defined under the 2003 NELAC Standard, sections 5.5.8.3.1 and 5.5.8.3.2.

NYSDOH ELAP does not certify for all parameters. Paradigm Environmental Services or the indicated subcontracted laboratory does hold certification for all analytes where certification is offered by ELAP unless otherwise specified. Aliquots separated for certain tests, such as TCLP, are indicated on the Chain of Custody and final reports with an "A" suffix.

Data qualifiers are used, when necessary, to provide additional information about the data. This information may be communicated as a flag or as text at the bottom of the report. Please refer to the following list of analyte-specific, frequently used data flags and their meaning:

"<" = Analyzed for but not detected at or above the quantitation limit.
"E" = Result has been estimated, calibration limit exceeded.
"Z" = See case narrative.
"D" = Sample, Laboratory Control Sample, or Matrix Spike Duplicate results above Relative Percent Difference limit.
"M" = Matrix spike recoveries outside QC limits. Matrix bias indicated.
"B" = Method blank contained trace levels of analyte. Refer to included method blank report.
"J" = Result estimated between the quantitation limit and half the quantitation limit.
"L" = Laboratory Control Sample recovery outside accepted QC limits.
"P" = Concentration differs by more than 40% between the primary and secondary analytical columns.
"NC" = Not calculable. Applicable to RPD if sample or duplicate result is non-detect or estimated (see primary report for data flags). Applicable to MS if sample is greater or equal to ten times the spike added. Applicable to sample surrogates or MS if sample dilution is 10x or higher.
"" = Indicates any recoveries outside associated acceptance windows. Surrogate outliers in samples are presumed matrix effects. LCS demonstrates method compliance unless otherwise noted.*
"(1)" = Indicates data from primary column used for QC calculation.
"A" = denotes a parameter for which ELAP does not offer approval as part of their laboratory certification program.
"F" = denotes a parameter for which Paradigm does not carry certification, the results for which should therefore only be used where ELAP certification is not required, such as personal exposure assessment.

GENERAL TERMS AND CONDITIONS
LABORATORY SERVICES

These Terms and Conditions embody the whole agreement of the parties in the absence of a signed and executed contract between the Laboratory (LAB) and Client. They shall supersede all previous communications, representations, or agreements, either verbal or written, between the parties. The LAB specifically rejects all additional, inconsistent, or conflicting terms, whether printed or otherwise set forth in any purchase order or other communication from the Client to the LAB. The invalidity or unenforceability in whole or in part of any provision, tern or condition hereof shall not affect in any way the validity or enforceability of the remainder of the Terms and Conditions. No waiver by LAB of any provision, term, or condition hereof or of any breach by or obligation of the Client hereunder shall constitute a waiver of such provision, term, or condition on any other occasion or a waiver of any other breach by or obligation of the Client. This agreement shall be administered and interpreted under the laws of the state which services are procured.

Warranty. Recognizing that the nature of many samples is unknown and that some may contain potentially hazardous components, LAB warrants only that it will perform testing services, obtain findings, and prepare reports in accordance with generally accepted analytical laboratory principles and practices at the time of performance of services. LAB makes no other warranty, express or implied.

Scope and Compensation. LAB agrees to perform the services described in the chain of custody to which these terms and conditions are attached. Unless the parties agree in writing to the contrary, the duties of LAB shall not be construed to exceed the services specifically described. LAB wi use LAB default method for all tests unless specified otherwise on the Work Order.

Payment terms are net 30 days from the date of invoice. All overdue payments are subject to an interest charge of one and one-half percent (1-1/2%) per month or a portion thereof. Client shall also be responsible for costs of collection, including payment of reasonable attorney fees if such expense is incurred. The prices, unless stated, do not include any sale, use or other taxes. Such taxes will be added to invoice prices when required.

Prices. Compensation for services performed will be based on the current Lab Analytical Fee Schedule or on quotations agreed to in writing by the parties. Turnaround time based charges are determined from the time of resolution of all work order questions. Testimony, court appearances or data compilation for legal action will be charged separately. Evaluation and reporting of initial screening runs may incur additional fees.

Limitations of Liability. In the event of any error, omission, or other professional negligence, the sole and exclusive responsibility of LAB shall be to re-perform the deficient work at its own expense and LAB shall have no other liability whatsoever. All claims shall be deemed waived unless made in writing and received by LAB within ninety (90) days following completion of services.

LAB shall have no liability, obligation, or responsibility of any kind for losses, costs, expenses, or other damages (including but not limited to any special, direct, incidental or consequential damages) with respect to LAB's services or results.

All results provided by LAB are strictly for the use of its clients and LAB is in no way responsible for the use of such results by clients or third parties. All reports should be considered in their entirety, and LAB is not responsible for the separation, detachment, or other use of any portion of these reports. Client may not assign the lab report without the written consent of the LAB.

Client covenants and agrees, at its/his/her sole expense, to indemnify, protect, defend, and save harmless the LAB from and against any and all damages, losses, liabilities, obligations, penalties, claims, litigation, demands, defenses, judgments, suits, actions, proceedings, costs, disbursements and/or expenses (including, without limitation attorneys' and experts' fees and disbursements) of any kind whatsoever which may at any time be imposed upon, incurred by or asserted or awarded against client relating to, resulting from or arising out of (a) the breach of this agreement by this client, (b) the negligence of the client in handling, delivering or disclosing any hazardous substance, (c) the violation of the Client of any applicable law, (d) non-compliance by the Client with any environmental permit or (e) a material misrepresentation in disclosing the materials to be tested.

Hazard Disclosure. Client represents and warrants that any sample delivered to LAB will be preceded or accompanied by complete written disclosure of the presence of any hazardous substances known or suspected by Client. Client further warrants that any sample containing any hazardous substance that is to be delivered to LAB will be packaged, labeled, transported, and delivered properly and in accordance with applicable laws.

Sample Handling. Prior to LAB's acceptance of any sample (or after any revocation of acceptance), the entire risk of loss or of damage to such sample remains with Client. Samples are accepted when receipt is acknowledged on chain of custody documentation. In no event will LAB have any responsibility for the action or inaction of any carrier shipping or delivering any sample to or from LAB premises.

Client authorizes LAB to proceed with the analysis of samples as received by the laboratory, recognizing that any samples not in compliance with all current DOH-ELAP-NELAP requirements for containers, preservation or holding time will be noted as such on th final report.

Disposal of hazardous waste samples is the responsibility of the Client. If the Client does not wish such samples returned, LAB may add storage and disposal fees to the final invoice. Maximum storage time for samples is 30 days after completion of analysis unless modified by applicable state or federal laws. Client will be required to give the LAB written instructions concerning disposal of these samples.

LAB reserves the absolute right, exercisable at any time, to refuse to receive delivery of, refuse to accept, or revoke acceptance of any sample, which, in the sole judgment of LAB (a) is of unsuitable volume, (b) may be or become unsuitable for or may pose a risk in handling, transport, or processing for any health, safety, environmental or other reason whether or not due to the presence in the sample of any hazardous substance, and whether or not such presence has been disclosed to LAB by Client or (c) if the condition or sample date make the sample unsuitable for analysis.

Legal Responsibility. LAB is solely responsible for performance of this contract, and no affiliated company, director, officer, employee, or agent shall have any legal responsibility hereunder, whether in contract or tort including negligence.

Assignment. LAB may assign its performance obligations under this contract to other parties, as it deems necessary. LAB shall disclose to Client any assignee (subcontractor) by ELAP ID # on the submitted final report.

Force Majeure. LAB shall have no responsibility or liability to the Client for any failure or delay in performance by LAB, which results in whole or in part from any cause or circumstance beyond the reasonable control of LAB. Such causes and circumstances shall include, but not limited to, acts of God, acts or orders of any government authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, difficulties or delays in transportation, mail or delivery services, inability to obtain sufficient services or supplies from LAB's usual suppliers, or any other cause beyond LAB's reasonable control.

Law. This contract shall be continued under the laws of the State of New York without regard to its conflicts of laws provision.

179 Lake Avenue, Rochester, NY 14608 Office (585) 647-2530 Fax (585) 647-3311

PARADIGM

CHAIN OF CUSTODY

1 of 2

REPORT TO:
CLIENT: Bavi Engineering
ADDRESS: 2110 S. Clinton Ave Suite 1
CITY: Rochester STATE: NY ZIP 14618
PHONE: 585-697-2821 office 585-703-4932 cell
ATTN: Jim MacKecknie

INVOICE TO:
CLIENT:
ADDRESS: SAME
CITY: STATE: ZIP:
PHONE:
ATTN: per history 9/1/2020

LAB PROJECT ID: 204122
Quotation #:
Email: jmackecknie@bavieng.com

PROJECT REFERENCE
Terminal B
40-20-118

Matrix Codes:
AQ - Aqueous Liquid, NQ - Non-Aqueous Liquid, WA - Water, WG - Groundwater, DW - Drinking Water, WW - Wastewater, SO - Soil, SL - Sludge, SD - Solid, PT - Paint, WP - Wipe, CK - Caulk, OL - Oil, AR - Air

REQUESTED ANALYSIS

DATE COLLECTED	TIME COLLECTED	COMPOSITE	GRAB	SAMPLE IDENTIFIER	MATRIX CODES	NUMBER OF CONTAINERS	VOC 8260 full TCL	SVOC 8270	BCRA Metals	PCB	Reactivity	Pesticides	Corrosivity	Flashpt	Herbicides		REMARKS	PARADIGM LAB SAMPLE NUMBER
8-27-2020	915		x	SB7, 4-6'	SO	2	x	x	x	x								01
	1045		x	SB8, 6-8'	SO	2	x	x	x	x								02
	1135		x	SB9, 3-5'	SO	2	x	x	x	x								03
	1355		x	SB10, 10-14'	SO	4	x	x	x	x	x	x	x	x	x		400 ppm PID	04
8-28-2020	850		x	B1 ST, 6-12	SO	2	x	x	x	x							89 ppm PID	05
				per client GP 9/1/2020														
																	Sub sent directly to	
																	sub lab. GP 9/1/2020	

Turnaround Time		Report Supplements			
Availability contingent upon lab approval; additional fees may apply.					
Standard 5 day	☒	None Required	☐	None Required	☐
10 day	☐	Batch QC	☐	Basic EDD	☐
Rush 3 day	☐	Category A	☐	NYSDEC EDD	☐
Rush 2 day	☐	Category B	☐		
Rush 1 day	☐				
Date Needed _____ please indicate date needed: _____		Other please indicate package needed: _____	☐	Other EDD please indicate EDD needed: _____	☐

	Date/Time	
Sampled By	8/28/20	3:10
Relinquished By	8/28/20	3:10
Received By	8-28-20	3:10
Received @ Lab By	9/1/2020 GP 9/1/2020	08:53

Total Cost:

P.I.F.

3°C iced 8/31/2020 16:02

By signing this form, client agrees to Paradigm Terms and Conditions (reverse).

See additional page for sample conditions.

PARADIGM

Chain of Custody Supplement

Client: Ravi Engineering **Completed by:** Glenn Pezzulo

Lab Project ID: 204122 **Date:** 9/1/2020

Sample Condition Requirements

Per NELAC/ELAP 210/241/242/243/244

Condition	NELAC compliance with the sample condition requirements upon receipt: Yes	No	N/A
Container Type	X	X 5035	
Comments			
Transferred to method-compliant container	X Sub-out		X
Headspace (<1 mL)			X
Comments	Portion of samples transferred to 2oz gloss jars for Hg sub-out.		
Preservation			X
Comments			
Chlorine Absent (<0.10 ppm per test strip)			X
Comments			
Holding Time	X		
Comments			
Temperature	X		X metals
Comments	3°C iced		
Compliant Sample Quantity/Type	X		
Comments	Sample for Reactivity, Herbicides sent directly to sub lab.		

179 Lake Avenue, Rochester, NY 14608 Office (585) 647-2530 Fax (585) 647-3311

1 of 1

CHAIN OF CUSTODY

NEC L20360094

11148

PARADIGM ENVIRONMENTAL SERVICES, INC

REPORT TO:		INVOICE TO:			
COMPANY:	Paradigm Environmental	COMPANY:	Same	LAB PROJECT #:	CLIENT PROJECT #:
ADDRESS:	179 Lake Avenue	ADDRESS:			
CITY: Rochester	STATE: NY ZIP: 14608	CITY:	STATE: ZIP:	TURNAROUND TIME: (WORKING DAYS)	
PHONE:	FAX:	PHONE:	FAX:	STD	OTHER
ATTN:	Reporting	ATTN:	Accounts Payable	1 2 3 5	
COMMENTS:	Please email results to reporting@paradigmenv.com			Date Due: 9/8/2020	

PROJECT NAME/SITE NAME:

REQUESTED ANALYSIS

	DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER CONTAINERS	Mercury										REMARKS	PARADIGM LAB SAMPLE NUMBER
1	8/27/2020	09:15		x	204122-01	Soil	1	x											
2		10:45			-02														
3		11:35			-03														
4		13:55			-04														
5		08:50			-05														
6																			
7																			
8																			
9																			
10																			

LAB USE ONLY BELOW THIS LINE

Sample Condition: Per NELAC/ELAP 210/241/242/243/244

Receipt Parameter	NELAC Compliance	
Container Type:	Y ☐	N ☐
Comments:		
Preservation:	Y ☐	N ☐
Comments:		
Holding Time:	Y ☐	N ☐
Comments:		
Temperature:	Y ☐	N ☐
Comments:		

Client

Sampled By	Date/Time	
[signature]	9/1/2020	16:00
Relinquished By	Date/Time	
R Cunningham AAL	9/1/20	16:10
Received By	Date/Time	
[signature]	9/2/20	0130
Received By	Date/Time	
Received @ Lab By	Date/Time	

Total Cost:

P.I.F.

179 Lake Avenue, Rochester, NY 14608 Office (585) 647-2530 Fax (585) 647-3311

PARADIGM ENVIRONMENTAL SERVICES, INC.

CHAIN OF CUSTODY

11148

L2035647

REPORT TO:		INVOICE TO:	
COMPANY:	Paradigm Environmental	COMPANY:	Same
ADDRESS:	179 Lake Avenue	ADDRESS:	
CITY:	Rochester STATE: NY ZIP: 14608	CITY:	STATE: ZIP:
PHONE:	FAX:	PHONE:	FAX:
ATTN:	Reporting	ATTN:	Accounts Payable
COMMENTS:	Please email results to reporting@paradigmenv.com		

LAB PROJECT #:

CLIENT PROJECT #:

TURNAROUND TIME: (WORKING DAYS)

STD: 1 [ ] 2 [ ] 3 [ ] 5 [X]

OTHER [ ]

Date Due:

PROJECT NAME/SITE NAME: Terminal B #40-20-118

REQUESTED ANALYSIS

DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER OF CONTAINERS	Reactivity	Herbicides									REMARKS	PARADIGM LAB SAMPLE NUMBER
8-27-20	1355		X	SB10, 10-14'	SO	1												

LAB USE ONLY BELOW THIS LINE

Sample Condition: Per NELAC/ELAP 210/241/242/243/244

Receipt Parameter	NELAC Compliance	
Container Type:	Y [ ]	N [ ]
Comments:		
Preservation:	Y [ ]	N [ ]
Comments:		
Holding Time:	Y [ ]	N [ ]
Comments:		
Temperature:	Y [ ]	N [ ]
Comments:		

Client

Sampled By: Brian Zlich	Date/Time: 8-28-20 15:50
Relinquished By: BZ AAC	Date/Time: 8-28-20 @ 15:51
Received By: BZ	Date/Time: 8-28-20 @ 15:50
Received By: Relinquished	Date/Time: 8/29/20 0030
Received @ Lab By	Date/Time

Total Cost:

P.I.F.

PARADIGM
ENVIRONMENTAL SERVICES INC

Analytical Report For

Ravi Engineering & Land Surveying, P.C.

For Lab Project ID

204143

Referencing

Terminal B Project # 40-20-118

Prepared

Wednesday, September 9, 2020

Any noncompliant QC parameters or other notes impacting data interpretation are flagged or documented on the final report or are noted below.

Certifies that this report has been approved by the Technical Director or Designee

179 Lake Avenue • Rochester, NY 14608 • (585) 647-2530 • Fax (585) 647-3311 • ELAP ID# 10958

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB4, 6-8.5'		
Lab Sample ID:	204143-01	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	<0.078	mg/Kg		9/5/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**1.41**	mg/Kg		9/8/2020 20:42
Barium	**10.7**	mg/Kg		9/8/2020 20:42
Cadmium	**0.350**	mg/Kg		9/8/2020 20:42
Chromium	**6.01**	mg/Kg		9/8/2020 20:42
Lead	**9.13**	mg/Kg		9/8/2020 20:42
Selenium	< 1.22	mg/Kg		9/8/2020 20:42
Silver	< 0.611	mg/Kg		9/8/2020 20:42

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/4/2020
Data File: 200908E

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1221	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1232	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1242	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1248	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1254	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1260	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1262	< 0.159	mg/Kg		9/3/2020 16:23
PCB-1268	< 0.159	mg/Kg		9/3/2020 16:23

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Report Prepared Wednesday, September 9, 2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB4, 6-8.5'		
Lab Sample ID:	204143-01	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**74.4**	17.8 - 74	*	9/3/2020 16:23

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/2/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 325	ug/Kg		9/2/2020 21:21
1,2,4,5-Tetrachlorobenzene	< 325	ug/Kg		9/2/2020 21:21
1,2,4-Trichlorobenzene	< 325	ug/Kg		9/2/2020 21:21
1,2-Dichlorobenzene	< 325	ug/Kg		9/2/2020 21:21
1,3-Dichlorobenzene	< 325	ug/Kg		9/2/2020 21:21
1,4-Dichlorobenzene	< 325	ug/Kg		9/2/2020 21:21
2,2-Oxybis (1-chloropropane)	< 325	ug/Kg		9/2/2020 21:21
2,3,4,6-Tetrachlorophenol	< 325	ug/Kg		9/2/2020 21:21
2,4,5-Trichlorophenol	< 325	ug/Kg		9/2/2020 21:21
2,4,6-Trichlorophenol	< 325	ug/Kg		9/2/2020 21:21
2,4-Dichlorophenol	< 325	ug/Kg		9/2/2020 21:21
2,4-Dimethylphenol	< 325	ug/Kg		9/2/2020 21:21
2,4-Dinitrophenol	< 1300	ug/Kg		9/2/2020 21:21
2,4-Dinitrotoluene	< 325	ug/Kg		9/2/2020 21:21
2,6-Dinitrotoluene	< 325	ug/Kg		9/2/2020 21:21
2-Chloronaphthalene	< 325	ug/Kg		9/2/2020 21:21
2-Chlorophenol	< 325	ug/Kg		9/2/2020 21:21
2-Methylnapthalene	< 325	ug/Kg		9/2/2020 21:21
2-Methylphenol	< 325	ug/Kg		9/2/2020 21:21
2-Nitroaniline	< 325	ug/Kg		9/2/2020 21:21
2-Nitrophenol	< 325	ug/Kg		9/2/2020 21:21
3&4-Methylphenol	< 325	ug/Kg		9/2/2020 21:21
3,3'-Dichlorobenzidine	< 325	ug/Kg		9/2/2020 21:21

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Report Prepared Wednesday, September 9, 2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB4, 6-8.5'		
Lab Sample ID:	204143-01	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

3-Nitroaniline	< 325	ug/Kg	9/2/2020 21:21
4,6-Dinitro-2-methylphenol	< 435	ug/Kg	9/2/2020 21:21
4-Bromophenyl phenyl ether	< 325	ug/Kg	9/2/2020 21:21
4-Chloro-3-methylphenol	< 325	ug/Kg	9/2/2020 21:21
4-Chloroaniline	< 325	ug/Kg	9/2/2020 21:21
4-Chlorophenyl phenyl ether	< 325	ug/Kg	9/2/2020 21:21
4-Nitroaniline	< 325	ug/Kg	9/2/2020 21:21
4-Nitrophenol	< 325	ug/Kg	9/2/2020 21:21
Acenaphthene	< 325	ug/Kg	9/2/2020 21:21
Acenaphthylene	< 325	ug/Kg	9/2/2020 21:21
Acetophenone	< 325	ug/Kg	9/2/2020 21:21
Anthracene	< 325	ug/Kg	9/2/2020 21:21
Atrazine	< 325	ug/Kg	9/2/2020 21:21
Benzaldehyde	< 325	ug/Kg	9/2/2020 21:21
Benzo (a) anthracene	< 325	ug/Kg	9/2/2020 21:21
Benzo (a) pyrene	< 325	ug/Kg	9/2/2020 21:21
Benzo (b) fluoranthene	< 325	ug/Kg	9/2/2020 21:21
Benzo (g,h,i) perylene	< 325	ug/Kg	9/2/2020 21:21
Benzo (k) fluoranthene	< 325	ug/Kg	9/2/2020 21:21
Bis (2-chloroethoxy) methane	< 325	ug/Kg	9/2/2020 21:21
Bis (2-chloroethyl) ether	< 325	ug/Kg	9/2/2020 21:21
Bis (2-ethylhexyl) phthalate	< 325	ug/Kg	9/2/2020 21:21
Butylbenzylphthalate	< 325	ug/Kg	9/2/2020 21:21
Caprolactam	< 325	ug/Kg	9/2/2020 21:21
Carbazole	< 325	ug/Kg	9/2/2020 21:21
Chrysene	< 325	ug/Kg	9/2/2020 21:21
Dibenz (a,h) anthracene	< 325	ug/Kg	9/2/2020 21:21
Dibenzofuran	< 325	ug/Kg	9/2/2020 21:21
Diethyl phthalate	< 325	ug/Kg	9/2/2020 21:21
Dimethyl phthalate	< 325	ug/Kg	9/2/2020 21:21

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier: SB4, 6-8.5'
Lab Sample ID: 204143-01 **Date Sampled:** 8/31/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 325	ug/Kg	9/2/2020	21:21
Di-n-octylphthalate	< 325	ug/Kg	9/2/2020	21:21
Fluoranthene	< 325	ug/Kg	9/2/2020	21:21
Fluorene	< 325	ug/Kg	9/2/2020	21:21
Hexachlorobenzene	< 325	ug/Kg	9/2/2020	21:21
Hexachlorobutadiene	< 325	ug/Kg	9/2/2020	21:21
Hexachlorocyclopentadiene	< 1300	ug/Kg	9/2/2020	21:21
Hexachloroethane	< 325	ug/Kg	9/2/2020	21:21
Indeno (1,2,3-cd) pyrene	< 325	ug/Kg	9/2/2020	21:21
Isophorone	< 325	ug/Kg	9/2/2020	21:21
Naphthalene	< 325	ug/Kg	9/2/2020	21:21
Nitrobenzene	< 325	ug/Kg	9/2/2020	21:21
N-Nitroso-di-n-propylamine	< 325	ug/Kg	9/2/2020	21:21
N-Nitrosodiphenylamine	< 325	ug/Kg	9/2/2020	21:21
Pentachlorophenol	< 650	ug/Kg	9/2/2020	21:21
Phenanthrene	< 325	ug/Kg	9/2/2020	21:21
Phenol	< 325	ug/Kg	9/2/2020	21:21
Pyrene	< 325	ug/Kg	9/2/2020	21:21

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**44.4**	37.8 - 85.8		9/2/2020	21:21
2-Fluorobiphenyl	**53.2**	40.4 - 80.4		9/2/2020	21:21
2-Fluorophenol	**52.4**	38.8 - 77.4		9/2/2020	21:21
Nitrobenzene-d5	**53.3**	37.4 - 75.9		9/2/2020	21:21
Phenol-d5	**53.9**	40.4 - 78		9/2/2020	21:21
Terphenyl-d14	**54.6**	40.2 - 90		9/2/2020	21:21

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49143.D

This report is part of a multipage document and should only be evaluated in its entirety. The Chain of Custody provides additional sample information, including compliance with the sample condition requirements upon receipt.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB4, 6-8.5'		
Lab Sample ID:	204143-01	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 7.53	ug/Kg		9/4/2020 18:37
1,1,2,2-Tetrachloroethane	< 7.53	ug/Kg		9/4/2020 18:37
1,1,2-Trichloroethane	< 7.53	ug/Kg		9/4/2020 18:37
1,1-Dichloroethane	< 7.53	ug/Kg		9/4/2020 18:37
1,1-Dichloroethene	< 7.53	ug/Kg		9/4/2020 18:37
1,2,3-Trichlorobenzene	< 18.8	ug/Kg		9/4/2020 18:37
1,2,4-Trichlorobenzene	< 18.8	ug/Kg		9/4/2020 18:37
1,2-Dibromo-3-Chloropropane	< 37.6	ug/Kg		9/4/2020 18:37
1,2-Dibromoethane	< 7.53	ug/Kg		9/4/2020 18:37
1,2-Dichlorobenzene	< 7.53	ug/Kg		9/4/2020 18:37
1,2-Dichloroethane	< 7.53	ug/Kg		9/4/2020 18:37
1,2-Dichloropropane	< 7.53	ug/Kg		9/4/2020 18:37
1,3-Dichlorobenzene	< 7.53	ug/Kg		9/4/2020 18:37
1,4-Dichlorobenzene	< 7.53	ug/Kg		9/4/2020 18:37
1,4-Dioxane	< 75.3	ug/Kg		9/4/2020 18:37
2-Butanone	< 37.6	ug/Kg		9/4/2020 18:37
2-Hexanone	< 18.8	ug/Kg		9/4/2020 18:37
4-Methyl-2-pentanone	< 18.8	ug/Kg		9/4/2020 18:37
Acetone	< 37.6	ug/Kg		9/4/2020 18:37
Benzene	< 7.53	ug/Kg		9/4/2020 18:37
Bromochloromethane	< 18.8	ug/Kg		9/4/2020 18:37
Bromodichloromethane	< 7.53	ug/Kg		9/4/2020 18:37
Bromoform	< 18.8	ug/Kg		9/4/2020 18:37
Bromomethane	< 7.53	ug/Kg		9/4/2020 18:37
Carbon disulfide	< 7.53	ug/Kg		9/4/2020 18:37
Carbon Tetrachloride	< 7.53	ug/Kg		9/4/2020 18:37
Chlorobenzene	< 7.53	ug/Kg		9/4/2020 18:37
Chloroethane	< 7.53	ug/Kg		9/4/2020 18:37

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB4, 6-8.5'		
Lab Sample ID:	204143-01	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 7.53	ug/Kg	9/4/2020	18:37
Chloromethane	< 7.53	ug/Kg	9/4/2020	18:37
cis-1,2-Dichloroethene	< 7.53	ug/Kg	9/4/2020	18:37
cis-1,3-Dichloropropene	< 7.53	ug/Kg	9/4/2020	18:37
Cyclohexane	< 37.6	ug/Kg	9/4/2020	18:37
Dibromochloromethane	< 7.53	ug/Kg	9/4/2020	18:37
Dichlorodifluoromethane	< 7.53	ug/Kg	9/4/2020	18:37
Ethylbenzene	< 7.53	ug/Kg	9/4/2020	18:37
Freon 113	< 7.53	ug/Kg	9/4/2020	18:37
Isopropylbenzene	< 7.53	ug/Kg	9/4/2020	18:37
m,p-Xylene	< 7.53	ug/Kg	9/4/2020	18:37
Methyl acetate	< 7.53	ug/Kg	9/4/2020	18:37
Methyl tert-butyl Ether	< 7.53	ug/Kg	9/4/2020	18:37
Methylcyclohexane	< 7.53	ug/Kg	9/4/2020	18:37
Methylene chloride	< 18.8	ug/Kg	9/4/2020	18:37
o-Xylene	< 7.53	ug/Kg	9/4/2020	18:37
Styrene	< 18.8	ug/Kg	9/4/2020	18:37
Tetrachloroethene	< 7.53	ug/Kg	9/4/2020	18:37
Toluene	< 7.53	ug/Kg	9/4/2020	18:37
trans-1,2-Dichloroethene	< 7.53	ug/Kg	9/4/2020	18:37
trans-1,3-Dichloropropene	< 7.53	ug/Kg	9/4/2020	18:37
Trichloroethene	< 7.53	ug/Kg	9/4/2020	18:37
Trichlorofluoromethane	< 7.53	ug/Kg	9/4/2020	18:37
Vinyl chloride	< 7.53	ug/Kg	9/4/2020	18:37

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB4, 6-8.5'		
Lab Sample ID:	204143-01	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**90.1**	75 - 134		9/4/2020	18:37
4-Bromofluorobenzene	**72.8**	59.5 - 129		9/4/2020	18:37
Pentafluorobenzene	**104**	88.8 - 118		9/4/2020	18:37
Toluene-D8	**90.9**	84 - 114		9/4/2020	18:37

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73092.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB5, 6-9'		
Lab Sample ID:	204143-02	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	**0.0900**	mg/Kg		9/5/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**4.45**	mg/Kg		9/8/2020 20:49
Barium	**54.0**	mg/Kg		9/8/2020 20:49
Cadmium	**0.842**	mg/Kg		9/8/2020 20:49
Chromium	**17.9**	mg/Kg		9/8/2020 20:49
Lead	**20.8**	mg/Kg		9/8/2020 20:49
Selenium	< 1.15	mg/Kg		9/8/2020 20:49
Silver	< 0.574	mg/Kg		9/8/2020 20:49

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/4/2020
Data File: 200908E

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1221	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1232	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1242	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1248	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1254	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1260	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1262	< 0.152	mg/Kg		9/5/2020 06:03
PCB-1268	< 0.152	mg/Kg		9/5/2020 06:03

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Report Prepared Wednesday, September 9, 2020

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB5, 6-9'		
Lab Sample ID:	204143-02	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**63.9**	17.8 - 74		9/5/2020 06:03

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/2/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 339	ug/Kg		9/3/2020 20:36
1,2,4,5-Tetrachlorobenzene	< 339	ug/Kg		9/3/2020 20:36
1,2,4-Trichlorobenzene	< 339	ug/Kg		9/3/2020 20:36
1,2-Dichlorobenzene	< 339	ug/Kg		9/3/2020 20:36
1,3-Dichlorobenzene	< 339	ug/Kg		9/3/2020 20:36
1,4-Dichlorobenzene	< 339	ug/Kg		9/3/2020 20:36
2,2-Oxybis (1-chloropropane)	< 339	ug/Kg		9/3/2020 20:36
2,3,4,6-Tetrachlorophenol	< 339	ug/Kg		9/3/2020 20:36
2,4,5-Trichlorophenol	< 339	ug/Kg		9/3/2020 20:36
2,4,6-Trichlorophenol	< 339	ug/Kg		9/3/2020 20:36
2,4-Dichlorophenol	< 339	ug/Kg		9/3/2020 20:36
2,4-Dimethylphenol	< 339	ug/Kg		9/3/2020 20:36
2,4-Dinitrophenol	< 1360	ug/Kg		9/3/2020 20:36
2,4-Dinitrotoluene	< 339	ug/Kg	M	9/3/2020 20:36
2,6-Dinitrotoluene	< 339	ug/Kg		9/3/2020 20:36
2-Chloronaphthalene	< 339	ug/Kg		9/3/2020 20:36
2-Chlorophenol	< 339	ug/Kg		9/3/2020 20:36
2-Methylnapthalene	< 339	ug/Kg		9/3/2020 20:36
2-Methylphenol	< 339	ug/Kg		9/3/2020 20:36
2-Nitroaniline	< 339	ug/Kg		9/3/2020 20:36
2-Nitrophenol	< 339	ug/Kg		9/3/2020 20:36
3&4-Methylphenol	< 339	ug/Kg		9/3/2020 20:36
3,3'-Dichlorobenzidine	< 339	ug/Kg		9/3/2020 20:36

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier: SB5, 6-9'
Lab Sample ID: 204143-02 **Date Sampled:** 8/31/2020
Matrix: Soil **Date Received:** 9/1/2020

3-Nitroaniline	< 339	ug/Kg		9/3/2020	20:36
4,6-Dinitro-2-methylphenol	< 454	ug/Kg		9/3/2020	20:36
4-Bromophenyl phenyl ether	< 339	ug/Kg		9/3/2020	20:36
4-Chloro-3-methylphenol	< 339	ug/Kg		9/3/2020	20:36
4-Chloroaniline	< 339	ug/Kg		9/3/2020	20:36
4-Chlorophenyl phenyl ether	< 339	ug/Kg		9/3/2020	20:36
4-Nitroaniline	< 339	ug/Kg		9/3/2020	20:36
4-Nitrophenol	< 339	ug/Kg	M	9/3/2020	20:36
Acenaphthene	< 339	ug/Kg		9/3/2020	20:36
Acenaphthylene	< 339	ug/Kg		9/3/2020	20:36
Acetophenone	< 339	ug/Kg		9/3/2020	20:36
Anthracene	< 339	ug/Kg		9/3/2020	20:36
Atrazine	< 339	ug/Kg		9/3/2020	20:36
Benzaldehyde	< 339	ug/Kg		9/3/2020	20:36
Benzo (a) anthracene	< 339	ug/Kg		9/3/2020	20:36
Benzo (a) pyrene	< 339	ug/Kg		9/3/2020	20:36
Benzo (b) fluoranthene	< 339	ug/Kg		9/3/2020	20:36
Benzo (g,h,i) perylene	< 339	ug/Kg		9/3/2020	20:36
Benzo (k) fluoranthene	< 339	ug/Kg		9/3/2020	20:36
Bis (2-chloroethoxy) methane	< 339	ug/Kg		9/3/2020	20:36
Bis (2-chloroethyl) ether	< 339	ug/Kg		9/3/2020	20:36
Bis (2-ethylhexyl) phthalate	< 339	ug/Kg		9/3/2020	20:36
Butylbenzylphthalate	< 339	ug/Kg		9/3/2020	20:36
Caprolactam	< 339	ug/Kg		9/3/2020	20:36
Carbazole	< 339	ug/Kg		9/3/2020	20:36
Chrysene	< 339	ug/Kg		9/3/2020	20:36
Dibenz (a,h) anthracene	< 339	ug/Kg		9/3/2020	20:36
Dibenzofuran	< 339	ug/Kg		9/3/2020	20:36
Diethyl phthalate	< 339	ug/Kg		9/3/2020	20:36
Dimethyl phthalate	< 339	ug/Kg		9/3/2020	20:36

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier: SB5, 6-9'
Lab Sample ID: 204143-02 **Date Sampled:** 8/31/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 339	ug/Kg		9/3/2020	20:36
Di-n-octylphthalate	< 339	ug/Kg		9/3/2020	20:36
Fluoranthene	< 339	ug/Kg		9/3/2020	20:36
Fluorene	< 339	ug/Kg		9/3/2020	20:36
Hexachlorobenzene	< 339	ug/Kg		9/3/2020	20:36
Hexachlorobutadiene	< 339	ug/Kg		9/3/2020	20:36
Hexachlorocyclopentadiene	< 1360	ug/Kg		9/3/2020	20:36
Hexachloroethane	< 339	ug/Kg		9/3/2020	20:36
Indeno (1,2,3-cd) pyrene	< 339	ug/Kg		9/3/2020	20:36
Isophorone	< 339	ug/Kg		9/3/2020	20:36
Naphthalene	< 339	ug/Kg		9/3/2020	20:36
Nitrobenzene	< 339	ug/Kg		9/3/2020	20:36
N-Nitroso-di-n-propylamine	< 339	ug/Kg		9/3/2020	20:36
N-Nitrosodiphenylamine	< 339	ug/Kg		9/3/2020	20:36
Pentachlorophenol	< 679	ug/Kg	M	9/3/2020	20:36
Phenanthrene	< 339	ug/Kg		9/3/2020	20:36
Phenol	< 339	ug/Kg		9/3/2020	20:36
Pyrene	< 339	ug/Kg		9/3/2020	20:36

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**45.9**	37.8 - 85.8		9/3/2020	20:36
2-Fluorobiphenyl	**57.5**	40.4 - 80.4		9/3/2020	20:36
2-Fluorophenol	**52.8**	38.8 - 77.4		9/3/2020	20:36
Nitrobenzene-d5	**53.5**	37.4 - 75.9		9/3/2020	20:36
Phenol-d5	**54.3**	40.4 - 78		9/3/2020	20:36
Terphenyl-d14	**56.5**	40.2 - 90		9/3/2020	20:36

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49200.D

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB5, 6-9'		
Lab Sample ID:	204143-02	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 6.46	ug/Kg		9/4/2020 18:59
1,1,2,2-Tetrachloroethane	< 6.46	ug/Kg		9/4/2020 18:59
1,1,2-Trichloroethane	< 6.46	ug/Kg		9/4/2020 18:59
1,1-Dichloroethane	< 6.46	ug/Kg		9/4/2020 18:59
1,1-Dichloroethene	< 6.46	ug/Kg		9/4/2020 18:59
1,2,3-Trichlorobenzene	< 16.1	ug/Kg		9/4/2020 18:59
1,2,4-Trichlorobenzene	< 16.1	ug/Kg		9/4/2020 18:59
1,2-Dibromo-3-Chloropropane	< 32.3	ug/Kg		9/4/2020 18:59
1,2-Dibromoethane	< 6.46	ug/Kg		9/4/2020 18:59
1,2-Dichlorobenzene	< 6.46	ug/Kg		9/4/2020 18:59
1,2-Dichloroethane	< 6.46	ug/Kg		9/4/2020 18:59
1,2-Dichloropropane	< 6.46	ug/Kg		9/4/2020 18:59
1,3-Dichlorobenzene	< 6.46	ug/Kg		9/4/2020 18:59
1,4-Dichlorobenzene	< 6.46	ug/Kg		9/4/2020 18:59
1,4-Dioxane	< 64.6	ug/Kg		9/4/2020 18:59
2-Butanone	< 32.3	ug/Kg		9/4/2020 18:59
2-Hexanone	< 16.1	ug/Kg		9/4/2020 18:59
4-Methyl-2-pentanone	< 16.1	ug/Kg		9/4/2020 18:59
Acetone	< 32.3	ug/Kg		9/4/2020 18:59
Benzene	< 6.46	ug/Kg		9/4/2020 18:59
Bromochloromethane	< 16.1	ug/Kg		9/4/2020 18:59
Bromodichloromethane	< 6.46	ug/Kg		9/4/2020 18:59
Bromoform	< 16.1	ug/Kg		9/4/2020 18:59
Bromomethane	< 6.46	ug/Kg		9/4/2020 18:59
Carbon disulfide	< 6.46	ug/Kg		9/4/2020 18:59
Carbon Tetrachloride	< 6.46	ug/Kg		9/4/2020 18:59
Chlorobenzene	< 6.46	ug/Kg		9/4/2020 18:59
Chloroethane	< 6.46	ug/Kg		9/4/2020 18:59

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB5, 6-9'		
Lab Sample ID:	204143-02	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 6.46	ug/Kg	9/4/2020	18:59
Chloromethane	< 6.46	ug/Kg	9/4/2020	18:59
cis-1,2-Dichloroethene	< 6.46	ug/Kg	9/4/2020	18:59
cis-1,3-Dichloropropene	< 6.46	ug/Kg	9/4/2020	18:59
Cyclohexane	< 32.3	ug/Kg	9/4/2020	18:59
Dibromochloromethane	< 6.46	ug/Kg	9/4/2020	18:59
Dichlorodifluoromethane	< 6.46	ug/Kg	9/4/2020	18:59
Ethylbenzene	< 6.46	ug/Kg	9/4/2020	18:59
Freon 113	< 6.46	ug/Kg	9/4/2020	18:59
Isopropylbenzene	< 6.46	ug/Kg	9/4/2020	18:59
m,p-Xylene	< 6.46	ug/Kg	9/4/2020	18:59
Methyl acetate	< 6.46	ug/Kg	9/4/2020	18:59
Methyl tert-butyl Ether	< 6.46	ug/Kg	9/4/2020	18:59
Methylcyclohexane	< 6.46	ug/Kg	9/4/2020	18:59
Methylene chloride	< 16.1	ug/Kg	9/4/2020	18:59
o-Xylene	< 6.46	ug/Kg	9/4/2020	18:59
Styrene	< 16.1	ug/Kg	9/4/2020	18:59
Tetrachloroethene	< 6.46	ug/Kg	9/4/2020	18:59
Toluene	< 6.46	ug/Kg	9/4/2020	18:59
trans-1,2-Dichloroethene	< 6.46	ug/Kg	9/4/2020	18:59
trans-1,3-Dichloropropene	< 6.46	ug/Kg	9/4/2020	18:59
Trichloroethene	< 6.46	ug/Kg	9/4/2020	18:59
Trichlorofluoromethane	< 6.46	ug/Kg	9/4/2020	18:59
Vinyl chloride	< 6.46	ug/Kg	9/4/2020	18:59

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB5, 6-9'		
Lab Sample ID:	204143-02	**Date Sampled:**	8/31/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**97.2**	75 - 134		9/4/2020	18:59
4-Bromofluorobenzene	**86.8**	59.5 - 129		9/4/2020	18:59
Pentafluorobenzene	**103**	88.8 - 118		9/4/2020	18:59
Toluene-D8	**94.8**	84 - 114		9/4/2020	18:59

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73093.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB6, 5-8'		
Lab Sample ID:	204143-03	**Date Sampled:**	9/1/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Mercury

Analyte	Result	Units	Qualifier	Date Analyzed
Mercury	**0.191**	mg/Kg		9/5/2020

Method Reference(s): EPA 7471B
Subcontractor ELAP ID: 11627

RCRA Metals (ICP)

Analyte	Result	Units	Qualifier	Date Analyzed
Arsenic	**9.57**	mg/Kg		9/8/2020 20:54
Barium	**244**	mg/Kg		9/8/2020 20:54
Cadmium	**6.09**	mg/Kg		9/8/2020 20:54
Chromium	**25.7**	mg/Kg		9/8/2020 20:54
Lead	**281**	mg/Kg		9/8/2020 20:54
Selenium	< 1.24	mg/Kg		9/8/2020 20:54
Silver	< 0.620	mg/Kg		9/8/2020 20:54

Method Reference(s): EPA 6010C
EPA 3050B
Preparation Date: 9/4/2020
Data File: 200908E

PCBs

Analyte	Result	Units	Qualifier	Date Analyzed
PCB-1016	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1221	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1232	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1242	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1248	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1254	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1260	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1262	< 0.201	mg/Kg		9/5/2020 06:28
PCB-1268	< 0.201	mg/Kg		9/5/2020 06:28

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB6, 5-8'		
Lab Sample ID:	204143-03	**Date Sampled:**	9/1/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed
Tetrachloro-m-xylene	**65.7**	17.8 - 74		9/5/2020 06:28

Method Reference(s): EPA 8082A
EPA 3546
Preparation Date: 9/2/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed
1,1-Biphenyl	< 348	ug/Kg		9/9/2020 08:24
1,2,4,5-Tetrachlorobenzene	< 348	ug/Kg		9/9/2020 08:24
1,2,4-Trichlorobenzene	< 348	ug/Kg		9/9/2020 08:24
1,2-Dichlorobenzene	< 348	ug/Kg		9/9/2020 08:24
1,3-Dichlorobenzene	< 348	ug/Kg		9/9/2020 08:24
1,4-Dichlorobenzene	< 348	ug/Kg		9/9/2020 08:24
2,2-Oxybis (1-chloropropane)	< 348	ug/Kg		9/9/2020 08:24
2,3,4,6-Tetrachlorophenol	< 348	ug/Kg		9/9/2020 08:24
2,4,5-Trichlorophenol	< 348	ug/Kg		9/9/2020 08:24
2,4,6-Trichlorophenol	< 348	ug/Kg		9/9/2020 08:24
2,4-Dichlorophenol	< 348	ug/Kg		9/9/2020 08:24
2,4-Dimethylphenol	< 348	ug/Kg		9/9/2020 08:24
2,4-Dinitrophenol	< 1390	ug/Kg		9/9/2020 08:24
2,4-Dinitrotoluene	< 348	ug/Kg		9/9/2020 08:24
2,6-Dinitrotoluene	< 348	ug/Kg		9/9/2020 08:24
2-Chloronaphthalene	< 348	ug/Kg		9/9/2020 08:24
2-Chlorophenol	< 348	ug/Kg		9/9/2020 08:24
2-Methylnapthalene	**553**	ug/Kg		9/9/2020 08:24
2-Methylphenol	< 348	ug/Kg		9/9/2020 08:24
2-Nitroaniline	< 348	ug/Kg		9/9/2020 08:24
2-Nitrophenol	< 348	ug/Kg		9/9/2020 08:24
3&4-Methylphenol	< 348	ug/Kg		9/9/2020 08:24
3,3'-Dichlorobenzidine	< 348	ug/Kg		9/9/2020 08:24

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB6, 5-8'		
Lab Sample ID:	204143-03	**Date Sampled:**	9/1/2020
Matrix:	Soil	**Date Received:**	9/1/2020

3-Nitroaniline	< 348	ug/Kg	9/9/2020 08:24
4,6-Dinitro-2-methylphenol	< 466	ug/Kg	9/9/2020 08:24
4-Bromophenyl phenyl ether	< 348	ug/Kg	9/9/2020 08:24
4-Chloro-3-methylphenol	< 348	ug/Kg	9/9/2020 08:24
4-Chloroaniline	< 348	ug/Kg	9/9/2020 08:24
4-Chlorophenyl phenyl ether	< 348	ug/Kg	9/9/2020 08:24
4-Nitroaniline	< 348	ug/Kg	9/9/2020 08:24
4-Nitrophenol	< 348	ug/Kg	9/9/2020 08:24
Acenaphthene	< 348	ug/Kg	9/9/2020 08:24
Acenaphthylene	< 348	ug/Kg	9/9/2020 08:24
Acetophenone	< 348	ug/Kg	9/9/2020 08:24
Anthracene	< 348	ug/Kg	9/9/2020 08:24
Atrazine	< 348	ug/Kg	9/9/2020 08:24
Benzaldehyde	< 348	ug/Kg	9/9/2020 08:24
Benzo (a) anthracene	**751**	ug/Kg	9/9/2020 08:24
Benzo (a) pyrene	**733**	ug/Kg	9/9/2020 08:24
Benzo (b) fluoranthene	**612**	ug/Kg	9/9/2020 08:24
Benzo (g,h,i) perylene	**489**	ug/Kg	9/9/2020 08:24
Benzo (k) fluoranthene	**559**	ug/Kg	9/9/2020 08:24
Bis (2-chloroethoxy) methane	< 348	ug/Kg	9/9/2020 08:24
Bis (2-chloroethyl) ether	< 348	ug/Kg	9/9/2020 08:24
Bis (2-ethylhexyl) phthalate	< 348	ug/Kg	9/9/2020 08:24
Butylbenzylphthalate	< 348	ug/Kg	9/9/2020 08:24
Caprolactam	< 348	ug/Kg	9/9/2020 08:24
Carbazole	< 348	ug/Kg	9/9/2020 08:24
Chrysene	**765**	ug/Kg	9/9/2020 08:24
Dibenz (a,h) anthracene	< 348	ug/Kg	9/9/2020 08:24
Dibenzofuran	< 348	ug/Kg	9/9/2020 08:24
Diethyl phthalate	< 348	ug/Kg	9/9/2020 08:24
Dimethyl phthalate	< 348	ug/Kg	9/9/2020 08:24

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier: SB6, 5-8'
Lab Sample ID: 204143-03 **Date Sampled:** 9/1/2020
Matrix: Soil **Date Received:** 9/1/2020

Di-n-butyl phthalate	< 348	ug/Kg	9/9/2020	08:24
Di-n-octylphthalate	< 348	ug/Kg	9/9/2020	08:24
Fluoranthene	**1450**	ug/Kg	9/9/2020	08:24
Fluorene	< 348	ug/Kg	9/9/2020	08:24
Hexachlorobenzene	< 348	ug/Kg	9/9/2020	08:24
Hexachlorobutadiene	< 348	ug/Kg	9/9/2020	08:24
Hexachlorocyclopentadiene	< 1390	ug/Kg	9/9/2020	08:24
Hexachloroethane	< 348	ug/Kg	9/9/2020	08:24
Indeno (1,2,3-cd) pyrene	**466**	ug/Kg	9/9/2020	08:24
Isophorone	< 348	ug/Kg	9/9/2020	08:24
Naphthalene	**1080**	ug/Kg	9/9/2020	08:24
Nitrobenzene	< 348	ug/Kg	9/9/2020	08:24
N-Nitroso-di-n-propylamine	< 348	ug/Kg	9/9/2020	08:24
N-Nitrosodiphenylamine	< 348	ug/Kg	9/9/2020	08:24
Pentachlorophenol	< 696	ug/Kg	9/9/2020	08:24
Phenanthrene	**1100**	ug/Kg	9/9/2020	08:24
Phenol	< 348	ug/Kg	9/9/2020	08:24
Pyrene	**1350**	ug/Kg	9/9/2020	08:24

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**52.0**	37.8 - 85.8		9/9/2020	08:24
2-Fluorobiphenyl	**47.9**	40.4 - 80.4		9/9/2020	08:24
2-Fluorophenol	**48.8**	38.8 - 77.4		9/9/2020	08:24
Nitrobenzene-d5	**50.7**	37.4 - 75.9		9/9/2020	08:24
Phenol-d5	**50.1**	40.4 - 78		9/9/2020	08:24
Terphenyl-d14	**50.4**	40.2 - 90		9/9/2020	08:24

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49283.D

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB6, 5-8'		
Lab Sample ID:	204143-03	**Date Sampled:**	9/1/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Volatile Organics

Analyte	Result	Units	Qualifier	Date Analyzed
1,1,1-Trichloroethane	< 11.6	ug/Kg		9/4/2020 16:45
1,1,2,2-Tetrachloroethane	< 11.6	ug/Kg		9/4/2020 16:45
1,1,2-Trichloroethane	< 11.6	ug/Kg		9/4/2020 16:45
1,1-Dichloroethane	< 11.6	ug/Kg		9/4/2020 16:45
1,1-Dichloroethene	< 11.6	ug/Kg		9/4/2020 16:45
1,2,3-Trichlorobenzene	< 29.0	ug/Kg		9/4/2020 16:45
1,2,4-Trichlorobenzene	< 29.0	ug/Kg		9/4/2020 16:45
1,2-Dibromo-3-Chloropropane	< 57.9	ug/Kg		9/4/2020 16:45
1,2-Dibromoethane	< 11.6	ug/Kg		9/4/2020 16:45
1,2-Dichlorobenzene	< 11.6	ug/Kg		9/4/2020 16:45
1,2-Dichloroethane	< 11.6	ug/Kg		9/4/2020 16:45
1,2-Dichloropropane	< 11.6	ug/Kg		9/4/2020 16:45
1,3-Dichlorobenzene	< 11.6	ug/Kg		9/4/2020 16:45
1,4-Dichlorobenzene	< 11.6	ug/Kg		9/4/2020 16:45
1,4-Dioxane	< 116	ug/Kg		9/4/2020 16:45
2-Butanone	< 57.9	ug/Kg		9/4/2020 16:45
2-Hexanone	< 29.0	ug/Kg		9/4/2020 16:45
4-Methyl-2-pentanone	< 29.0	ug/Kg		9/4/2020 16:45
Acetone	< 57.9	ug/Kg		9/4/2020 16:45
Benzene	< 11.6	ug/Kg		9/4/2020 16:45
Bromochloromethane	< 29.0	ug/Kg		9/4/2020 16:45
Bromodichloromethane	< 11.6	ug/Kg		9/4/2020 16:45
Bromoform	< 29.0	ug/Kg		9/4/2020 16:45
Bromomethane	< 11.6	ug/Kg		9/4/2020 16:45
Carbon disulfide	< 11.6	ug/Kg		9/4/2020 16:45
Carbon Tetrachloride	< 11.6	ug/Kg		9/4/2020 16:45
Chlorobenzene	< 11.6	ug/Kg		9/4/2020 16:45
Chloroethane	< 11.6	ug/Kg		9/4/2020 16:45

PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB6, 5-8'		
Lab Sample ID:	204143-03	**Date Sampled:**	9/1/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Chloroform	< 11.6	ug/Kg	9/4/2020	16:45
Chloromethane	< 11.6	ug/Kg	9/4/2020	16:45
cis-1,2-Dichloroethene	< 11.6	ug/Kg	9/4/2020	16:45
cis-1,3-Dichloropropene	< 11.6	ug/Kg	9/4/2020	16:45
Cyclohexane	< 57.9	ug/Kg	9/4/2020	16:45
Dibromochloromethane	< 11.6	ug/Kg	9/4/2020	16:45
Dichlorodifluoromethane	< 11.6	ug/Kg	9/4/2020	16:45
Ethylbenzene	< 11.6	ug/Kg	9/4/2020	16:45
Freon 113	< 11.6	ug/Kg	9/4/2020	16:45
Isopropylbenzene	**115**	ug/Kg	9/4/2020	16:45
m,p-Xylene	< 11.6	ug/Kg	9/4/2020	16:45
Methyl acetate	< 11.6	ug/Kg	9/4/2020	16:45
Methyl tert-butyl Ether	< 11.6	ug/Kg	9/4/2020	16:45
Methylcyclohexane	**200**	ug/Kg	9/4/2020	16:45
Methylene chloride	< 29.0	ug/Kg	9/4/2020	16:45
o-Xylene	< 11.6	ug/Kg	9/4/2020	16:45
Styrene	< 29.0	ug/Kg	9/4/2020	16:45
Tetrachloroethene	< 11.6	ug/Kg	9/4/2020	16:45
Toluene	< 11.6	ug/Kg	9/4/2020	16:45
trans-1,2-Dichloroethene	< 11.6	ug/Kg	9/4/2020	16:45
trans-1,3-Dichloropropene	< 11.6	ug/Kg	9/4/2020	16:45
Trichloroethene	< 11.6	ug/Kg	9/4/2020	16:45
Trichlorofluoromethane	< 11.6	ug/Kg	9/4/2020	16:45
Vinyl chloride	< 11.6	ug/Kg	9/4/2020	16:45

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PARADIGM ENVIRONMENTAL SERVICES, INC.

Lab Project ID: 204143

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Sample Identifier:	SB6, 5-8'		
Lab Sample ID:	204143-03	**Date Sampled:**	9/1/2020
Matrix:	Soil	**Date Received:**	9/1/2020

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
1,2-Dichloroethane-d4	**79.5**	75 - 134		9/4/2020	16:45
4-Bromofluorobenzene	**78.4**	59.5 - 129		9/4/2020	16:45
Pentafluorobenzene	**95.5**	88.8 - 118		9/4/2020	16:45
Toluene-D8	**115**	84 - 114	*	9/4/2020	16:45

Method Reference(s): EPA 8260C
EPA 5035A - L

Data File: x73087.D

This sample was not collected following SW846 5035A specifications. Accordingly, any Volatiles soil results that are less than 200 ug/Kg, including Non Detects, may be biased low, per ELAP method 5035 guidance document from 11/15/2012.

PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Lab Project ID: 204143

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed	
1,1-Biphenyl	<279	ug/Kg		9/2/2020	15:24
1,2,4,5-Tetrachlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,2,4-Trichlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,2-Dichlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,3-Dichlorobenzene	<279	ug/Kg		9/2/2020	15:24
1,4-Dichlorobenzene	<279	ug/Kg		9/2/2020	15:24
2,2-Oxybis (1-chloropropane)	<279	ug/Kg		9/2/2020	15:24
2,3,4,6-Tetrachlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4,5-Trichlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4,6-Trichlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4-Dichlorophenol	<279	ug/Kg		9/2/2020	15:24
2,4-Dimethylphenol	<279	ug/Kg		9/2/2020	15:24
2,4-Dinitrophenol	<1120	ug/Kg		9/2/2020	15:24
2,4-Dinitrotoluene	<279	ug/Kg		9/2/2020	15:24
2,6-Dinitrotoluene	<279	ug/Kg		9/2/2020	15:24
2-Chloronaphthalene	<279	ug/Kg		9/2/2020	15:24
2-Chlorophenol	<279	ug/Kg		9/2/2020	15:24
2-Methylnapthalene	<279	ug/Kg		9/2/2020	15:24
2-Methylphenol	<279	ug/Kg		9/2/2020	15:24
2-Nitroaniline	<279	ug/Kg		9/2/2020	15:24
2-Nitrophenol	<279	ug/Kg		9/2/2020	15:24
3&4-Methylphenol	<279	ug/Kg		9/2/2020	15:24
3,3'-Dichlorobenzidine	<279	ug/Kg		9/2/2020	15:24
3-Nitroaniline	<279	ug/Kg		9/2/2020	15:24
4,6-Dinitro-2-methylphenol	<559	ug/Kg		9/2/2020	15:24
4-Bromophenyl phenyl ether	<279	ug/Kg		9/2/2020	15:24
4-Chloro-3-methylphenol	<279	ug/Kg		9/2/2020	15:24
4-Chloroaniline	<279	ug/Kg		9/2/2020	15:24

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PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B Project # 40-20-118

Lab Project ID: 204143

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed	
4-Chlorophenyl phenyl ether	<279	ug/Kg		9/2/2020	15:24
4-Nitroaniline	<279	ug/Kg		9/2/2020	15:24
4-Nitrophenol	<279	ug/Kg		9/2/2020	15:24
Acenaphthene	<279	ug/Kg		9/2/2020	15:24
Acenaphthylene	<279	ug/Kg		9/2/2020	15:24
Acetophenone	<279	ug/Kg		9/2/2020	15:24
Anthracene	<279	ug/Kg		9/2/2020	15:24
Atrazine	<279	ug/Kg		9/2/2020	15:24
Benzaldehyde	<279	ug/Kg		9/2/2020	15:24
Benzo (a) anthracene	<279	ug/Kg		9/2/2020	15:24
Benzo (a) pyrene	<279	ug/Kg		9/2/2020	15:24
Benzo (b) fluoranthene	<279	ug/Kg		9/2/2020	15:24
Benzo (g,h,i) perylene	<279	ug/Kg		9/2/2020	15:24
Benzo (k) fluoranthene	<279	ug/Kg		9/2/2020	15:24
Bis (2-chloroethoxy) methane	<279	ug/Kg		9/2/2020	15:24
Bis (2-chloroethyl) ether	<279	ug/Kg		9/2/2020	15:24
Bis (2-ethylhexyl) phthalate	<279	ug/Kg		9/2/2020	15:24
Butylbenzylphthalate	<279	ug/Kg		9/2/2020	15:24
Caprolactam	<279	ug/Kg		9/2/2020	15:24
Carbazole	<279	ug/Kg		9/2/2020	15:24
Chrysene	<279	ug/Kg		9/2/2020	15:24
Dibenz (a,h) anthracene	<279	ug/Kg		9/2/2020	15:24
Dibenzofuran	<279	ug/Kg		9/2/2020	15:24
Diethyl phthalate	<279	ug/Kg		9/2/2020	15:24
Dimethyl phthalate	<279	ug/Kg		9/2/2020	15:24
Di-n-butyl phthalate	<279	ug/Kg		9/2/2020	15:24
Di-n-octylphthalate	<279	ug/Kg		9/2/2020	15:24
Fluoranthene	<279	ug/Kg		9/2/2020	15:24

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PARADIGM
ENVIRONMENTAL SERVICES, INC

Method Blank Report

Client: **Ravi Engineering & Land Surveying, P.C.**

Project Reference: Terminal B Project # 40-20-118

Lab Project ID: 204143

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Result	Units	Qualifier	Date Analyzed	
Fluorene	<279	ug/Kg		9/2/2020	15:24
Hexachlorobenzene	<279	ug/Kg		9/2/2020	15:24
Hexachlorobutadiene	<279	ug/Kg		9/2/2020	15:24
Hexachlorocyclopentadiene	<1120	ug/Kg		9/2/2020	15:24
Hexachloroethane	<279	ug/Kg		9/2/2020	15:24
Indeno (1,2,3-cd) pyrene	<279	ug/Kg		9/2/2020	15:24
Isophorone	<279	ug/Kg		9/2/2020	15:24
Naphthalene	<279	ug/Kg		9/2/2020	15:24
Nitrobenzene	<279	ug/Kg		9/2/2020	15:24
N-Nitroso-di-n-propylamine	<279	ug/Kg		9/2/2020	15:24
N-Nitrosodiphenylamine	<279	ug/Kg		9/2/2020	15:24
Pentachlorophenol	<559	ug/Kg		9/2/2020	15:24
Phenanthrene	<279	ug/Kg		9/2/2020	15:24
Phenol	<279	ug/Kg		9/2/2020	15:24
Pyrene	<279	ug/Kg		9/2/2020	15:24

Surrogate	Percent Recovery	Limits	Outliers	Date Analyzed	
2,4,6-Tribromophenol	**61.1**	37.8 - 85.8		9/2/2020	15:24
2-Fluorobiphenyl	**62.8**	40.4 - 80.4		9/2/2020	15:24
2-Fluorophenol	**62.8**	38.8 - 77.4		9/2/2020	15:24
Nitrobenzene-d5	**61.9**	37.4 - 75.9		9/2/2020	15:24
Phenol-d5	**65.5**	40.4 - 78		9/2/2020	15:24
Terphenyl-d14	**66.9**	40.2 - 90		9/2/2020	15:24

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49131.D
QC Batch ID: QC200902ABNS
QC Number: 1

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PARADIGM
ENVIRONMENTAL SERVICES, INC.

QC Report for Laboratory Control Sample

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B Project # 40-20-118

Lab Project ID: 204143

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Spike Added	Spike Units	LCS Result	LCS % Recovery	% Rec Limits	LCS Outliers	Date Analyzed
1,2,4-Trichlorobenzene	2790	ug/Kg	1670	59.9	45.7 - 73.3		9/2/2020
1,4-Dichlorobenzene	2790	ug/Kg	1610	57.7	43.1 - 68.3		9/2/2020
2,3,4,6-Tetrachlorophenol	4190	ug/Kg	2520	60.2	47.3 - 80.4		9/2/2020
2,4,6-Trichlorophenol	4190	ug/Kg	2830	67.5	52.2 - 86.9		9/2/2020
2,4-Dichlorophenol	4190	ug/Kg	2620	62.6	51.4 - 79.8		9/2/2020
2,4-Dimethylphenol	4190	ug/Kg	2850	68.1	45.4 - 92.2		9/2/2020
2,4-Dinitrophenol	4190	ug/Kg	1670	39.8	17.6 - 63		9/2/2020
2,4-Dinitrotoluene	2790	ug/Kg	1910	68.2	44.4 - 83.4		9/2/2020
2-Chlorophenol	4190	ug/Kg	2650	63.4	48.8 - 77.3		9/2/2020
2-Nitrophenol	4190	ug/Kg	2510	60.0	47.3 - 77		9/2/2020
4,6-Dinitro-2-methylphenol	4190	ug/Kg	2310	55.0	27.6 - 94.6		9/2/2020
4-Chloro-3-methylphenol	4190	ug/Kg	2750	65.7	50 - 82.5		9/2/2020
4-Nitrophenol	4190	ug/Kg	2670	63.7	42.7 - 85.9		9/2/2020
Acenaphthene	2790	ug/Kg	1860	66.5	46.4 - 78.8		9/2/2020
N-Nitroso-di-n-propylamine	2790	ug/Kg	1810	64.8	43.2 - 78.2		9/2/2020
Pentachlorophenol	4190	ug/Kg	2600	62.0	32.1 - 116		9/2/2020

This report is part of a multipage document and should only be evaluated in its entirety. The Chain of Custody provides additional sample information, including compliance with the sample condition requirements upon receipt.

Report Prepared Friday, September 04, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC

QC Report for Laboratory Control Sample

Client: Ravi Engineering & Land Surveying, P.C.

Project Reference: Terminal B Project # 40-20-118

Lab Project ID: 204143

Matrix: Soil

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Spike Added	Spike Units	LCS Result	LCS % Recovery	% Rec Limits	LCS Outliers	Date Analyzed
Phenol	4190	ug/Kg	2580	61.5	47.5 - 78		9/2/2020
Pyrene	2790	ug/Kg	2040	72.9	47.1 - 88.4		9/2/2020

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File: B49132.D
QC Number: 1
QC Batch ID: QC200902ABNS

This report is part of a multipage document and should only be evaluated in its entirety. The Chain of Custody provides additional sample information, including compliance with the sample condition requirements upon receipt.

Report Prepared Friday, September 04, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC

QC Report for Matrix Spike and Matrix Spike Duplicate

Client: Ravi Engineering & Land Surveying, P.C.

Lab Project ID: 204143

Project Reference: Terminal B Project # 40-20-118

Lab Sample ID: 204143-02
Sample Identifier: SB5, 6-9'
Matrix: Soil

Date Sampled: 8/31/2020
Date Received: 9/1/2020
Date Analyzed: 9/3/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Sample Result	Result Units	MS Added	MS Result	MS % Recovery	MSD Added	MSD Result	MSD % Recovery	% Rec. Limits	MS Outlier	MSD Outlier	Relative % Diff.	RPD Limit	RPD Outlier
1,2,4-Trichlorobenzene	< 339	ug/Kg	3060	1590	51.7	3210	1630	50.9	45.7 - 73.3			1.69	28.2	
1,4-Dichlorobenzene	< 339	ug/Kg	3060	1430	46.7	3210	1420	44.3	43.1 - 68.3			5.21	27.9	
2,4-Dinitrotoluene	< 339	ug/Kg	3060	1450	47.3	3210	1380	42.9	44.4 - 83.4		*	9.87	42.9	
2-Chlorophenol	< 339	ug/Kg	4600	2470	53.8	4820	2560	53.1	48.8 - 77.3			1.34	26.4	
4-Chloro-3-methylphenol	< 339	ug/Kg	4600	2680	58.4	4820	2760	57.3	50 - 82.5			1.92	30.2	
4-Nitrophenol	< 339	ug/Kg	4600	1560	34.0	4820	1610	33.5	42.7 - 85.9	*	*	1.40	34.2	
Acenaphthene	< 339	ug/Kg	3060	1750	57.0	3210	1810	56.5	46.4 - 78.8			0.930	29.7	
N-Nitroso-di-n-propylamine	< 339	ug/Kg	3060	1600	52.1	3210	1650	51.4	43.2 - 78.2			1.42	33.8	
Pentachlorophenol	< 679	ug/Kg	4600	897	19.5	4820	929	19.3	32.1 - 116	*	*	1.15	43.9	
Phenol	< 339	ug/Kg	4600	2400	52.3	4820	2500	51.9	47.5 - 78			0.788	27	
Pyrene	< 339	ug/Kg	3060	2090	68.1	3210	2130	66.2	47.1 - 88.4			2.85	33.9	

Any estimated values are displayed, and derived values calculated, based on numeric result only. See primary analytical report for data flags.

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Report Prepared Friday, September 04, 2020

PARADIGM
ENVIRONMENTAL SERVICES, INC.

QC Report for Matrix Spike and Matrix Spike Duplicate

Client: Ravi Engineering & Land Surveying, P.C.

Lab Project ID: 204143

Project Reference: Terminal B Project # 40-20-118

Lab Sample ID: 204143-02
Sample Identifier: SB5, 6-9'
Matrix: Soil

Date Sampled: 8/31/2020
Date Received: 9/1/2020
Date Analyzed: 9/3/2020

Semi-Volatile Organics (Acid/Base Neutrals)

Analyte	Sample Result	Result Units	MS Added	MS Result	MS % Recovery	MSD Added	MSD Result	MSD % Recovery	% Rec. Limits	MS Outlier	MSD Outlier	Relative % Diff.	RPD Limit	RPD Outlier

Method Reference(s): EPA 8270D
EPA 3546
Preparation Date: 9/2/2020
Data File(s): B49201.D
B49202.D
B49200.D
2
QC Batch ID: QC200902ABNS

Any estimated values are displayed, and derived values calculated, based on numeric result only. See primary analytical report for data flags.

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Report Prepared Friday, September 04, 2020

Analytical Report Appendix

The reported results relate only to the samples as they have been received by the laboratory.

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All soil/sludge samples have been reported on a dry weight basis, unless qualified "reported as received". Other solids are reported as received.

Low level Volatiles blank reports for soil/solid matrix are based on a nominal 5 gram weight. Sample results and reporting limits are based on actual weight, which may be more or less than 5 grams.

The Chain of Custody provides additional information, including compliance with sample condition requirements upon receipt. Sample condition requirements are defined under the 2003 NELAC Standard, sections 5.5.8.3.1 and 5.5.8.3.2.

NYSDOH ELAP does not certify for all parameters. Paradigm Environmental Services or the indicated subcontracted laboratory does hold certification for all analytes where certification is offered by ELAP unless otherwise specified. Aliquots separated for certain tests, such as TCLP, are indicated on the Chain of Custody and final reports with an "A" suffix.

Data qualifiers are used, when necessary, to provide additional information about the data. This information may be communicated as a flag or as text at the bottom of the report. Please refer to the following list of analyte-specific, frequently used data flags and their meaning:

"<" = Analyzed for but not detected at or above the quantitation limit.
"E" = Result has been estimated, calibration limit exceeded.
"Z" = See case narrative.
"D" = Sample, Laboratory Control Sample, or Matrix Spike Duplicate results above Relative Percent Difference limit.
"M" = Matrix spike recoveries outside QC limits. Matrix bias indicated.
"B" = Method blank contained trace levels of analyte. Refer to included method blank report.
"J" = Result estimated between the quantitation limit and half the quantitation limit.
"L" = Laboratory Control Sample recovery outside accepted QC limits.
"P" = Concentration differs by more than 40% between the primary and secondary analytical columns.
"NC" = Not calculable. Applicable to RPD if sample or duplicate result is non-detect or estimated (see primary report for data flags). Applicable to MS if sample is greater or equal to ten times the spike added. Applicable to sample surrogates or MS if sample dilution is 10x or higher.
"" = Indicates any recoveries outside associated acceptance windows. Surrogate outliers in samples are presumed matrix effects. LCS demonstrates method compliance unless otherwise noted.*
"(1)" = Indicates data from primary column used for QC calculation.
"A" = denotes a parameter for which ELAP does not offer approval as part of their laboratory certification program.
"F" = denotes a parameter for which Paradigm does not carry certification, the results for which should therefore only be used where ELAP certification is not required, such as personal exposure assessment.

GENERAL TERMS AND CONDITIONS
LABORATORY SERVICES

These Terms and Conditions embody the whole agreement of the parties in the absence of a signed and executed contract between the Laboratory (LAB) and Client. They shall supersede all previous communications, representations, or agreements, either verbal or written, between the parties. The LAB specifically rejects all additional, inconsistent, or conflicting terms, whether printed or otherwise set forth in any purchase order or other communication from the Client to the LAB. The invalidity or unenforceability in whole or in part of any provision, tern or condition hereof shall not affect in any way the validity or enforceability of the remainder of the Terms and Conditions. No waiver by LAB of any provision, term, or condition hereof or of any breach by or obligation of the Client hereunder shall constitute a waiver of such provision, term, or condition on any other occasion or a waiver of any other breach by or obligation of the Client. This agreement shall be administered and interpreted under the laws of the state which services are procured.

Warranty. Recognizing that the nature of many samples is unknown and that some may contain potentially hazardous components, LAB warrants only that it will perform testing services, obtain findings, and prepare reports in accordance with generally accepted analytical laboratory principles and practices at the time of performance of services. LAB makes no other warranty, express or implied.

Scope and Compensation. LAB agrees to perform the services described in the chain of custody to which these terms and conditions are attached. Unless the parties agree in writing to the contrary, the duties of LAB shall not be construed to exceed the services specifically described. LAB wi use LAB default method for all tests unless specified otherwise on the Work Order.

Payment terms are net 30 days from the date of invoice. All overdue payments are subject to an interest charge of one and one-half percent (1-1/2%) per month or a portion thereof. Client shall also be responsible for costs of collection, including payment of reasonable attorney fees if such expense is incurred. The prices, unless stated, do not include any sale, use or other taxes. Such taxes will be added to invoice prices when required.

Prices. Compensation for services performed will be based on the current Lab Analytical Fee Schedule or on quotations agreed to in writing by the parties. Turnaround time based charges are determined from the time of resolution of all work order questions. Testimony, court appearances or data compilation for legal action will be charged separately. Evaluation and reporting of initial screening runs may incur additional fees.

Limitations of Liability. In the event of any error, omission, or other professional negligence, the sole and exclusive responsibility of LAB shall be to re-perform the deficient work at its own expense and LAB shall have no other liability whatsoever. All claims shall be deemed waived unless made in writing and received by LAB within ninety (90) days following completion of services.

LAB shall have no liability, obligation, or responsibility of any kind for losses, costs, expenses, or other damages (including but not limited to any special, direct, incidental or consequential damages) with respect to LAB's services or results.

All results provided by LAB are strictly for the use of its clients and LAB is in no way responsible for the use of such results by clients or third parties. All reports should be considered in their entirety, and LAB is not responsible for the separation, detachment, or other use of any portion of these reports. Client may not assign the lab report without the written consent of the LAB.

Client covenants and agrees, at its/his/her sole expense, to indemnify, protect, defend, and save harmless the LAB from and against any and all damages, losses, liabilities, obligations, penalties, claims, litigation, demands, defenses, judgments, suits, actions, proceedings, costs, disbursements and/or expenses (including, without limitation attorneys' and experts' fees and disbursements) of any kind whatsoever which may at any time be imposed upon, incurred by or asserted or awarded against client relating to, resulting from or arising out of (a) the breach of this agreement by this client, (b) the negligence of the client in handling, delivering or disclosing any hazardous substance, (c) the violation of the Client of any applicable law, (d) non-compliance by the Client with any environmental permit or (e) a material misrepresentation in disclosing the materials to be tested.

Hazard Disclosure. Client represents and warrants that any sample delivered to LAB will be preceded or accompanied by complete written disclosure of the presence of any hazardous substances known or suspected by Client. Client further warrants that any sample containing any hazardous substance that is to be delivered to LAB will be packaged, labeled, transported, and delivered properly and in accordance with applicable laws.

Sample Handling. Prior to LAB's acceptance of any sample (or after any revocation of acceptance), the entire risk of loss or of damage to such sample remains with Client. Samples are accepted when receipt is acknowledged on chain of custody documentation. In no event will LAB have any responsibility for the action or inaction of any carrier shipping or delivering any sample to or from LAB premises.

Client authorizes LAB to proceed with the analysis of samples as received by the laboratory, recognizing that any samples not in compliance with all current DOH-ELAP-NELAP requirements for containers, preservation or holding time will be noted as such on th final report.

Disposal of hazardous waste samples is the responsibility of the Client. If the Client does not wish such samples returned, LAB may add storage and disposal fees to the final invoice. Maximum storage time for samples is 30 days after completion of analysis unless modified by applicable state or federal laws. Client will be required to give the LAB written instructions concerning disposal of these samples.

LAB reserves the absolute right, exercisable at any time, to refuse to receive delivery of, refuse to accept, or revoke acceptance of any sample, which, in the sole judgment of LAB (a) is of unsuitable volume, (b) may be or become unsuitable for or may pose a risk in handling, transport, or processing for any health, safety, environmental or other reason whether or not due to the presence in the sample of any hazardous substance, and whether or not such presence has been disclosed to LAB by Client or (c) if the condition or sample date make the sample unsuitable for analysis.

Legal Responsibility. LAB is solely responsible for performance of this contract, and no affiliated company, director, officer, employee, or agent shall have any legal responsibility hereunder, whether in contract or tort including negligence.

Assignment. LAB may assign its performance obligations under this contract to other parties, as it deems necessary. LAB shall disclose to Client any assignee (subcontractor) by ELAP ID # on the submitted final report.

Force Majeure. LAB shall have no responsibility or liability to the Client for any failure or delay in performance by LAB, which results in whole or in part from any cause or circumstance beyond the reasonable control of LAB. Such causes and circumstances shall include, but not limited to, acts of God, acts or orders of any government authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, difficulties or delays in transportation, mail or delivery services, inability to obtain sufficient services or supplies from LAB's usual suppliers, or any other cause beyond LAB's reasonable control.

Law. This contract shall be continued under the laws of the State of New York without regard to its conflicts of laws provision.

179 Lake Avenue, Rochester, NY 14608 Office (585) 647-2530 Fax (585) 647-3311

PARADIGM

CHAIN OF CUSTODY

1 of 2

REPORT TO:
CLIENT: Ravi Engineering
ADDRESS: 2110 S. Clinton Ave Suite 1
CITY: Rochester STATE: NY ZIP 14618
PHONE: 585-697-2821, 585-703-4832 (cell)
ATTN: Jim Mackeknie

INVOICE TO:
CLIENT:
ADDRESS: — SAME —
CITY: STATE: ZIP:
PHONE:
ATTN:

LAB PROJECT ID 204143
Quotation #:
Email: jmackeknie@raviengi.com

PROJECT REFERENCE
Terminal B
Project # 40.20.118

Matrix Codes:
AQ - Aqueous Liquid; NQ - Non-Aqueous Liquid; WA - Water; WG - Groundwater; DW - Drinking Water; WW - Wastewater; SO - Soil; SL - Sludge; SD - Solid; PT - Paint; WP - Wipe; CK - Caulk; OL - Oil; AR - Air

REQUESTED ANALYSIS

DATE COLLECTED	TIME COLLECTED	COMPOSITE	GRAB	SAMPLE IDENTIFIER	MATRIX CODES	NUMBER OF CONTAINERS	VOC 8260(full)	SVOC 8270	RCRA Metals	PCBs							REMARKS	PARADIGM LAB SAMPLE NUMBER
8-31-2020	850		X	SB4, 6-8.5'	SO	2	✓	✓	✓	✓							TCL	01
↓	1135		X	SB5, 6-9'	SO	2	✓	✓	✓	✓								02
9-1-2020	925		X	SB6 5-8	SO	3 ~~2~~	✓	✓	✓	✓							58.2 ppm PID (xtra Sample Volume provided use effect. B Cont)	03

Turnaround Time		Report Supplements			
Availability contingent upon lab approval; additional fees may apply.					
Standard 5 day	☒	None Required	☐	None Required	☐
10 day	☐	Batch QC	☐	Basic EDD	☐
Rush 3 day	☐	Category A	☐	NYSDEC EDD	☐
Rush 2 day	☐	Category B	☐		
Rush 1 day	☐				
Date Needed _____ please indicate date needed: _____		Other please indicate package needed: _____	☐	Other EDD please indicate EDD needed: _____	☐

Sampled By	9-1-20	12:20	Total Cost:
Relinquished By	9-1-20	12:20	
Received By	9-1-20	12:20	P.I.F.
Received @ Lab By	9/1/2020	15:34	

5°C iced 9/1/2020 15:27

By signing this form, client agrees to Paradigm Terms and Conditions (reverse).

See additional page for sample conditions.

PARADIGM

Chain of Custody Supplement

Client: Ravi Engineering **Completed by:** Glenn Pezzulo

Lab Project ID: 204143 **Date:** 9/1/2020

Sample Condition Requirements

Per NELAC/ELAP 210/241/242/243/244

Condition	NELAC compliance with the sample condition requirements upon receipt: Yes	No	N/A
Container Type	X	X 5035	
Comments			
Transferred to method-compliant container			X
Headspace (<1 mL)			X
Comments			
Preservation			X
Comments			
Chlorine Absent (<0.10 ppm per test strip)			X
Comments			
Holding Time	X		
Comments			
Temperature	X		X Metals
Comments	5°C iced		
Compliant Sample Quantity/Type	X		
Comments	Samples for Hg sent directly to sub lab.		

179 Lake Avenue, Rochester, NY 14608 Office (585) 647-2530 Fax (585) 647-3311

PARADIGM ENVIRONMENTAL SERVICES, INC.

CHAIN OF CUSTODY

L 2036052 11148

REPORT TO:		INVOICE TO:			
COMPANY:	Paradigm Environmental	COMPANY:	Same	LAB PROJECT #:	CLIENT PROJECT #:
ADDRESS:	179 Lake Avenue	ADDRESS:			
CITY: Rochester STATE: NY ZIP: 14608		CITY: STATE: ZIP:		TURNAROUND TIME: (WORKING DAYS)	
PHONE: FAX:		PHONE: FAX:		STD	OTHER
ATTN:	Reporting	ATTN:	Accounts Payable	1 2 3 X 5	
COMMENTS:	Please email results to reporting@paradigmenv.com			Date Due:	

PROJECT NAME/SITE NAME: Terminal B Project #40-20-118

REQUESTED ANALYSIS

DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER CONTAINERS	Mercury										REMARKS	PARADIGM LAB SAMPLE NUMBER
8/31/20	8:50		X	SB4, 6-8.5'	SO	1	X											
8/31/20	11:35		X	SB5, 6-9'	SO	1	X											
9/1/20	9:25		X	SB6, 5-8'	SO	1	X											

LAB USE ONLY BELOW THIS LINE

Sample Condition: Per NELAC/ELAP 210/241/242/243/244

Receipt Parameter	NELAC Compliance	
Container Type:	Y ☐	N ☐
Comments:		
Preservation:	Y ☐	N ☐
Comments:		
Holding Time:	Y ☐	N ☐
Comments:		
Temperature:	Y ☐	N ☐
Comments:		

Client

Sampled By: Brian Beach	Date/Time: 9-1-20 2:30	Total Cost: 14.30
Relinquished By:	Date/Time: 9/1/20 1430	
Received By:	Date/Time: 9/1/20 1430	P.I.F.
Received By: Relinquished by	Date/Time: 9/2/20 0130	
Received @ Lab By	Date/Time	

PHASE II ENVIRONMENTAL SITE INVESTIGATION REPORT – AREA D

Buffalo Outer Harbor Civic Improvements
275, 461, 525, 575, and 901 Fuhrmann Boulevard
Buffalo, New York

17-012-0132

Prepared for:

Trowbridge Wolf Michaels Landscape Architects, LLP
Attn. Kathryn Wolf
1001 West Seneca Street, Ste. 201
Ithaca, NY 14850

Prepared by:

LiRo Engineers, Inc.
690 Delaware Avenue
Buffalo, New York 14209

November 17, 2017

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1.0 INTRODUCTION

On behalf of Trowbridge Wolf Michaels Landscape Architects, LLP (TWML), LiRo Engineers, Inc. (LiRo) is conducting a Phase II Environmental Site Investigation (ESI) for the Buffalo Outer Harbor Civic Improvements project located at 275, 461, 525, 575, and 901 Fuhrmann Boulevard (the "Site") in Buffalo, New York (Figure 1). The Outer Harbor Site encompasses over 165 acres and five City of Buffalo tax parcels. The Phase II ESI is being performed to characterize environmental conditions in key areas where civic improvements are proposed.

Due to the size of the Site and past and future uses of the properties, the Site has been divided into six areas identified as Area A through Area F. This Phase II ESI report is specific to the investigation at Area D (and a small contiguous portion of Area F). Phase II ESI reports for other Site Areas are being prepared under separate covers.

Documents previously prepared by LiRo for this project include a Phase I Environmental Site Assessment (May 2017), a Site Investigation Work Plan (June 15, 2017), and a Health and Safety Plan (HASP) (April 2017). These documents define the scope of work, technical approach, and procedures for conducting the Phase II ESI.

1.1 Project Objectives

Portions of the Outer Harbor are currently in planning phase for redevelopment into recreational space. The proposed recreational space improvements include, but are not limited to, a Visitor Hub, Bike Path Extension, Recreational Spaces, Overlook(s)/Art Installation(s), a Bike Park, recreational use signage, a large event space, and a flexible, multi-use space on the Michigan Avenue Pier.

The objective of the Phase II ESI is to characterize Site environmental conditions with respect to the contemplated improvements in Area D. The Phase II ESI has been designed to develop a base of data sufficient to evaluate potential exposure to contaminants in soil or soil vapor for future site workers and recreational users; to develop soil management requirements for the civic improvement construction; and, to determine engineering controls or institutional controls that could be implemented to prevent exposure of future site users and workers to site contaminants.

2.0 BACKGROUND

2.1 Site Setting

The project Site is located in the Buffalo "Outer Harbor" section of the City's waterfront, and is situated along the Lake Erie shoreline within a protected harbor, formed by an outer break wall built between 1865 and 1890. Historically, the Outer Harbor provided deep water port facilities and associated landside transportation and industrial uses.

2.2 Site Background and Previous Investigations

LiRo prepared a Phase I Environmental Site Assessment for the Outer Harbor areas which included a comprehensive review of previous investigations and reports. The key documents relevant to environmental conditions in Area D and summarized in the Phase I include:

- Limited Human Health Exposure Assessment for Portions of the Buffalo Outer Harbor, prepared by URS and dated February 2012.
- Human Health Risk Assessment of Near-Term Recreational Activities for Portions of the Buffalo Outer Harbor, prepared by C&S Engineers, Inc. (C&S) and dated January 2017.
- NYSDEC Record of Decision (ROD), Buffalo Outer Harbor/Radio Tower Area Site, City of Buffalo, New York, prepared by the NYSDEC and dated March 1999.

Area D is a large section of land south of the former Bell Slip of the Buffalo Outer Harbor Site. Area D has been the subject of multiple studies that were summarized in the 2012 report prepared by URS. The Greenway Nature Trail/bicycle path (installed under New York State Department of Environmental Conservation (NYSDEC) oversight in Area C) was extended through the western portion of Area D. The interior (eastern) sections of Area D remain as vacant land with secondary vegetative growth (trees, shrubs, and grasses).

The property was largely created as a result of land reclamation and filling that has occurred over the past 100 years. Fill materials have been reported to consist of dredge spoils from US Army Corps of Engineers and miscellaneous filling from terrestrial human activities. Historical site investigation records indicate that a portion of Area D may have been used for storage of construction fill and that the William Pfohl Trucking Company operated a transfer station which

stored/delivered rock salt, zircon and sand, foundry sand from Chevrolet Motors River Road Foundry Plant, iron ore pellets, ball and china clay, gypsum rock, potash, and scrap metal.

Area D and Area E (Area E is also referred to as the Radio Tower Area or RTE) were investigated by the NYSDEC and it was determined that Area D did not contain hazardous waste, as documented in the March 1999 NYSDEC Record of Decision (ROD), Buffalo Outer Harbor/RTA Site. The 1999 ROD required a remedial action for the RTA but removed Area D from the Registry of Inactive Hazardous Waste Disposal Sites. No remedy was proposed for the land outside of the RTA.

The 1999 NYSDEC ROD reported concentrations of metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) greater than screening levels in surface soil, and subsurface soil. Volatile Organic Compounds (VOCs), pesticides, and metals were reported in groundwater at concentrations greater than screening levels.

The 2012 URS report summarized the historical NYSDEC data, but recognized limitations on the amount and quality of data available.

The LiRo Phase I ESA reported evidence of historical gasoline underground storage tanks (USTs) and above-ground storage tanks (ASTs) at a location in the northeastern edge of Area D along Fuhrmann Boulevard. Tanks reported include a 12,000-gallon UST, 4,000-gallon UST, 2,000-gallon UST, and two USTs/ASTs from a former helicopter (Heussler Helicopter) operation. These petroleum tanks were reported as present between 1952 and 1965 (see Figure 2 for the suspected area of historic storage tanks). The tank area has not been specifically investigated in any of the environmental sampling performed to date.

Area D is not currently regulated under any NYSDEC program. Due to the nature of the creation of this area from unknown or poorly documented filling operations, the soils (surface, subsurface, and deep subsurface) are not homogenous and subject to changes in material composition and analyte concentrations.

There has been a recent installation of a sculpture feature in Area D in a relatively small area adjacent to the Greenway Nature Trail. Several improvements are planned for Area D for other recreational uses including an extension of the exiting Greenway Nature Trail bike path, a mountain bike park, a great lawn/event venue, a visitor hub and additional art installations/overlooks.

3.0 SITE INVESTIGATION PROGRAM

3.1 Scope of Work

The following sections detail the work elements conducted during the Phase II ESI. The Phase II ESI field sampling and equipment decontamination were conducted in accordance with the methods and protocols described in the Work Plan (LiRo, 2017). The Phase II ESI investigation included the following subsurface investigation activities.

- Advancing 47 soil borings to a terminal depth of 6 or 8 feet below ground surface (ft. bgs).
- Field screening, classification, and identification of soils from the ground surface to the bottom of each boring. Soil samples were visually classified in the field using the Unified Soil Classification System (USCS). Field screening consisted of visual and olfactory indicators of impacts as well as screening with a photoionization detector (PID).
- Collecting surface soil samples (depth of 1 foot or less) and subsurface soil samples (depth greater than 1 foot) at all boring locations.
- Collecting 20 surface soil grab samples (depths of 0-2 inches and 2-12 inches) from 10 additional locations.
- Installing and sampling three soil vapor probes to a depth of 6 ft. bgs.
- Laboratory analysis of the soil and soil vapor samples at an accredited environmental laboratory.
- Collection of 30 shallow (0 to 1 ft. bgs) soil samples for horticultural testing at Cornell University. The results for the horticultural sampling are pending and will be included as an addendum or in the final version of this Phase II report.

Sampling locations are depicted on Figure 2. Details regarding these activities are discussed below.

3.2 Soil Investigation

Forty seven (47) soil borings were advanced using a direct push Geoprobe rig at the locations

shown on Figure 2. SJB Services, Inc. (SJB) of Buffalo, New York provided the direct push drilling services. Soil samples were collected continuously from grade to a depth of 6 or 8 (depending on location) ft. bgs using a 4-foot long macro-core and dual-tube sampler equipped with a dedicated acetate liner. The recovered samples were field-screened for volatile vapors using a PID unit equipped with a 10.6 electron volt (eV) lamp along their entire length after the acetate liner was cut. Soil descriptions for each boring were recorded on boring logs, which are provided in Appendix A.

Two soil samples were collected for chemical analysis from each Geoprobe boring. One shallow sample was collected from each boring to evaluate surface soil conditions and one deeper soil sample was collected to evaluate subsurface soil conditions. PID readings above background were detected in seven of the 47 soil borings. Other physical indicators of impacts, including odors or product sheen were not observed in any of the soil borings. In accordance with the Work Plan, the borings were backfilled with soil cuttings and the surface was restored with like materials.

3.3 Temporary Soil Vapor Probe Installation

Three soil vapor probes, SVP-1, SVP-2, and SVP-3 were installed adjacent to boring locations D-SB35, D-SB-36, and D-SB37, respectively. The soil vapor probes were sampled as a screening level investigation to support planning for a potential visitor hub structure. SJB installed the vapor probes in accordance with procedures described in the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 17, 2006 (NYSDOH Guidance). The soil vapor probes were each installed to a depth of approximately 6 ft. bgs and consisted of a 6-inch long screened implant attached to ¼-inch Teflon® tubing. A sandpack was placed around the implant from approximately 5 to 6 ft. bgs. The remainder of the borehole was sealed with bentonite.

3.4 Sampling and Analysis

Soil samples were collected and place in laboratory supplied, pre-cleaned sample jars labeled with a unique sample identification code, packed in a cooler with ice, and shipped under chain-of-custody control to ALS Group USA, Corp. (ALS) of Rochester, New York, a New York State Certified Laboratory (Environmental Laboratory Approval Program (ELAP) Certification #10145).

All soil samples were analyzed for NYSDEC Part 375/CP-51 Listed semi-volatile organic compounds (SVOCs) using United States Environmental Protection Agency (USEPA) Method 8270, polychlorinated biphenyls (PCBs) using USEPA Method 8082, metals using USEPA Methods 6010/7439, and pesticides using USEPA Methods 8081/8082. In addition to the above analyses, all surface soil samples were also analyzed for NYSDEC Part 375/CP-51 Listed herbicides using USEPA Method 8151, hexavalent chromium using USEPA Method 7199, and cyanide using USEPA Method 9012. Select samples were also analyzed for NYSDEC Part 375/CP-51 Listed volatile organic compounds (VOCs) using USEPA Method 8260.

Soil vapor samples were collected on September 1, 2017. Samples were collected from each soil vapor probe over a period of 6 hours using 6 liter Summa® canisters equipped with flow regulators calibrated for a flow rate of 0.017 liters per minute (LPM).

The soil vapor samples were analyzed for USEPA TO-15 VOCs using USEPA Method TO-15 and methane using USEPA Method TO-3 Modified.

3.5 Identification of Standards, Criteria and Guidance

Soil sample analytical results were compared to the NYSDEC Restricted Use (Track 2) Soil Cleanup Objectives (SCOs) for Restricted-Residential use and Commercial use.

New York State has not promulgated soil vapor standards, but the NYSDOH has established exposure guidelines, Air Guidance Values (AGVs), for indoor air quality. To evaluate concentrations of contaminants in soil vapor, the soil vapor analytical results were compared to the NYSDOH AGVs. As a screening tool, the soil vapor analytical results were also compared to background levels of VOCs in outdoor air presented in the NYSDOH Soil Vapor Intrusion Guidance Document, including Upper Fence Limit indoor air values from "Table C-1. NYSDOH 2003: Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes," 90th Percentile outdoor air values from "Table C-2. USEPA 2001: BASE Database, SUMMA canister method," and the 95th percentile Outdoor Air values from Table "Table C-5, HEI 2005: Relationship of Indoor, Outdoor and Personal Air published in the NYSDOH Soil Vapor Intrusion Guidance Document, Appendix C" (October 2006).

3.6 Deviations from Work Plan

There were no deviations from the Work Plan.

4.0 GEOLOGY AND HYDROGEOLOGY

4.1 Site and Regional Topographic Setting

LiRo reviewed the United States Geologic Survey (USGS), Buffalo Southeast, New York 7.5' Quadrangle (dated 1965). The elevation of Area D is approximately 580 ft. above mean sea level (amsl). The area immediately surrounding the Site is generally flat with a very gentle slope to the southwest towards Lake Erie.

4.2 Site and Regional Geology

Based on previous studies completed at the Site and LiRo's general knowledge of the area, the Site is completely manmade land, composed of fill from the early 1900s to 1980s. The Site is mostly vegetated with urban or secondary growth grasses, shrubs, and a few trees.

Based on the Geologic Map of New York, dated 1970, the Site is located within the Onondaga and Bois Blanc Limestones, specifically the Onondaga Limestone including Seneca, Morehouse (cherty), and Clarence Limestone Members, Edgecliff cherty Limestone Member, local coral bioherms, and the Bois Blanc Limestone including sandy, thin, discontinuous soils.

Local geology reported from Site geotechnical borings to depths as great as 65 ft. bgs report fill from ground surface to depths ranging from 5 to 20 ft. bgS, underlain by sand, silts, silty clay, and gravels. Bedrock, described as gray thick bedded limestone, was encounter at depths of 56 to 60 ft. bgs.

Five fill types have been identified from 0 to 26 ftbg in past reports. The fill types include: 1) landfill deposits; 2) hydraulic fill with a silt and clay matrix; 3) sand fill; 4) construction debris fill; and, 5) industrial process fill consisting of crushed concrete, asphalt, brick, wood, ash, glass, plastic, slag, coal, and cinder. The fill may occur as a combination of two or more fill types.

In Area D and E, south of the Bell Slip, two fill areas were reported. One fill area is located east of the north-south gravel roadway in the eastern one-third of Area D which is comprised of mainly industrial fill consisting of foundry sands, slag, brick, and layers of silt/clay size particles of ash and/or flue dust with thickness up to 14 feet thick. The second fill area is west of the

gravel road and contains hydraulic fill (dredged material) overlain by brick, gravel, crushed concrete, and slag.

Soil at the Outer Harbor has been identified through the Environmental Data Resources (EDR) database report as Urban Land and Haplaquolls. Urban land is defined as where 80% or more of the soil surface is covered by asphalt, concrete, buildings, or other impervious structures. Urban Land can include parking lots, shopping/business centers, industrial parks, etc. Haplaquolls soils are described as very poorly drained fine sandy loam.

Soil boring observations during the Phase II ESI indicated that fill material, which generally consisted of sandy silt, sandy gravel, or silty clay mixed with concrete, asphalt, slag, glass, coal, metal debris and red brick, was present in all 47 soil borings from grade to a maximum depth of 8 ft. bgs. The soil boring observations during the Phase II ESI did not identify a significant difference in fill types across Area D. Native soils were not encountered in any of the 47 soil borings.

4.3 Site and Regional Hydrogeology

Past investigations have reported groundwater at depths ranging from 8 to 15 ft. bgs. Groundwater flow is generally to the west towards Lake Erie. It is assumed that the groundwater table may be influenced by fluctuations in Lake Erie water levels. Lake Erie is the only surface water body in the study area, no ponds, rivers, or streams are present. Rain water either infiltrates to groundwater or follows existing topography and discharges via overland surface runoff directly to Lake Erie in areas where no manmade improvements have been constructed.

The closest state wetland is located approximately 300 ft. north of the Site. The EDR report indicates that approximately 25 percent of Area D occurs within the 100-year flood zone.

Groundwater was not encountered in any of the 47 soil borings installed during the Phase II ESI.

5.0 NATURE AND EXTENT OF CONTAMINATION

Soil analytical data for TCL VOCs, TCL SVOCs, PCBs, Pesticides, Herbicides, and TAL Metals were compared to Soil Cleanup Objectives (SCOs) listed in 6 NYCRR Part 375 for Restricted-Residential and Commercial uses. Laboratory analytical reports are included in Appendix B.

5.1 Surface Soil Contamination

A total of 67 surface soil composite samples were collected at 57 locations (47 Geoprobe borings with one surface soil sample each and 10 shallow sample locations with 2 samples each) for chemical analysis. The surface soil analytical results for detected compounds are presented in Table 1 through Table 5. Figure 3 illustrates the surface soil sample locations where: (1) analytical results did not indicate any exceedances of the Restricted-Residential Use SCOs; (2) analytical results indicated exceedances of Restricted-Residential Use SCOs; or, (3) analytical results indicated exceedances of Commercial Use SCOs.

SVOCs were detected at each of the 57 sample locations. Concentrations were found exceeding Restricted-Residential use and/or Commercial use SCOs at 28 of the 57 surface soil sample locations. The compounds exceeding SCOs included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene . Table 1 presents a summary of SVOC detections in surface soils.

Pesticides were detected at 30 of the 57 surface soil sample locations, however, none of the concentrations exceeded SCOs. Table 2 presents a summary of pesticide and herbicide detections in surface soils.

PCBs were detected at 35 of the 57 surface soil sample locations. Concentrations were found exceeding Restricted-Residential and/or Commercial use SCOs in seven of the 57 soil sample locations. Table 3 presents a summary of PCB detections in surface soils.

Metals were detected at each of the 57 surface soil sample locations. Metals, including arsenic, barium, cadmium, chromium, copper, lead, manganese, and/or mercury were detected at concentrations exceeding the Restricted-Residential and/or Commercial use SCOs at 21 of the 57 surface soil sample locations. Table 4 presents a summary of metals detections in surface soils.

One grab sample was collected for VOC analysis based on field screening (PID readings of

1,500 parts per million (ppm) from location F-SB4 at the 0 to 1 ft. bgs depth interval. No VOCs were reported in the sample, and it is likely that the PID measurement was anomalous at this location. Table 5 presents a summary of VOC detections in surface soils.

5.2 Subsurface Soil Contamination

A total of 47 composite samples of subsurface soil (deeper than 1-foot) were collected from 47 locations for chemical analysis. The subsurface soil analytical results for detected compounds are presented in Table 6 through Table 10. Figure 4 illustrates the subsurface soil sample locations where: (1) analytical results did not indicate any exceedances of the Restricted Residential Use SCOs; (2) analytical results indicated exceedances of Restricted Residential Use SCOs; or, (3) analytical results indicated exceedances of Commercial Use SCOs.

SVOCs were detected in all 47 subsurface sample locations. SVOCs , including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluouranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and/or phenanthrene, were detected in 26 of the 47 subsurface soil sample locations in exceedance of the Restricted-Residential Use SCO and/or the Restricted Commercial Use SCO. Table 6 presents a summary of the SVOC detections in subsurface soils.

Pesticides were detected in 25 of the 47 subsurface soil sample locations. Pesticides, including 4,4'-DDD, 4,4'-DDT, and/or Dieldrin were detected in two of the 47 subsurface sample locations at concentrations exceeding the Restricted-Residential Use SCOs and/or the Restricted Commercial Use SCOs. Table 7 presents a summary of the Pesticide detections in subsurface soils.

PCBs were detected in 27 of the 47 subsurface soil sample locations. Total PCBs exceeding the Restricted-Residential Use SCO and/or Restricted Commercial Use SCO were detected in seven of the 47 subsurface sample locations. Table 8 presents a summary of the PCB detections in subsurface soils.

Metals were detected in all 47 subsurface soil sample locations. Metals, including arsenic, barium, cadmium, chromium, copper, lead, manganese, and/or mercury, were detected in 20 of the 47 subsurface soil sample locations at concentrations exceeding the Restricted-Residential Use SCOs and/or the Restricted Commercial Use SCOs. Table 9 presents a summary of metals detections in subsurface soils.

Seven grab samples were collected for VOC analysis based on field screening. VOCs were

detected in six of the seven grab samples collected at concentrations below the Restricted-Residential Use SCOs. Table 10 presents a summary of VOC detections in subsurface soils.

5.3 Soil Vapor

The soil vapor analytical results indicate that concentrations of VOCs were present in each of the soil vapor samples collected. The concentrations of VOCs were below the NYSDOH AGVs. Several VOCs, including acetone, chloroform, trichloroethene, tetrachloroethene, ethylbenzene, m&p-xylene, o-xylene, styrene, alpha-pinene, and d-limonene, were detected at concentrations above the NYSDOH Background Levels for outdoor air. The soil vapor analytical results indicate that concentrations of methane were present in each of the soil vapor samples collected. The highest concentration of methane was detected at SVP-1 at a concentration of 4,900 parts per million volume (ppmV) which is the equivalent of approximately 0.5 percent. The lower explosive limit (LEL) of methane is 5 percent. Table 11 presents a summary of VOCs and methane detections in soil vapor.

6.0 QUALITATIVE EXPOSURE ASSESSMENT

The qualitative exposure assessment considers the nature of populations currently exposed or that have the potential to be exposed to Area D related contaminants both on- and off-site and describes the reasonably anticipated future land use of Area D and affected populations.

The qualitative exposure assessment evaluates five elements associated with exposure pathways, and describes how each of these elements pertains to the Site. The exposure pathways that are addressed include the following:

1. A description of the contaminant source(s) including the location of the contaminant release to the environment (any waste disposal area or point of discharge) or if the original source is unknown, the contaminated environmental medium (soil, indoor or outdoor air, biota, water, etc.) at the point of exposure;
2. An explanation of the contaminant release and transport mechanisms to the exposed population;
3. Identification of all potential exposure point(s) where actual or potential human contact with a contaminated medium may occur;
4. Description(s) of the route(s) of exposure (i.e., ingestion, inhalation, dermal absorption, etc.); and,
5. A characterization of the receptor populations who may be exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway are documented; a potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway is not known. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present, and can be reasonably anticipated to never exist in the future.

6.1 Characterization of Exposure Setting

As part of the assessment process, potential exposure pathways are determined through an evaluation of the physical setting of the Site and the potentially exposed populations. A brief description of the physical setting of the Site is presented in Section 2.0. The consideration of Site-specific factors related to the land usage is important in the development of realistic exposure scenarios and quantification of risks and hazards. The current and future potential land uses that are reasonably expected for the Site determine which populations may potentially be exposed. The Site land uses are discussed below.

<u>Current Land Use</u>

The current land use of Area D is limited recreational use. The Greenway Nature Trail/bicycle

path (installed under NYSDEC oversight in Area C) was extended through the western portion of Area D. The interior (eastern) sections of Area D remain as vacant land with secondary vegetative growth (trees, shrubs, and grasses).

Future Land Use

The future land use of Area D is expanded recreational use. The current improvements in Area D include the recent installation of a sculpture feature in a relatively small area adjacent to the Greenway Nature Trail. Several improvements are planned for Area D for other recreational uses including an extension of the exiting Greenway Nature Trail bike path, a mountain bike park, a great lawn/event venue, a visitor hub and additional art installations/overlooks.

6.2 Contaminant Sources

Based on the findings of the Phase II ESI, a specific contaminant source or release was not identified. The source of the contamination is inferred to be contaminants within the fill that was placed at the Site. Impacted media at the Site include: (1) SVOC, total PCB, and metal impacted surface soil; (2) SVOC, total PCB, pesticide, and metal impacted subsurface soil; and, (3) VOC impacted soil vapor. Air is also considered an impacted medium due to the potential release of vapors from soil to ambient and/or indoor air. Groundwater beneath the Site was not encountered during the Phase II ESI above the maximum investigation depth of 8 ft bgs. Ingestion, dermal contact, and inhalation are the potential routes of exposure.

6.3 Contaminant Release and Transport Mechanisms

Contaminants in surface soils can be released and transported by any direct contact with the exposed surface soil. Contaminants in subsurface soil may become suspended in the air column and could be inhaled during ground intrusive activity, such as excavating soil for utility trenching or general construction. Contaminants in soil vapor present in the surface soil can volatilize or adhere to soil particles and could be inhaled.

6.4 Potential Exposure Points

Potential exposure points are determined by identifying whether or not the potentially exposed population can contact these media.

Exposure pathways for contaminants present in undisturbed surface soils is potentially complete, where the soil is not under pavement.

For construction/utility workers, the exposure pathway to contaminants in subsurface soils is potentially complete.

The exposure pathway for ambient air inhalation of volatile chemicals from soil vapor is potentially complete. If an enclosed structure is constructed, engineering controls such as a vapor barrier should be considered. The soil vapor-to-ambient air exposure is considered *de minimus* in an outdoor or unenclosed setting as volatile chemicals are significantly diluted upon release to ambient air.

6.5 Potential Exposure Routes

Humans can be exposed to a variety of contaminated media, including soil, groundwater, surface water, sediment, air, and biota that has contact with other contaminated media. Based on the physical conditions of the Site, potential exposure routes associated with soil include incidental ingestion, direct dermal contact, and inhalation (airborne particulate). Potential exposure routes associated with soil vapor include inhalation (vapors).

6.6 Summary and Conclusion

As discussed in the preceding sections, the qualitative exposure assessment identified media and potential human exposure to surface and subsurface soil (through dermal contact, incidental ingestion, and inhalation of particulates), and soil vapor (through inhalation of vapors). The potentially exposed receptors include construction/utility workers and Site recreational users. The completed exposure pathways are summarized in the table below:

Environmental Media & Exposure Route	Human Exposure Assessment
Direct contact with surface soils (and incidental ingestion)	• Site recreational users can come into contact with contaminated surface soils. • Construction/utility workers can come into contact with contaminated surface soils.

Environmental Media & Exposure Route	Human Exposure Assessment
Direct contact with subsurface soils (and incidental ingestion)	• Site recreational area workers or construction/utility workers can come into contact with contaminated subsurface soils during ground-intrusive work. • Site recreational users can come into contact with contaminated subsurface soils if they are using the Site during construction activities.
Inhalation of air (exposures related to fugitive dust and soil vapor intrusion)	• Site recreational users may be exposed to soil vapors if buildings are constructed at the Site. • Site recreational users may be exposed to contaminated soils via fugitive dust (i.e., from dust-producing recreation or vehicles driving in unpaved areas

7.0 CONCLUSIONS AND RECOMMENDATIONS

LiRo performed a Phase II ESI in Area D and a small portion of Area F between August 16, 2017 and September 1, 2017 that consisted of surface and subsurface soil sampling and soil vapor sampling to assess the recognized environmental conditions (RECs) and/or environmental issues identified in the LiRo Phase I ESA report.

7.1 Conclusions

Based on the results of the Phase II ESI, the following conclusions are presented:

- Field screening of subsurface soils identified olfactory evidence of contamination as well as elevated PID readings in six (6) of the 47 Geoprobe boring locations (D-SB7, S-SB13, D-SB31, D-SB32, D-SB33, and D-SB34);
- The study area is underlain by fill materials which generally consist of sandy silt, sandy gravel, or silty clay mixed with concrete, asphalt, slag, glass, coal, metal debris, and red brick, from grade to a maximum investigation depth of 8 ft. bgs. Native soils were not encountered in any of the 47 soil borings.
- Surface soil sample results indicated concentrations of SVOCs, total PCBs, and metals that exceed Part 375 Restricted Use (Track 2) – Restricted-Residential SCOs and/or Commercial SCOs;
- Surface soil results from a relatively large area in the northwestern portion of the site reported contaminant levels that were lower than Commercial SCOs;
- Subsurface soil sample results indicated concentrations of SVOCs, pesticides, total PCBs, and metals that exceed Part 375 Restricted Use (Track 2) – Restricted-Residential SCOs and/or Commercial SCOs;
- Soil vapor results indicate that concentrations of VOCs were present in each of the soil vapor samples collected. The concentrations of VOCs were below the NYSDOH AGVs.
- Soil vapor results indicate that concentrations of methane were present in each of the soil vapor samples collected, with a maximum concentration of 4,900 ppmv which is the equivalent of 0.5 percent;
- Groundwater was not encountered during the Phase II ESI.

7.2 Recommendations

For the Site to be suitable for the proposed development, the following measures are recommended:

- Area D development plans should include a design for a site-wide cover system for areas where surface soil contaminant levels exceed applicable SCOs. The cover should be 1-

foot thick or 2-feet thick with thickness keyed to proposed use (passive or active recreation);

- If Area D is developed incrementally, then an institutional control should be used to prevent public access to contaminated portions of the site that have not been covered;
- Area D development plans should include a site management plan (SMP) which details provisions and procedures that will be implemented to prevent exposure of future Site workers and future Site recreational users to contaminated soil;
- To prevent exposure for future Site recreational users, the SMP should include annual inspection of the cover or barrier system and controls that would be used to mitigate potential exposure to the contaminated soil;
- Due to the presence of SVOCs, total PCBs, pesticides, and metals above Part 375 SCOs, dust control procedures are recommended during excavation or re-grading activities to minimize the creation and dispersion of fugitive airborne dust. A Community Air Monitoring Plan (CAMP) should be developed in accordance with the NYSDEC Division of Environmental Remediation (DER)-10 Regulations. The CAMP requires real-time monitoring for VOCs and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is intended to provide a measure of protection for the downwind community from potential airborne contaminant releases as a direct result of construction or subsurface work activities. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability;
- Before beginning any construction or re-grading activities at Area D, the selected Contractor should submit a site-specific health and safety plan (HASP) that will meet the requirements set forth by the Occupational Safety and Health Administration (OSHA), the NYSDOH and any other applicable regulations. The HASP should identify the possible locations and risks associated with the potential contaminants that may be encountered, and the administrative and engineering controls that will be utilized to mitigate concerns (i.e., dust control procedures for SVOCs, PCBs, pesticides, and metals);
- If an enclosed structure is contemplated for the visitor center, engineering controls (such as a vapor barrier) should be incorporated into the building design;
- Monitoring for methane should be incorporated into any construction plans requiring intrusive excavation work.

TABLES

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS1-0-2	D-SS1-2-12	D-SS2-0-2	D-SS2-2-12	D-SS3-0-2	D-SS3-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Acenaphthene	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	500,000	ND	ND	130 J	ND	ND	ND
Anthracene	100,000	500,000	110 J	78 J	140 J	ND	190 J	410 J
Benz(a)anthracene	1,000	5,600	360 J	260 J	520	ND	720	*1,400 J*
Benzo(a)pyrene	1,000	1,000	350 J	230 J	550	ND	720	**1,300 J**
Benzo(b)fluoranthene	1,000	5,600	450	290 J	760	ND	920	*1,600 J*
Benzo(g,h,i)perylene	100,000	500,000	240 J	150 J	380 J	ND	430	860 J
Benzo(k)fluouranthene	3,900	56,000	140 J	120 J	250 J	ND	310 J	550 J
Chrysene	3,900	56,000	360 J	260 J	550	ND	710	1,400 J
Dibenz(a,h)anthracene	330	560	ND	ND	100 J	ND	120 J	ND
Dibenzofuran	59,000	350,000	ND	ND	ND	ND	ND	ND
Fluouranthene	100,000	500,000	720	540	1,000	ND	1,400	2,800
Fluourene	100,000	500,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	280 J	180 J	450	ND	*520*	*930 J*
Naphthalene	100,000	500,000	ND	ND	ND	ND	94 J	ND
Phenanthrene	100,000	500,000	350 J	260 J	480	ND	740	1,900
Pyrene	100,000	500,000	580	430	810	ND	1,100	2,300
Total SVOCs	NS	NS	3,940	2,798	6,120	ND	7,974	15,450

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS4-0-2	D-SS4-2-12	D-SS5-0-2	D-SS5-2-12	D-SS6-0-2	D-SS6-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Acenaphthene	100,000	500,000	190 J	ND	2,100	ND	ND	ND
Acenaphthylene	100,000	500,000	ND	79 J	ND	ND	ND	ND
Anthracene	100,000	500,000	530	260 J	6,100	820 J	ND	ND
Benz(a)anthracene	1,000	5,600	*1,200*	870	**7,700**	*2,000*	ND	ND
Benzo(a)pyrene	1,000	1,000	**1,100**	860	**6,200**	**1,900 J**	ND	ND
Benzo(b)fluoranthene	1,000	5,600	*1,400*	*1,100*	***6,700***	*2,300*	ND	ND
Benzo(g,h,i)perylene	100,000	500,000	590	460	2,900	950 J	ND	ND
Benzo(k)fluouranthene	3,900	56,000	450	410	2,400	890 J	ND	ND
Chrysene	3,900	56,000	1,200	910	*7,000*	2,000	ND	ND
Dibenz(a,h)anthracene	330	560	160 J	130 J	**880 J**	ND	ND	ND
Dibenzofuran	59,000	350,000	160 J	ND	2,300	ND	ND	ND
Fluouranthene	100,000	500,000	2,700	1,900	20,000	5,200	ND	ND
Fluourene	100,000	500,000	210 J	ND	2,900	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	*730*	*570*	*3,600*	*1,200 J*	ND	ND
Naphthalene	100,000	500,000	150 J	ND	2,700	ND	ND	ND
Phenanthrene	100,000	500,000	2,100	1,100	24,000	4,700	ND	ND
Pyrene	100,000	500,000	2,200	1,600	15,000	4,000	ND	ND
Total SVOCs	NS	NS	15,070	10,249	112,480	25,960	ND	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS7-0-2	D-SS7-2-12	D-SS8-0-2	D-SS8-2-12	D-SS9-0-2	D-SS9-2-12
			8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Acenaphthene	100,000	500,000	ND	480	150 J	110 J	ND	ND
Acenaphthylene	100,000	500,000	210 J	170 J	90 J	ND	ND	ND
Anthracene	100,000	500,000	530	1,300	700	550	ND	ND
Benz(a)anthracene	1,000	5,600	*1,100*	*2,300*	*1,600*	*1,100*	140 J	ND
Benzo(a)pyrene	1,000	1,000	**1,100**	**2,100**	**1,300**	840	110 J	ND
Benzo(b)fluoranthene	1,000	5,600	*1,300*	*2,400*	*1,600*	*1,200*	200 J	100 J
Benzo(g,h,i)perylene	100,000	500,000	500	900	730	480	95 J	ND
Benzo(k)fluouranthene	3,900	56,000	440	720	540	410	ND	ND
Chrysene	3,900	56,000	1,000	2,100	1,500	1,100	170 J	78 J
Dibenz(a,h)anthracene	330	560	150 J	260 J	190 J	160 J	ND	ND
Dibenzofuran	59,000	350,000	ND	410	160 J	150 J	ND	ND
Fluouranthene	100,000	500,000	2,800	5,400	4,000	2,600	280 J	84 J
Fluourene	100,000	500,000	180 J	560	260 J	170 J	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	*630*	*1,100*	*890*	*540*	86 J	ND
Naphthalene	100,000	500,000	ND	250 J	ND	85 J	ND	ND
Phenanthrene	100,000	500,000	1,700	5,100	3,300	2,300	250 J	110 J
Pyrene	100,000	500,000	2,200	4,400	3,200	2,100	250 J	73 J
Total SVOCs	NS	NS	13,840	29,950	20,210	13,895	1,581	445

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS10-0-2	D-SS10-2-12	F-SB1-0-1	F-SB2-0-1	F-SB3-0-1	F-SB4-0-1
			8/17/2017	8/17/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-2 inches	2-12 inches	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	ND	ND	120 J	510 J	ND	ND
Acenaphthylene	100,000	500,000	200 J	850 J	ND	ND	ND	ND
Anthracene	100,000	500,000	380 J	1,900	420	1,300 J	ND	ND
Benz(a)anthracene	1,000	5,600	*1,200*	*4,500*	*1,100*	*2,500*	470 J	240 J
Benzo(a)pyrene	1,000	1,000	**1,300**	**4,100**	1,000	**2,300**	490 J	240 J
Benzo(b)fluoranthene	1,000	5,600	*1,600*	*4,800*	*1,200*	*2,700*	530 J	320 J
Benzo(g,h,i)perylene	100,000	500,000	650	3,000	640	1,300 J	ND	140 J
Benzo(k)fluouranthene	3,900	56,000	580	1,700	430	980 J	ND	110 J
Chrysene	3,900	56,000	1,300	*4,100*	1,000	2,300	430 J	270 J
Dibenz(a,h)anthracene	330	560	190 J	**600 J**	170 J	*370 J*	ND	ND
Dibenzofuran	59,000	350,000	ND	590 J	120 J	460 J	ND	ND
Fluouranthene	100,000	500,000	2,700	12,000	2,200	5,600	790 J	340 J
Fluourene	100,000	500,000	130 J	1,100 J	170 J	550 J	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	*790*	*3,300*	*760*	*1,600 J*	ND	160 J
Naphthalene	100,000	500,000	ND	ND	150 J	370 J	ND	95 J
Phenanthrene	100,000	500,000	1,500	10,000	1,600	5,000	440 J	270 J
Pyrene	100,000	500,000	2,400	9,100	1,900	4,800	750 J	300 J
Total SVOCs	NS	NS	14,920	61,640	12,980	32,640	3,900	2,485

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB1-0-1	D-SB2-0-1	D-SB3-0-1	D-SB4-0-1	D-SB5-0-1	D-SB6-0-1
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	500,000	ND	ND	130 J	ND	ND	ND
Anthracene	100,000	500,000	110 J	ND	350 J	140 J	ND	ND
Benz(a)anthracene	1,000	5,600	390 J	510 J	960	520	ND	550
Benzo(a)pyrene	1,000	1,000	380	470 J	920	520	ND	790
Benzo(b)fluoranthene	1,000	5,600	550	580 J	*1,200*	600	ND	920
Benzo(g,h,i)perylene	100,000	500,000	230 J	ND	600	320 J	ND	540
Benzo(k)fluouranthene	3,900	56,000	180 J	ND	410	230 J	ND	310 J
Chrysene	3,900	56,000	400	480 J	960	490	ND	660
Dibenz(a,h)anthracene	330	560	ND	ND	160 J	85 J	ND	130 J
Dibenzofuran	59,000	350,000	ND	ND	ND	ND	ND	ND
Fluouranthene	100,000	500,000	690	890 J	2,000	990	ND	720
Fluourene	100,000	500,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	270 J	ND	*730*	380 J	ND	*610*
Naphthalene	100,000	500,000	ND	ND	ND	ND	ND	ND
Phenanthrene	100,000	500,000	360 J	560 J	1,200	540	ND	290 J
Pyrene	100,000	500,000	600	760 J	1,700	850	ND	690
Total SVOCs	NS	NS	4,160	4,250	11,320	5,665	ND	6,210

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

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ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB7-0-1	D-SB8-0-1	D-SB9-0-1	D-SB10-0-1	D-SB11-0-1	D-SB12-0-1
			8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	500,000	120 J	ND	ND	ND	ND	ND
Anthracene	100,000	500,000	220 J	300 J	ND	ND	ND	ND
Benz(a)anthracene	1,000	5,600	690	600 J	830 J	ND	140 J	ND
Benzo(a)pyrene	1,000	1,000	700	590 J	900 J	ND	140 J	ND
Benzo(b)fluoranthene	1,000	5,600	870	650 J	*1,100 J*	ND	160 J	ND
Benzo(g,h,i)perylene	100,000	500,000	350 J	420 J	560 J	ND	90 J	ND
Benzo(k)fluouranthene	3,900	56,000	310 J	250 J	ND	ND	ND	ND
Chrysene	3,900	56,000	650	550 J	790 J	ND	140 J	ND
Dibenz(a,h)anthracene	330	560	94 J	ND	ND	ND	ND	ND
Dibenzofuran	59,000	350,000	ND	ND	ND	ND	ND	ND
Fluouranthene	100,000	500,000	1,400	1,200	1,400 J	ND	240 J	ND
Fluourene	100,000	500,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	440	440 J	*570 J*	ND	79 J	ND
Naphthalene	100,000	500,000	ND	ND	ND	ND	ND	ND
Phenanthrene	100,000	500,000	650	940 J	700 J	ND	160 J	ND
Pyrene	100,000	500,000	1,200	1,000 J	1,300 J	ND	220 J	ND
Total SVOCs	NS	NS	7,694	6,940	8,150	ND	1,369	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

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ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB13-0-1	D-SB14-0-1	D-SB15-0-1	D-SB16-0-1	D-SB17-0-1	D-SB18-0-1
			8/22/2017	8/22/2017	8/22/2017	8/23/2016	8/23/2017	8/23/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	500,000	ND	ND	ND	260 J	ND	ND
Anthracene	100,000	500,000	120 J	480 J	ND	660 J	280 J	ND
Benz(a)anthracene	1,000	5,600	390 J	*1,600*	ND	*2,800*	740	520 J
Benzo(a)pyrene	1,000	1,000	420	**1,600**	ND	**2,900**	620 J	450 J
Benzo(b)fluoranthene	1,000	5,600	520	*1,800*	ND	*4,900*	820	610 J
Benzo(g,h,i)perylene	100,000	500,000	240 J	930 J	ND	2,500	510 J	340 J
Benzo(k)fluouranthene	3,900	56,000	170 J	600 J	ND	1,400	310 J	ND
Chrysene	3,900	56,000	400	1,700	ND	3,000	660 J	480 J
Dibenz(a,h)anthracene	330	560	ND	270 J	ND	**690 J**	ND	ND
Dibenzofuran	59,000	350,000	ND	ND	ND	330 J	ND	ND
Fluouranthene	100,000	500,000	760	2,900	87 J	4,200	1,100	900
Fluourene	100,000	500,000	ND	ND	ND	240 J	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	280 J	*940 J*	ND	*2,100*	400 J	310 J
Naphthalene	100,000	500,000	ND	ND	ND	580 J	ND	ND
Phenanthrene	100,000	500,000	460	2,000	ND	2,800	1,100	610 J
Pyrene	100,000	500,000	680	2,900	ND	3,800	1,100	860
Total SVOCs	NS	NS	4,440	17,720	87	33,160	7,640	5,080

Notes:

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SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB19-0-1	D-SB20-0-1	D-SB21-0-1	D-SB22-0-1	D-SB23-0-1	D-SB24-0-1
			8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/24/2017	8/24/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	900	ND	2,400	ND	ND	ND
Acenaphthylene	100,000	500,000	2,900	ND	350 J	ND	ND	ND
Anthracene	100,000	500,000	7,600	ND	7,700	ND	ND	510 J
Benz(a)anthracene	1,000	5,600	**11,000**	910 J	**12,000**	310 J	490 J	*1,800*
Benzo(a)pyrene	1,000	1,000	**9,200**	830 J	**8,700**	ND	480 J	**1,800**
Benzo(b)fluoranthene	1,000	5,600	**11,000**	1,000 J	**11,000**	400 J	700 J	*2,900*
Benzo(g,h,i)perylene	100,000	500,000	7,500	620 J	4,900	ND	440 J	1,500
Benzo(k)fluouranthene	3,900	56,000	*4,500*	430 J	*5,100*	ND	ND	720 J
Chrysene	3,900	56,000	*8,900*	830 J	*9,900*	570 J	590 J	1,900
Dibenz(a,h)anthracene	330	560	**1,600**	ND	**1,400**	ND	ND	*380 J*
Dibenzofuran	59,000	350,000	4,800	ND	1,700	ND	ND	ND
Fluouranthene	100,000	500,000	32,000	1,500	28,000	600 J	600 J	3,600
Fluourene	100,000	500,000	7,800	ND	2,700	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	**6,300**	*510 J*	*4,700*	ND	320 J	*1,200*
Naphthalene	100,000	500,000	14,000	ND	1,700	ND	330 J	ND
Phenanthrene	100,000	500,000	38,000	1,000 J	26,000	630 J	640 J	1,600
Pyrene	100,000	500,000	26,000	1,400	22,000	510 J	690 J	3,100
Total SVOCs	NS	NS	194,000	9,030	150,250	3,020	5,280	21,010

Notes:

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ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB25-0-1	D-SB26-0-1	D-SB27-0-1	D-SB28-0-1	D-SB29-0-1	D-SB30-0-1
			8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthylene	100,000	500,000	ND	ND	ND	ND	ND	ND
Anthracene	100,000	500,000	ND	720 J	ND	350 J	390 J	ND
Benz(a)anthracene	1,000	5,600	410 J	*1,800*	280 J	840	*1,100*	ND
Benzo(a)pyrene	1,000	1,000	320 J	**1,500**	ND	700 J	910	ND
Benzo(b)fluoranthene	1,000	5,600	470 J	*2,100*	280 J	910	*1,100*	ND
Benzo(g,h,i)perylene	100,000	500,000	270 J	990	ND	490 J	640 J	ND
Benzo(k)fluouranthene	3,900	56,000	ND	560 J	ND	280 J	470 J	ND
Chrysene	3,900	56,000	400 J	1,800	280 J	810	990	ND
Dibenz(a,h)anthracene	330	560	ND	270 J	ND	ND	ND	ND
Dibenzofuran	59,000	350,000	ND	ND	ND	ND	ND	ND
Fluouranthene	100,000	500,000	610 J	3,900	460 J	1,700	2,200	ND
Fluourene	100,000	500,000	ND	360 J	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	ND	*830*	ND	420 J	*530 J*	ND
Naphthalene	100,000	500,000	ND	2,000	ND	ND	ND	ND
Phenanthrene	100,000	500,000	500 J	2,500	350 J	1,500	1,500	ND
Pyrene	100,000	500,000	570 J	3,200	460 J	1,600	2,000	ND
Total SVOCs	NS	NS	3,550	22,530	2,110	9,600	11,830	ND

Notes:

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ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB31-0-1	D-SB32-0-1	D-SB33-0-1	D-SB34-0-1	D-SB35-0-1	D-SB36-0-1
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	ND	ND	480 J	ND	750 J	380
Acenaphthylene	100,000	500,000	ND	ND	210 J	ND	ND	ND
Anthracene	100,000	500,000	ND	ND	2,500	190 J	1,800	550
Benz(a)anthracene	1,000	5,600	620 J	570 J	*3,600*	*1,500*	*4,500*	*1,100*
Benzo(a)pyrene	1,000	1,000	580 J	620 J	**3,300**	**1,300**	**4,100**	970
Benzo(b)fluoranthene	1,000	5,600	840 J	870 J	*3,800*	*2,400*	*5,000*	*1,300*
Benzo(g,h,i)perylene	100,000	500,000	420 J	590 J	1,900	1,000	2,500	520
Benzo(k)fluouranthene	3,900	56,000	ND	ND	1,500	820	1,900	460
Chrysene	3,900	56,000	720 J	640 J	3,400	1,900	*4,300*	1,100
Dibenz(a,h)anthracene	330	560	ND	ND	*480 J*	310 J	**720 J**	160 J
Dibenzofuran	59,000	350,000	ND	ND	430 J	ND	460 J	240 J
Fluouranthene	100,000	500,000	1,300 J	960 J	7,600	2,000	9,100	2,600
Fluourene	100,000	500,000	ND	ND	1,000	ND	790 J	380
Indeno(1,2,3-cd)pyrene	500	5,600	420 J	*510 J*	*2,200*	*1,100*	*2,900*	*610*
Naphthalene	100,000	500,000	ND	ND	270 J	ND	200 J	150 J
Phenanthrene	100,000	500,000	870 J	730 J	5,900	830	6,500	2,500
Pyrene	100,000	500,000	1,100 J	950 J	6,500	1,700	7,500	1,900
Total SVOCs	NS	NS	6,870	6,440	45,070	15,050	53,020	14,920

Notes:

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ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 1 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Surface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth						
			D-SB37-0-1	D-SB38-0-1	D-SB39-0-1	D-SB40-0-1	D-SB41-0-1	D-SB42-0-1	D-SB43-0-1
			8/25/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Acenaphthene	100,000	500,000	1,400	ND	ND	ND	690 J	ND	480 J
Acenaphthylene	100,000	500,000	ND	ND	ND	ND	ND	ND	ND
Anthracene	100,000	500,000	2,300	ND	ND	ND	1,400	740 J	1,200
Benz(a)anthracene	1,000	5,600	*4,100*	700 J	510 J	ND	*2,200*	*2,400*	*3,000*
Benzo(a)pyrene	1,000	1,000	**3,500**	550 J	460 J	ND	**1,800**	**2,000**	**2,700**
Benzo(b)fluoranthene	1,000	5,600	*4,300*	740 J	590 J	530 J	*2,000*	*2,700*	*3,700*
Benzo(g,h,i)perylene	100,000	500,000	2,100	390 J	340 J	590 J	1,000	1,000 J	1,300
Benzo(k)fluouranthene	3,900	56,000	1,600	ND	ND	ND	790	910 J	980
Chrysene	3,900	56,000	*4,000*	600 J	540 J	450 J	1,900	2,200	2,400
Dibenz(a,h)anthracene	330	560	**620 J**	ND	ND	ND	270 J	ND	*380 J*
Dibenzofuran	59,000	350,000	820	ND	ND	ND	460 J	ND	330 J
Fluouranthene	100,000	500,000	9,100	1,100	800	500 J	5,100	4,200	6,400
Fluourene	100,000	500,000	1,400	ND	ND	ND	670 J	ND	610 J
Indeno(1,2,3-cd)pyrene	500	5,600	*2,400*	340 J	280 J	ND	*890*	*890 J*	*1,300*
Naphthalene	100,000	500,000	370 J	ND	ND	450 J	280 J	1,200 J	560 J
Phenanthrene	100,000	500,000	8,600	720 J	490 J	520 J	5,600	2,600	5,400
Pyrene	100,000	500,000	6,900	1,100 J	800	540 J	4,400	3,600	4,800
Total SVOCs	NS	NS	53,510	6,240	4,810	3,580	29,450	24,440	35,540

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS1-0-2	D-SS1-2-12	D-SS2-0-2	D-SS2-2-12	D-SS3-0-2	D-SS3-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	8.3 J
4,4'-DDT	7,900	47,000	ND	ND	ND	5.3 JP	11	60
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	29 P
Endrin	11,000	89,000	ND	ND	ND	8.1 J	ND	28
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	ND	ND	ND	13	11	125

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS4-0-2	D-SS4-2-12	D-SS5-0-2	D-SS5-2-12	D-SS6-0-2	D-SS6-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	8.3 JP	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	39	14	15	8.2 J	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	7.5 JP	ND	ND	ND	ND	ND
Endrin	11,000	89,000	18	7.2 J	10	6.2 J	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	73	21	25	14	ND	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS7-0-2	D-SS7-2-12	D-SS8-0-2	D-SS8-2-12	D-SS9-0-2	D-SS9-2-12
			8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	24	15 P	51	71	33	57
Aldrin	97	680	ND	ND	ND	6.5 J	ND	6.2 J
Dieldrin	200	1,400	12	ND	ND	ND	ND	ND
Endrin	11,000	89,000	10 P	14	26	43	17	29
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	5 J
Lindane	1,300	9,200	ND	ND	6.6 J	10	ND	ND
Total Pesticides	NS	NS	46	29	84	131	50	97

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS10-0-2	D-SS10-2-12	F-SB1-0-1	F-SB2-0-1	F-SB3-0-1	F-SB4-0-1
			8/17/2017	8/17/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-2 inches	2-12 inches	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	8.4 J	ND	ND	ND	7.8 J	ND
4,4'-DDT	7,900	47,000	10	6.1 J	ND	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	7.2 J	ND	ND	ND	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	16	18	17 J	ND	ND
Total Pesticides	NS	NS	26	24	18	17	8	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB1-0-1	D-SB2-0-2	D-SB3-0-1	D-SB4-0-1	D-SB5-0-1	D-SB6-0-1
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	39	ND	ND
4,4'-DDT	7,900	47,000	ND	ND	ND	92	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	6.6 J	ND	ND	30	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	7	ND	ND	161	ND	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB7-0-1	D-SB8-0-1	D-SB9-0-1	D-SB10-0-1	D-SB11-0-1	D-SB12-0-1
			8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	5.3 J	6.5 J	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	ND	5	7	ND	ND	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB13-0-1	D-SB14-0-1	D-SB15-0-1	D-SB16-0-1	D-SB17-0-1	D-SB18-0-1
			8/22/2017	8/22/2017	8/22/2017	8/23/2017	8/23/2017	8/23/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	54	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	180	ND	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	44	ND	ND	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	ND	278	ND	ND	ND	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB19-0-1	D-SB20-0-1	D-SB21-0-1	D-SB22-0-1	D-SB23-0-1	D-SB24-0-1
			8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/24/2017	8/24/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	19	ND
4,4'-DDT	7,900	47,000	ND	ND	ND	110	48	50
Aldrin	97	680	ND	ND	ND	ND	ND	5.8 J
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	7.9 J	ND	ND	49 P	26	29
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	8	ND	ND	159	93	85

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB25-0-1	D-SB26-0-1	D-SB27-0-1	D-SB28-0-1	D-SB29-0-1	D-SB30-0-1
			8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	51	37	12	ND	27	ND
Aldrin	97	680	6.9 J	16	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	29	26	ND	ND	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	87	79	12	ND	27	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB31-0-1	D-SB32-0-1	D-SB33-0-1	D-SB34-0-1	D-SB35-0-1	D-SB36-0-1
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	ND	ND	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4200	24,000	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	7.8 J	5.3 J
Total Pesticides	NS	NS	ND	ND	ND	ND	7.8	5.3

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 2 - Summary of Pesticides Detected in Surface Soil

Herbicide/Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth						
			D-SB37-0-1	D-SB38-0-1	D-SB39-0-1	D-SB40-0-1	D-SB41-0-1	D-SB42-0-1	D-SB43-0-1
			8/25/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	ND	ND	ND	8.6 J	49	17
Aldrin	97	680	ND	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	14	8 J
alpha-Chlordane	4200	24,000	9.3 J	ND	ND	ND	ND	ND	ND
delta-BHC	100,000	500,000	ND	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	16	ND	ND	ND	ND	ND	6.3 J
Total Pesticides	NS	NS	25.3	ND	ND	ND	9	63	31

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS1-0-2	D-SS1-2-12	D-SS2-0-2	D-SS2-2-12	D-SS3-0-2	D-SS3-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	440
Aroclor 1260	NS	NS	34 J	27 J	130	95	120	420
Total PCBs	1,000	1,000	34	27	130	95	120	860

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS4-0-2	D-SS4-2-12	D-SS5-0-2	D-SS5-2-12	D-SS6-0-2	D-SS6-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Aroclor 1248	NS	NS	52	ND	0.046	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	110	50	ND	ND
Aroclor 1260	NS	NS	210	94	83	42	ND	390
Total PCBs	1,000	1,000	262	94	193	92	ND	390

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS7-0-2	D-SS7-2-12	D-SS8-0-2	D-SS8-2-12	D-SS9-0-2	D-SS9-2-12
			8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Aroclor 1248	NS	NS	ND	ND	140	290	100 J	260
Aroclor 1254	NS	NS	ND	ND	550	930	470	750
Aroclor 1260	NS	NS	23 J	320	130 P	230	120	200
Total PCBs	1,000	1,000	23	320	820	**1,450**	690	**1,210**

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
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Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

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Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS10-0-2	D-SS10-2-12	F-SB1-0-1	F-SB2-0-1	F-SB3-0-1	F-SB4-0-1
			8/17/2017	8/17/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-2 inches	2-12 inches	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	70	40	28 J	ND	44	ND
Total PCBs	1,000	1,000	70	40	28	ND	44	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB1-0-1	D-SB2-0-1	D-SB3-0-1	D-SB4-0-1	D-SB5-0-1	D-SB6-0-1
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	76	79	110	42	ND	ND
Total PCBs	1,000	1,000	76	79	110	42	ND	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
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Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB7-0-1	D-SB8-0-1	D-SB9-0-1	D-SB10-0-1	D-SB11-0-1	D-SB12-0-1
			8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	44	ND	ND	ND	ND	ND
Total PCBs	1,000	1,000	44	ND	ND	ND	ND	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB13-0-1	D-SB14-0-1	D-SB15-0-1	D-SB16-0-1	D-SB17-0-1	D-SB18-0-1
			8/22/2017	8/22/2017	8/22/2017	8/23/2017	8/23/2017	8/23/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	ND	69	ND	23 J	64	ND
Total PCBs	1,000	1,000	ND	69	ND	23	64	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB19-0-1	D-SB20-0-1	D-SB21-0-1	D-SB22-0-1	D-SB23-0-1	D-SB24-0-1
			8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/24/2017	8/24/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	890	280	300
Aroclor 1254	NS	NS	ND	ND	ND	2,000	930 P	1,000
Aroclor 1260	NS	NS	79	130	ND	1,700	370	240
Total PCBs	1,000	1,000	79	130	ND	**4,590**	**1,580**	**1,540**

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
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ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

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Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB25-0-1	D-SB26-0-1	D-SB27-0-1	D-SB28-0-1	D-SB29-0-1	D-SB30-0-1
			8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	350	1,100	ND	ND	ND	ND
Aroclor 1254	NS	NS	1,000	820	ND	ND	ND	ND
Aroclor 1260	NS	NS	380	230	120	23 J	ND	ND
Total PCBs	1,000	1,000	**1,730**	**2,150**	120	23	ND	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

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Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB31-0-1	D-SB32-0-1	D-SB33-0-1	D-SB34-0-1	D-SB35-0-1	D-SB36-0-1
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	ND	ND	ND	ND	ND	ND
Total PCBs	1,000	1,000	ND	ND	ND	ND	ND	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 3 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Surface Soil

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth						
			D-SB37-0-1	D-SB38-0-1	D-SB39-0-1	D-SB40-0-1	D-SB41-0-1	D-SB42-0-1	D-SB43-0-1
			8/25/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND	77
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND	220
Aroclor 1260	NS	NS	42	ND	28 J	43	140	170	170
Total PCBs	1,000	1,000	42	ND	28	43	140	170	467

Notes:

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SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS1-0-2	D-SS1-2-12	D-SS2-0-2	D-SS2-2-12	D-SS3-0-2	D-SS3-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/16/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Aluminum	NS	NS	11,800	9,750	20,800	6,170	12,900	10,700
Antimony	NS	NS	ND	ND	ND	ND	3.3 J	4.1 J
Arsenic	16	16	6.9	4.9	10.1	**19.5**	**19**	**17**
Barium	400	400	108	89.4	**427**	152	356	*357*
Beryllium	72	590	1.17	0.82	3.07	0.88	1.15	0.91
Cadmium	4.3	9.3	0.51 J	0.36 J	0.66	0.61	*3.46*	*3.38*
Calcium	NS	NS	50,300	57,400	94,800	5,890	23,200	26,800
Chromium (Total)	180	1,500	36	*93.8*	18	17.2	58.6	85.3
Cobalt	NS	NS	4.9 J	3.8 J	2.4 J	5.6	5.5 J	5.9
Copper	270	270	26.5	18.2	42.3	102	**348**	**377**
Iron	NS	NS	19,700	16,600	26,900	13,900	25,300	22,600
Lead	400	1,000	40.3	31.6	115	*760*	*451*	*515*
Magnesium	NS	NS	8,850	7,010	9,880	900	5,090	6,570
Manganese	2,000	10,000	928	1,850	1,520	141	553	454
Mercury	0.81	2.8	0.113	0.075	0.147	0.107	*1.01*	*0.839*
Nickel	310	310	13.6	9.4	8.6	15.1	35.9	34.8
Potassium	NS	NS	1,920	1,500	2,620	720	1,300	1,190
Selenium	180	1,500	1.7	1.9	2.2	2.3	2.3	1.5
Silver	180	1,500	ND	ND	0.1 J	10.7	2.1	2.9
Sodium	NS	NS	280	300	540	200	430	330
Thallium	NS	NS	ND	ND	ND	ND	ND	ND
Vanadium	NS	NS	18.6	19.1	15.8	28.6	21.6	22.6
Zinc	10,000	10,000	117	78.3	149	140	730	764
Chromium, Hexavalent	110	400	ND	--	0.05 J	--	0.19 J	--
Cyanide	27	27	1.09	--	8.83	--	0.94	--

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

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J = Estimated value

-- = Not Analyzed

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

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Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS4-0-2	D-SS4-2-12	D-SS5-0-2	D-SS5-2-12	D-SS6-0-2	D-SS6-2-12
			8/16/2017	8/16/2017	8/16/2017	8/16/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Aluminum	NS	NS	9,800	10,300	11,700	11,300	5,680	4,910
Antimony	NS	NS	ND	ND	ND	ND	ND	ND
Arsenic	16	16	9.1	11.3	5.8	5.6	7.8	5.8
Barium	400	400	146	164	122	121	55	46.7
Beryllium	72	590	0.62	0.61	0.99	0.88	0.81	0.55
Cadmium	4.3	9.3	*2.77*	1.68	1.56	0.96	0.47 J	0.42 J
Calcium	NS	NS	31,500	26,500	57,500	70,100	100,000	54,900
Chromium (Total)	180	1,500	32.9	39.9	20.4	17.1	14.4	9.8
Cobalt	NS	NS	6.4	7.6	5.8	5.7	2.6 J	3.2 J
Copper	270	270	51.2	54.8	106	69.7	10.4	8.7
Iron	NS	NS	22,700	24,300	23,100	20,500	12,500	12,700
Lead	400	1,000	*432*	*525*	189	157	47.1	52.2
Magnesium	NS	NS	9,950	9,430	13,300	19,000	7,170	6,600
Manganese	2,000	10,000	767	761	660	674	685	501
Mercury	0.81	2.8	0.651	0.791	0.295	0.293	0.039	0.034
Nickel	310	310	19.2	20.3	16.7	14	5.6	6.8
Potassium	NS	NS	1,790	1,590	2,260	2,410	740	650
Selenium	180	1,500	1.2	1.1 J	1.8	0.9 J	1.1	0.9 J
Silver	180	1,500	0.6 J	0.4 J	0.3 J	0.2 J	ND	ND
Sodium	NS	NS	210	170	210	230	280	190
Thallium	NS	NS	ND	ND	ND	0.8 J	2.0	ND
Vanadium	NS	NS	24.4	28.2	20.9	20.9	12.8	12.7
Zinc	10,000	10,000	589	432	406	260	81.4	71
Chromium, Hexavalent	110	400	ND	--	ND	--	ND	--
Cyanide	27	27	0.58	--	3.3	--	1.11	--

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

-- = Not Analyzed

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS7-0-2	D-SS7-2-12	D-SS8-0-2	D-SS8-2-12	D-SS9-0-2	D-SS9-2-12
			8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017	8/17/2017
			0-2 inches	2-12 inches	0-2 inches	2-12 inches	0-2 inches	2-12 inches
Aluminum	NS	NS	6,120	9,540	5,890	5,740	6,140	3,390
Antimony	NS	NS	ND	ND	2.2 J	2.8 J	1.5 J	1.2 J
Arsenic	16	16	3.5	5.4	6.5	8.4	4.7	5.7
Barium	400	400	49.6	80.9	81.1	74.8	39.6	39.3
Beryllium	72	590	0.35	0.51	0.37	0.39	0.26 J	0.23 J
Cadmium	4.3	9.3	0.57 J	0.54 J	*8.1*	**11.7**	*5.81*	*7.17*
Calcium	NS	NS	184,000	54,100	15,300	8,230	5,520	4,020
Chromium (Total)	180	1,500	10.9	20.2	55.7	70.3	40.1	96.5
Cobalt	NS	NS	3.7 J	6.1	4 J	2.9 J	1.9 J	3.2 J
Copper	270	270	18.2	36	66.1	89.8	44.3	75.6
Iron	NS	NS	13,000	18,600	26,300	37,000	28,400	38,200
Lead	400	1,000	56.6	87.9	*490*	*609*	299	362
Magnesium	NS	NS	11,100	15,000	2,370	1,840	880	750
Manganese	2,000	10,000	934	451	1,030	1,560	1,010	1,170
Mercury	0.81	2.8	0.181	0.157	0.347	0.256	0.123	0.185
Nickel	310	310	9.9	18.7	21.2	25.6	16.1	40
Potassium	NS	NS	1,520	1,970	1,090	890	660	440
Selenium	180	1,500	ND	1.2	2.2	2	1.3	2.2
Silver	180	1,500	0.09 J	0.1 J	1.5	2.2	1.1	1.3
Sodium	NS	NS	200	200	180	150	130	130
Thallium	NS	NS	4.0	ND	ND	ND	ND	ND
Vanadium	NS	NS	13.7	22.0	14.6	14.3	13.0	11.1
Zinc	10,000	10,000	117	190	1,300	1,890	897	1,110
Chromium, Hexavalent	110	400	0.11 J	--	0.1 J	--	ND	--
Cyanide	27	27	0.08 J	--	1.1	--	0.83	--

Notes:

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Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SS10-0-2	D-SS10-2-12	F-SB1-0-1	F-SB2-0-1	F-SB3-0-1	F-SB4-0-1
			8/17/2017	8/17/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-2 inches	2-12 inches	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	8,900	9,550	13,500	7,200	18,500	14,600
Antimony	NS	NS	1.6 J	1.7 J	2.8 J	1.5 J	ND	ND
Arsenic	16	16	6.7	5.7	11.8	13.1	14.4	14.9
Barium	400	400	148	154	293	92	216	174
Beryllium	72	590	0.54	0.62	1.7	0.82	2.07	0.75
Cadmium	4.3	9.3	1.16	0.96	1.03	0.88	1.34	0.61
Calcium	NS	NS	36,200	44,800	60,600	56,500	167,000	45,200
Chromium (Total)	180	1,500	21.6	17.3	20.2	14	32.2	29.2
Cobalt	NS	NS	6	5.5 J	4.4 J	4.4 J	5.5 J	3.4 J
Copper	270	270	49.5	44.9	131	44.4	26.9	21.2
Iron	NS	NS	20,900	17,600	23,400	19,400	19,800	44,400
Lead	400	1,000	302	293	*449*	159	90.3	222
Magnesium	NS	NS	11,000	14,300	7,750	14,500	12,700	4,780
Manganese	2,000	10,000	505	497	607	603	1,140	*5,100*
Mercury	0.81	2.8	0.655	0.801	0.394	0.35	0.057	0.044
Nickel	310	310	16.1	14.6	14.7	13.4	15.8	10.3
Potassium	NS	NS	1,780	1,720	1,460	1,330	4,120	1,910
Selenium	180	1,500	0.8 J	0.6 J	1.5	1.4	2.5	3.4
Silver	180	1,500	0.2 J	0.2 J	0.6 J	0.1 J	0.7 J	ND
Sodium	NS	NS	200	200	440	220	540	620
Thallium	NS	NS	ND	ND	ND	1.2	5.7	1 J
Vanadium	NS	NS	21.4	19.9	20.1	17.4	28.3	42.7
Zinc	10,000	10,000	328	271	409	192	246	69.8
Chromium, Hexavalent	110	400	ND	--	0.08 J	ND	0.08 J	0.25 J
Cyanide	27	27	0.41	--	0.94	0.38	0.33	0.22

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Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB1-0-1	D-SB2-0-1	D-SB3-0-1	D-SB4-0-1	D-SB5-0-1	D-SB6-0-1
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	16,000	8,810	10,100	7,520	23,000	10,300
Antimony	NS	NS	ND	ND	ND	ND	ND	ND
Arsenic	16	16	11.9	13.2	15.2	10	3.6	14.1
Barium	400	400	267	129	158	114	227	175
Beryllium	72	590	2.02	1.01	1.36	0.74	4.37	1.24
Cadmium	4.3	9.3	1.21	1.32	1.35	0.92	0.8	1.07
Calcium	NS	NS	90,900	111,000	91,200	68,300	158,000	131,000
Chromium (Total)	180	1,500	34.6	27.4	29.8	25.3	13.5	164
Cobalt	NS	NS	4.8 J	4.7 J	4.9 J	4.8 J	1.3 J	3.6 J
Copper	270	270	43.8	38.7	42.8	36.8	23.6	26
Iron	NS	NS	28,800	16,400	18,000	14,400	16,500	20,000
Lead	400	1,000	153	144	121	184	37.1	127
Magnesium	NS	NS	14,800	9,900	8,480	11,200	23,400	14,600
Manganese	2,000	10,000	1,480	532	599	455	1,960	*3,070*
Mercury	0.81	2.8	0.154	0.132	0.201	0.447	ND	0.096
Nickel	310	310	13.7	14.6	16	13.1	6.3	11.8
Potassium	NS	NS	2,460	2,210	2,290	1,950	1,450	1,900
Selenium	180	1,500	1.7	1.5	2.1	1.12	1.8	2.34
Silver	180	1,500	0.3 J	0.5 J	0.4 J	0.4 J	ND	0.3 J
Sodium	NS	NS	430	240	270	220	1,420	750
Thallium	NS	NS	1.1 J	3.0	2.0	1.5	2.4	3.6
Vanadium	NS	NS	27.5	24.5	25.6	23.5	8.8	69.7
Zinc	10,000	10,000	253	283	260	211	116	172
Chromium, Hexavalent	110	400	ND	ND	ND	ND	ND	0.91
Cyanide	27	27	4.14	0.46	1.44	0.22	5.18	0.16

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Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB7-0-1	D-SB8-0-1	D-SB9-0-1	D-SB10-0-1	D-SB11-0-1	D-SB12-0-1
			8/21/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	10,700	5,790	6,980	6,190	13,600	9,780
Antimony	NS	NS	ND	ND	ND	ND	ND	ND
Arsenic	16	16	**17.3**	4.8	4.1	3.2	3.8	5.4
Barium	400	400	171	120	58	51.7	132	73.1
Beryllium	72	590	1.44	0.35	0.49	0.47	1.63	0.48
Cadmium	4.3	9.3	1.3	0.31 J	0.26 J	0.15 J	0.63	0.35 J
Calcium	NS	NS	111,000	42,400	96,400	124,000	113,000	37,900
Chromium (Total)	180	1,500	33.9	9.2	9.9	6.5	8	13.9
Cobalt	NS	NS	5.1 J	4.4 J	3.1 J	2.5 J	2.4 J	8.2
Copper	270	270	77.3	22.3	29.4	14	18	18.9
Iron	NS	NS	18,900	13,900	10,500	7,980	8,640	19,100
Lead	400	1,000	198	161	92.8	18.9	90.5	17.3
Magnesium	NS	NS	9,460	8,740	18,300	17,500	29,100	13,300
Manganese	2,000	10,000	989	306	513	488	1,890	467
Mercury	0.81	2.8	0.28	0.3	0.136	0.115	0.149	0.033 J
Nickel	310	310	16.3	12.8	8.5	7.6	6.5	18.6
Potassium	NS	NS	3,080	800	1,220	1,050	1,590	1,650
Selenium	180	1,500	1.53	0.4 J	0.6 J	ND	1.4	0.9 J
Silver	180	1,500	0.5 J	ND	ND	ND	ND	ND
Sodium	NS	NS	360	150	250	270	450	160
Thallium	NS	NS	2.5	ND	1.9	3.2	1.6	ND
Vanadium	NS	NS	26.1	13.4	14.8	11.3	11.6	22.5
Zinc	10,000	10,000	263	77	74.1	41.2	274	68.4
Chromium, Hexavalent	110	400	ND	ND	ND	ND	ND	ND
Cyanide	27	27	0.44	0.21	0.1	0.22	0.82	0.09 J

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Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB13-0-1	D-SB14-0-1	D-SB15-0-1	D-SB16-0-1	D-SB17-0-1	D-SB18-0-1
			8/22/2017	8/22/2017	8/22/2017	8/23/2017	8/23/2017	8/23/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	13,500	9,940	7,320	9,730	13,100	6,250
Antimony	NS	NS	ND	ND	ND	ND	ND	ND
Arsenic	16	16	4.6	7.6	3.8	13.3	3.8	3.8
Barium	400	400	117	258	49.2	139	115	55.9
Beryllium	72	590	1.12	0.74	0.32	1.07	2.12	0.34
Cadmium	4.3	9.3	0.38 J	0.97	0.18 J	2.97	0.19 J	0.71
Calcium	NS	NS	69,800	42,600	44,600	39,000	107,000	101,000
Chromium (Total)	180	1,500	12.1	21.9	9.7	30.4	9.5	11.1
Cobalt	NS	NS	4.6 J	5.3 J	5.1 J	4.9 J	1.7 J	3.8 J
Copper	270	270	28.6	35.9	11.5	158	17	23.3
Iron	NS	NS	14,100	18,900	14,000	59,200	10,300	11,500
Lead	400	1,000	193	*692*	9.7	267	64.6	70.4
Magnesium	NS	NS	14,200	9,960	14,600	7,150	13,800	10,800
Manganese	2,000	10,000	919	593	329	1,590	1,730	274
Mercury	0.81	2.8	0.165	ND	0.016 J	0.578	ND	0.089
Nickel	310	310	10.6	14.5	10.4	18.2	6.1	10.6
Potassium	NS	NS	1,650	1,250	1,610	1,080	1,320	1,130
Selenium	180	1,500	1 J	0.9 J	ND	2	1.6	ND
Silver	180	1,500	ND	0.09 J	ND	0.4 J	ND	ND
Sodium	NS	NS	350	210	150	370	490	170
Thallium	NS	NS	ND	ND	ND	ND	1.2	2.2
Vanadium	NS	NS	16.7	19.4	20.7	23.0	8.5	14.3
Zinc	10,000	10,000	112	320	50.5	514	87.4	728
Chromium, Hexavalent	110	400	ND	ND	ND	0.06 J	ND	ND
Cyanide	27	27	0.27	1.64	ND	2.72	0.93	0.04 J

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Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB19-0-1	D-SB20-0-1	D-SB21-0-1	D-SB22-0-1	D-SB23-0-1	D-SB24-0-1
			8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/24/2017	8/24/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	9,960	7,820	7,640	4,510	6,770	4,930
Antimony	NS	NS	ND	1.1 J	ND	ND	2.4 J	1.6 J
Arsenic	16	16	7.3	5.3	5.9	11.4	10.8	8.9
Barium	400	400	113	123	83.3	52.9	89.8	50.8
Beryllium	72	590	0.99	0.51	0.42	0.29 J	0.78	0.26 J
Cadmium	4.3	9.3	0.53 J	0.69	0.69	*7.3*	*7.47*	**11.3**
Calcium	NS	NS	51,500	58,200	48,700	9,780	22,300	6,710
Chromium (Total)	180	1,500	12.2	12.9	19.7	165	56.4	81.4
Cobalt	NS	NS	5.2 J	5 J	4.4 J	4.9 J	3.5 J	3.1 J
Copper	270	270	72.3	34.7	20.1	149	91.8	92.4
Iron	NS	NS	15,600	15,300	16,900	94,900	37,900	49,600
Lead	400	1,000	151	207	127	398	*559*	*543*
Magnesium	NS	NS	11,700	13,400	17,200	3,360	3,880	800
Manganese	2,000	10,000	712	454	434	1,410	1,620	1,560
Mercury	0.81	2.8	0.447	0.308	0.18	0.297	0.35	0.273
Nickel	310	310	13.1	13.4	12.2	51.1	30	28.2
Potassium	NS	NS	1,300	1,390	1,200	590	750	300
Selenium	180	1,500	1 J	ND	ND	2.4	1.8	2.29
Silver	180	1,500	0.1 J	0.1 J	0.2 J	1.5	1.7	2
Sodium	NS	NS	250	210	500	140	230	160
Thallium	NS	NS	ND	ND	ND	ND	ND	ND
Vanadium	NS	NS	17.5	17.9	21.2	19.6	16.9	15.6
Zinc	10,000	10,000	161	124	173	1,200	1,330	1,960
Chromium, Hexavalent	110	400	ND	0.2 J	ND	0.24 J	0.23 J	0.31 J
Cyanide	27	27	0.22	0.049 J	0.08 J	1.24	1.55	0.578

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Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB25-0-1	D-SB26-0-1	D-SB27-0-1	D-SB28-0-1	D-SB29-0-1	D-SB30-0-1
			8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	3,880	20,700	8,060	9,590	6,650	4,130
Antimony	NS	NS	3.1 J	1.9 J	ND	ND	ND	ND
Arsenic	16	16	6.4	6.7	4.9	9	3.2	10.3
Barium	400	400	52.7	216	82.5	93.1	61.7	222
Beryllium	72	590	0.29 J	3.25	0.7	0.72	0.33	0.38
Cadmium	4.3	9.3	**13.3**	2.74	0.5 J	0.45 J	0.37 J	0.3 J
Calcium	NS	NS	9,930	120,000	33,100	76,200	88,100	68,400
Chromium (Total)	180	1,500	60.4	20	12.1	16.1	10.4	8.1
Cobalt	NS	NS	2.4 J	2.8 J	5 J	5.2 J	3.8 J	3 J
Copper	270	270	99.5	88	30.5	31.7	37.6	36.4
Iron	NS	NS	28,300	16,700	15,000	31,300	11,500	11,400
Lead	400	1,000	*767*	249	79.7	76.8	108	117
Magnesium	NS	NS	2,700	27,000	6,450	17,800	26,600	4,100
Manganese	2,000	10,000	1,640	1,790	306	552	286	105
Mercury	0.81	2.8	0.152	ND	**3.1**	0.089	0.199	0.046
Nickel	310	310	24.6	11.6	14.4	17.5	9.8	12.9
Potassium	NS	NS	380	1,680	1,350	1,780	1,390	680
Selenium	180	1,500	1.7	2.38	0.56 J	1.21	ND	0.7 J
Silver	180	1,500	2.9	1.4	0.08 J	ND	ND	1.5
Sodium	NS	NS	120	740	220	620	290	270
Thallium	NS	NS	ND	0.7 J	ND	0.9 J	1.6	0.8 J
Vanadium	NS	NS	11.1	14.0	13.7	22.0	16.8	16.7
Zinc	10,000	10,000	2,310	587	183	110	107	178
Chromium, Hexavalent	110	400	ND	0.21 J	0.15 J	0.06 J	ND	ND
Cyanide	27	27	0.458	1.14	0.69	0.13	ND	0.2

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Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB31-0-1	D-SB32-0-1	D-SB33-0-1	D-SB34-0-1	D-SB35-0-1	D-SB36-0-1
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	10,100	13,100	5,900	21,300	21,800	3,670
Antimony	NS	NS	ND	1.5 J	ND	ND	5.9 J	2.9 J
Arsenic	16	16	6.8	7.5	15	8	**18.3**	3.5
Barium	400	400	147	265	371	279	**879**	36
Beryllium	72	590	1.49	1.78	0.77	3.02	2.14	0.47
Cadmium	4.3	9.3	1.36	3.33	1.47	2.21	**24**	1.01
Calcium	NS	NS	172,000	129,000	47,500	102,000	86,200	12,600
Chromium (Total)	180	1,500	44.3	104	56.4	59	*637*	10.2
Cobalt	NS	NS	2.1 J	1.9 J	4 J	2.3 J	7	1.6 J
Copper	270	270	122	265	**449**	153	**1,520**	**279**
Iron	NS	NS	13,000	13,600	15,500	24,100	32,500	6,180
Lead	400	1,000	113	317	**1,020**	224	*754*	64.4
Magnesium	NS	NS	11,500	13,600	4,160	13,000	11,200	3,140
Manganese	2,000	10,000	823	1,010	481	*2,140*	932	253
Mercury	0.81	2.8	0.074	0.122	0.716	0.185	0.138	0.255
Nickel	310	310	10.8	13.8	25.6	11.2	46.4	5.8
Potassium	NS	NS	930	1,200	630	1,860	1,860	400
Selenium	180	1,500	1.5	2.2	1.9	3.2	2.1	0.8 J
Silver	180	1,500	0.6 J	2.6	0.6 J	1.3	16.6	0.1 J
Sodium	NS	NS	440	610	410	720	760	130
Thallium	NS	NS	4.1	2.4	ND	ND	0.8 J	ND
Vanadium	NS	NS	12.2	14.4	12.7	13.3	26.8	7.3
Zinc	10,000	10,000	244	557	480	325	4,730	540
Chromium, Hexavalent	110	400	ND	ND	ND	ND	0.38 J	0.09 J
Cyanide	27	27	0.46	0.38	0.18	0.707	1.14	0.11

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

-- = Not Analyzed

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 4 - Summary of Metals Detected in Surface Soil

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth						
			D-SB37-0-1	D-SB38-0-1	D-SB39-0-1	D-SB40-0-1	D-SB41-0-1	D-SB42-0-1	D-SB43-0-1
			8/25/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet	0-1 feet
Aluminum	NS	NS	60,500	9,590	8,500	7,500	9,890	5,410	5,260
Antimony	NS	NS	5.1 J	ND	ND	ND	ND	ND	ND
Arsenic	16	16	12.8	8.3	7.1	12.6	6.7	4.9	6.8
Barium	400	400	287	90.1	83.7	76.5	77.3	56	74
Beryllium	72	590	3.07	0.88	0.84	0.73	0.71	0.35	0.35
Cadmium	4.3	9.3	2.36	0.31 J	0.36 J	0.66	0.56	0.48 J	3.29
Calcium	NS	NS	82,800	96,500	101,000	70,800	42,000	70,100	39,800
Chromium (Total)	180	1,500	51.9	11.7	10	17.3	12.8	9.5	29.6
Cobalt	NS	NS	3.5 J	5.1 J	3.8 J	6.3	7.4	3.4 J	3.5 J
Copper	270	270	**2,740**	21.9	24.3	43.4	50.4	24.6	**1,420**
Iron	NS	NS	14,000	15,400	14,200	21,800	23,900	10,600	19,200
Lead	400	1,000	378	38.1	70.7	108	45.8	107	310
Magnesium	NS	NS	15,700	15,100	17,100	6,470	12,400	11,800	12,400
Manganese	2,000	10,000	*2,610*	784	787	426	402	266	648
Mercury	0.81	2.8	0.232	0.024 J	0.103	0.626	0.19	0.225	0.425
Nickel	310	310	28.9	12.8	10.1	16.6	18.9	9.5	5.5
Potassium	NS	NS	1,390	1,420	1,250	990	1,270	1,150	900
Selenium	180	1,500	2.7	0.9 J	0.9 J	1.5	0.6 J	0.5 J	1 J
Silver	180	1,500	0.7 J	ND	ND	0.1 J	ND	ND	0.9 J
Sodium	NS	NS	730	290	300	210	190	240	200
Thallium	NS	NS	ND	2.2	2.1	1.3	ND	1.8	ND
Vanadium	NS	NS	17.7	16.0	12.8	17.4	17.6	15.1	16.5
Zinc	10,000	10,000	896	67.6	63.3	140	128	117	1,090
Chromium, Hexavalent	110	400	0.21 J	ND	ND	ND	ND	ND	0.08 J
Cyanide	27	27	ND	0.19	0.59	0.29	0.15	0.09 J	0.25

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

-- = Not Analyzed

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 5 - Summary of Volatile Organic Compounds (VOCs) Detected in Surface Soils

	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth
			F-SB4-0-1
			8/21/2017
			0-1 feet
Total VOCs	NS	NS	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			F-SB1-1-6	F-SB2-1-6	F-SB3-1-6	F-SB4-1-6	D-SB1-1-6	D-SB2-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	ND	ND	ND	ND	1300	ND
Acenaphthylene	100,000	500,000	ND	170 J	ND	ND	ND	86 J
Anthracene	100,000	500,000	110 J	320 J	ND	200 J	2,900	300 J
Benz(a)anthracene	1,000	5,600	290 J	*1,100*	*1,800 J*	560	*3,700*	880
Benzo(a)pyrene	1,000	1,000	310 J	**1,100**	**2,500**	490	**2,900**	820
Benzo(b)fluoranthene	1,000	5,600	350	*1,300*	*2,200*	650	*3,200*	990
Benzo(g,h,i)perylene	100,000	500,000	190 J	550	1,600 J	290 J	1,100 J	520
Benzo(k)fluouranthene	3,900	56,000	120 J	460	770 J	220 J	1,100 J	390
Chrysene	3,900	56,000	290 J	1,100	2,000	600	3,300	830
Dibenz(a,h)anthracene	330	560	ND	150 J	ND	85 J	*370 J*	130 J
Dibenzofuran	59,000	350,000	ND	ND	ND	100 J	930 J	ND
Fluouranthene	100,000	500,000	600	2,600	2,400	1,300	8,700	1,900
Fluourene	100,000	500,000	ND	110 J	ND	ND	1,300	100 J
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	220 J	*690*	*1,100 J*	350 J	*1,500*	*630*
Naphthalene	100,000	500,000	ND	ND	ND	100 J	410 J	ND
Phenanthrene	100,000	500,000	410	1,500	830 J	1,100	9,500	1,100
Phenol	100,000	500,000	ND	ND	ND	ND	ND	ND
Pyrene	100,000	500,000	500	2,100	2,600	1,100	7,200	1,500
Total SVOCs	NS	NS	3,390	13,250	17,800	7,145	49,410	10,176

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB3-1-6	D-SB4-1-6	D-SB5-1-6	D-SB6-1-6	D-SB7-1-6	D-SB8-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	ND	160 J	ND	ND	120 J	ND
Acenaphthylene	100,000	500,000	ND	86 J	ND	ND	200 J	100 J
Anthracene	100,000	500,000	140 J	450	ND	ND	470	330 J
Benz(a)anthracene	1,000	5,600	350 J	*1,100*	860 J	850 J	*1,600*	930
Benzo(a)pyrene	1,000	1,000	340 J	**1,400**	820 J	820 J	**1,600**	920
Benzo(b)fluoranthene	1,000	5,600	420	*1,300*	1,000 J	1,000 J	*2,100*	1,000
Benzo(g,h,i)perylene	100,000	500,000	200 J	860	510 J	480 J	740	540
Benzo(k)fluouranthene	3,900	56,000	150 J	420	ND	ND	660	350 J
Chrysene	3,900	56,000	320 J	1,200	810 J	870 J	1,900	880
Dibenz(a,h)anthracene	330	560	ND	200 J	ND	ND	220 J	140 J
Dibenzofuran	59,000	350,000	ND	120 J	ND	ND	130 J	ND
Fluouranthene	100,000	500,000	730	2,300	1,600 J	1,600 J	3,500	1,900
Fluourene	100,000	500,000	ND	200 J	ND	ND	220 J	120 J
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	250 J	800	*550 J*	*530 J*	*870*	*630*
Naphthalene	100,000	500,000	250 J	100 J	ND	ND	170 J	80 J
Phenanthrene	100,000	500,000	530	1,700	1,200 J	1,300 J	1,900	1,100
Phenol	100,000	500,000	ND	ND	ND	ND	ND	ND
Pyrene	100,000	500,000	630	2,200	1,400 J	1,400 J	3,300	1,600
Total SVOCs	NS	NS	4,310	14,596	8,750	8,850	19,700	10,620

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB9-1-6	D-SB10-1-6	D-SB11-1-6	D-SB12-1-6	D-SB13-1-6	D-SB14-1-6
			8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	930 J	1,200 J	ND	430 J	ND	ND
Acenaphthylene	100,000	500,000	ND	ND	ND	270 J	ND	ND
Anthracene	100,000	500,000	3,600	3,400	ND	1,300	100 J	190 J
Benz(a)anthracene	1,000	5,600	*4,600*	*4,800*	*1,100 J*	*3,300*	290 J	580
Benzo(a)pyrene	1,000	1,000	**3,600**	**4,100**	**1,200 J**	**3,200**	310 J	940
Benzo(b)fluoranthene	1,000	5,600	*4,100*	*4,700*	*1,100 J*	*3,800*	370	1,000
Benzo(g,h,i)perylene	100,000	500,000	1,500	1,900	570 J	1,600	190 J	750
Benzo(k)fluouranthene	3,900	56,000	1,500	1,800 J	ND	1,400	130 J	320 J
Chrysene	3,900	56,000	3,900	*4,100*	1,100 J	3,100	290 J	620
Dibenz(a,h)anthracene	330	560	*550 J*	**600 J**	ND	*460 J*	ND	160 J
Dibenzofuran	59,000	350,000	1,300	890 J	ND	310 J	ND	ND
Fluouranthene	100,000	500,000	10,000	11,000	1,200 J	6,600	570	1,000
Fluourene	100,000	500,000	2,300	1,800 J	ND	570 J	ND	ND
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	*2,000*	*2,400*	*580 J*	*2,000*	200 J	*780*
Naphthalene	100,000	500,000	250 J	ND	ND	260 J	ND	ND
Phenanthrene	100,000	500,000	10,000	11,000	790 J	4,600	380	610
Phenol	100,000	500,000	ND	ND	ND	ND	ND	ND
Pyrene	100,000	500,000	7,600	8,700	1,800 J	5,400	490	950
Total SVOCs	NS	NS	57,730	62,390	9,440	38,600	3,320	7,900

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB15-1-6	D-SB16-1-6	D-SB17-1-6	D-SB18-1-6	D-SB19-1-6	D-SB20-1-6
			8/22/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	ND	ND	840	2,800	ND	1,900
Acenaphthylene	100,000	500,000	ND	ND	ND	570 J	ND	940
Anthracene	100,000	500,000	110 J	250 J	2,600	6,100	450 J	8,300
Benz(a)anthracene	1,000	5,600	310 J	750	*2,900*	**9,000**	*1,200*	**9,900**
Benzo(a)pyrene	1,000	1,000	310 J	680 J	**2,100**	**6,800**	980	**7,500**
Benzo(b)fluoranthene	1,000	5,600	370 J	870	*2,600*	**8,000**	*1,300*	**9,400**
Benzo(g,h,i)perylene	100,000	500,000	180 J	450 J	1,100	3,800	660 J	4,400
Benzo(k)fluouranthene	3,900	56,000	130 J	290 J	900	3,700	630 J	*4,000*
Chrysene	3,900	56,000	300 J	730	2,500	7,900	1,100	*8,500*
Dibenz(a,h)anthracene	330	560	ND	ND	ND	**1,100**	ND	**1,400**
Dibenzofuran	59,000	350,000	ND	ND	1,000	2,700	ND	2,500
Fluouranthene	100,000	500,000	610	1,300	6,600	17,000	2,300	27,000
Fluourene	100,000	500,000	ND	ND	1,400	3,800	ND	4,900
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	480 J	ND
Indeno(1,2,3-cd)pyrene	500	5,600	210 J	380 J	*1,000*	*3,400*	*580 J*	*4,400*
Naphthalene	100,000	500,000	ND	ND	1,100	5,500	1,700	1,600
Phenanthrene	100,000	500,000	340 J	1,100	7,300	22,000	1,800	26,000
Phenol	100,000	500,000	ND	ND	ND	ND	ND	ND
Pyrene	100,000	500,000	520	1,300	5,200	15,000	2,100	19,000
Total SVOCs	NS	NS	3,390	8,100	39,140	119,170	15,280	141,640

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB21-1-6	D-SB22-1-6	D-SB23-1-6	D-SB24-1-6	D-SB25-1-6	D-SB26-1-6
			8/23/2017	8/23/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	ND	ND	ND	ND	ND	1,000 J
Acenaphthylene	100,000	500,000	ND	ND	ND	ND	ND	ND
Anthracene	100,000	500,000	370 J	ND	ND	270 J	250 J	2,900
Benz(a)anthracene	1,000	5,600	840	240 J	230 J	410 J	280 J	*4,800*
Benzo(a)pyrene	1,000	1,000	770 J	230 J	260 J	300 J	ND	**3,700**
Benzo(b)fluoranthene	1,000	5,600	980	330 J	350 J	460 J	250 J	*4,600*
Benzo(g,h,i)perylene	100,000	500,000	560 J	ND	ND	230 J	ND	2,300
Benzo(k)fluouranthene	3,900	56,000	380 J	ND	ND	ND	ND	1,800
Chrysene	3,900	56,000	780 J	310 J	290 J	740 J	470 J	*4,100*
Dibenz(a,h)anthracene	330	560	ND	ND	ND	ND	ND	**650 J**
Dibenzofuran	59,000	350,000	ND	ND	ND	ND	ND	830 J
Fluouranthene	100,000	500,000	1,400	410 J	320 J	690 J	680 J	11,000
Fluourene	100,000	500,000	ND	ND	ND	ND	ND	1,400
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	470 J	ND	ND	ND	ND	*2,000*
Naphthalene	100,000	500,000	300 J	ND	ND	340 J	ND	3,900
Phenanthrene	100,000	500,000	1,200	440 J	290 J	870	790	9,600
Phenol	100,000	500,000	ND	ND	ND	290 J	410 J	ND
Pyrene	100,000	500,000	1,300	420 J	330 J	660 J	650 J	8,600
Total SVOCs	NS	NS	9,350	2,380	2,070	5,260	3,780	63,180

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB27-1-6	D-SB28-1-6	D-SB29-1-6	D-SB30-1-8	D-SB31-1-8	D-SB32-1-8
			8/24/2017	8/24/2017	8/24/2017	8/25/2017	8/25/2017	8/25/2017
			1-6 feet	1-6 feet	1-6 feet	1-8 feet	1-8 feet	1-8 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	200 J	370 J	120 J
Acenaphthene	100,000	500,000	ND	ND	510 J	ND	200 J	ND
Acenaphthylene	100,000	500,000	ND	ND	ND	ND	170 J	ND
Anthracene	100,000	500,000	ND	ND	1,600	110 J	740	ND
Benz(a)anthracene	1,000	5,600	ND	1,000 J	*4,600*	280 J	*1,700*	140 J
Benzo(a)pyrene	1,000	1,000	ND	850 J	**3,600**	190 J	**1,500**	150 J
Benzo(b)fluoranthene	1,000	5,600	ND	*1,100 J*	*4,200*	240 J	*2,100*	200 J
Benzo(g,h,i)perylene	100,000	500,000	ND	660 J	1,800	ND	930	ND
Benzo(k)fluouranthene	3,900	56,000	ND	430 J	1,900	ND	800	ND
Chrysene	3,900	56,000	ND	1,000 J	3,700	220 J	1,800	160 J
Dibenz(a,h)anthracene	330	560	ND	ND	*540 J*	ND	220 J	ND
Dibenzofuran	59,000	350,000	ND	ND	310 J	ND	200 J	ND
Fluouranthene	100,000	500,000	520 J	1,800	8,300	520	4,100	270 J
Fluourene	100,000	500,000	ND	ND	500 J	ND	380 J	ND
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	ND	*530 J*	*1,700*	ND	*940*	ND
Naphthalene	100,000	500,000	ND	ND	330 J	ND	250 J	ND
Phenanthrene	100,000	500,000	470 J	1,500	5,800	360 J	2,900	220 J
Phenol	100,000	500,000	ND	ND	ND	ND	ND	ND
Pyrene	100,000	500,000	510 J	1,800	8,400	460	3,600	270 J
Total SVOCs	NS	NS	1,500	10,670	47,790	2,580	22,900	1,530

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB33-1-8	D-SB34-1-8	D-SB35-1-8	D-SB36-1-8	D-SB37-1-8	D-SB38-1-6
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/29/2017
			1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	11,000	1,200 J	ND	100 J	250 J	ND
Acenaphthylene	100,000	500,000	1,700 J	ND	ND	ND	500 J	ND
Anthracene	100,000	500,000	32,000	3,700	190 J	210 J	1,400	ND
Benz(a)anthracene	1,000	5,600	**39,000**	*5,000*	410 J	410 J	*4,300*	260 J
Benzo(a)pyrene	1,000	1,000	**31,000**	**4,100**	320 J	330 J	**4,400**	240 J
Benzo(b)fluoranthene	1,000	5,600	**34,000**	*5,300*	480	420	*4,900*	340 J
Benzo(g,h,i)perylene	100,000	500,000	16,000	2,700	250 J	220 J	2,700	ND
Benzo(k)fluouranthene	3,900	56,000	*14,000*	1,800	180 J	180 J	1,900	ND
Chrysene	3,900	56,000	*34,000*	*4,600*	450	380 J	3,600	320 J
Dibenz(a,h)anthracene	330	560	**4,800 J**	**710 J**	ND	ND	**730 J**	ND
Dibenzofuran	59,000	350,000	13,000	1,300	ND	ND	340 J	ND
Fluouranthene	100,000	500,000	91,000	12,000	1,000	880	7,900	420 J
Fluourene	100,000	500,000	24,000	2,000	ND	110 J	540 J	ND
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	**18,000**	*2,900*	250 J	230 J	*3,200*	ND
Naphthalene	100,000	500,000	13,000	540 J	97 J	110 J	240 J	ND
Phenanthrene	100,000	500,000	*110,000*	11,000	760	940	4,900	320 J
Phenol	100,000	500,000	ND	ND	2,600	ND	ND	ND
Pyrene	100,000	500,000	72,000	9,600	850	710	6,300	440 J
Total SVOCs	NS	NS	558,500	68,450	7,837	5,230	48,100	2,340

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 6 - Summary of Semi-Volatile Organic Compounds (SVOCs) Detected in Subsurface Soil

SVOCs	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth				
			D-SB39-1-6	D-SB40-1-6	D-SB41-1-6	D-SB42-1-6	D-SB43-1-6
			8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
m,p-Cresols	100,000	500,000	ND	ND	ND	ND	ND
Acenaphthene	100,000	500,000	ND	ND	2,300	ND	ND
Acenaphthylene	100,000	500,000	ND	ND	590 J	ND	ND
Anthracene	100,000	500,000	330 J	ND	7,400	ND	290 J
Benz(a)anthracene	1,000	5,600	660 J	ND	**14,000**	460 J	660 J
Benzo(a)pyrene	1,000	1,000	510 J	320 J	**11,000**	400 J	560 J
Benzo(b)fluoranthene	1,000	5,600	630 J	240 J	**14,000**	490 J	740 J
Benzo(g,h,i)perylene	100,000	500,000	400 J	ND	6,100	ND	370 J
Benzo(k)fluouranthene	3,900	56,000	260 J	ND	*6,500*	ND	310 J
Chrysene	3,900	56,000	610 J	ND	*12,000*	450 J	680 J
Dibenz(a,h)anthracene	330	560	ND	ND	**1,900**	ND	ND
Dibenzofuran	59,000	350,000	ND	ND	1,100	ND	ND
Fluouranthene	100,000	500,000	1,300	ND	28,000	830 J	1,300
Fluourene	100,000	500,000	ND	ND	2,400	ND	ND
Hexachlorobenzene	1,200	6,000	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	5,600	340 J	ND	**5,800**	ND	290 J
Naphthalene	100,000	500,000	ND	ND	660 J	ND	260 J
Phenanthrene	100,000	500,000	1,200	ND	18,000	690 J	970
Phenol	100,000	500,000	ND	ND	ND	ND	ND
Pyrene	100,000	500,000	1,100	ND	24,000	720 J	1,100
Total SVOCs	NS	NS	7,340	560	155,750	4,040	7,530

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			F-SB1-1-6	F-SB2-1-6	F-SB3-1-6	F-SB4-1-6	D-SB1-1-6	D-SB2-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	8.0 J	ND	ND	13	7.5 J
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	8.3 J	ND
alpha-Chlordane	4,200	24,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	5.7 J	ND
Total Pesticides	NS	NS	ND	8	ND	ND	27	8

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB3-1-6	D-SB4-1-6	D-SB5-1-6	D-SB6-1-6	D-SB7-1-6	D-SB8-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	*18,000*	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	ND	ND	ND	**54,000**	8.4 J
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	10,000	ND
alpha-Chlordane	4,200	24,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	ND	ND	ND	ND	82,000	8

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB9-1-6	D-SB10-1-6	D-SB11-1-6	D-SB12-1-6	D-SB13-1-6	D-SB14-1-6
			8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	10	ND
4,4'-DDT	7,900	47,000	ND	ND	76	ND	14 B	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	29	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4,200	24,000	ND	6.7 J	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	ND	7	105	ND	24	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB15-1-6	D-SB16-1-6	D-SB17-1-6	D-SB18-1-6	D-SB19-1-6	D-SB20-1-6
			8/22/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	6.6 BJ	ND	ND	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	*230 P*	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4,200	24,000	ND	ND	9.9 J	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	7	ND	9.9	ND	230	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB21-1-6	D-SB22-1-6	D-SB23-1-6	D-SB24-1-6	D-SB25-1-6	D-SB26-1-6
			8/23/2017	8/23/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	100	6.9	88	53	48
Aldrin	97	680	ND	ND	ND	19	18	18 J
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	30	31
Endrin	11,000	89,000	ND	75	ND	57	35	42
alpha-Chlordane	4,200	24,000	ND	ND	ND	7.2 J	ND	ND
Lindane	1,300	9,200	ND	ND	ND	6.7 J	ND	ND
Total Pesticides	NS	NS	ND	175	6.9	177.9	136	139

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB27-1-6	D-SB28-1-6	D-SB29-1-6	D-SB30-1-8	D-SB31-1-8	D-SB32-1-8
			8/24/2017	8/24/2017	8/24/2017	8/25/2017	8/25/2017	8/25/2017
			1-6 feet	1-6 feet	1-6 feet	1-8 feet	1-8 feet	1-8 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	33	9.6 J	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	11 P	ND	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4,200	24,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	ND	ND	ND	ND
Total Pesticides	NS	NS	ND	44	9.6	ND	ND	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB33-1-8	D-SB34-1-8	D-SB35-1-8	D-SB36-1-8	D-SB37-1-8	D-SB38-1-6
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/29/2017
			1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-6 feet
4,4'-DDD	13,000	92,000	9.2 J	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	11 J	ND	ND	ND	ND	ND
Aldrin	97	680	ND	ND	ND	ND	ND	ND
Dieldrin	200	1,400	ND	ND	ND	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	ND	ND
Endrin	11,000	89,000	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4,200	24,000	ND	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	19	ND	ND	7.6 J	ND
Total Pesticides	NS	NS	20.2	19	ND	ND	7.6	ND

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 7 - Summary of Pesticides Detected in Subsurface Soils

Pesticide	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth				
			D-SB39-1-6	D-SB40-1-6	D-SB41-1-6	D-SB42-1-6	D-SB43-1-6
			8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
4,4'-DDD	13,000	92,000	ND	ND	ND	ND	ND
4,4'-DDE	8,900	62,000	ND	ND	ND	ND	ND
4,4'-DDT	7,900	47,000	ND	6.5 J	52	6.3 J	67
Aldrin	97	680	ND	ND	ND	ND	21
Dieldrin	200	1,400	ND	ND	ND	ND	ND
Endosulfan II	24,000	200,000	ND	ND	ND	ND	36
Endrin	11,000	89,000	ND	ND	ND	ND	46
alpha-Chlordane	4,200	24,000	ND	ND	ND	ND	ND
Lindane	1,300	9,200	ND	ND	14	ND	ND
Total Pesticides	NS	NS	ND	7	66	6	170

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 8 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Subsurface Soils

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			F-SB1-1-6	F-SB2-1-6	F-SB3-1-6	F-SB4-1-6	D-SB1-1-6	D-SB2-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	ND	ND	ND	ND	88	52
Total PCBs	1,000	1,000	ND	ND	ND	ND	88	52

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 8 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Subsurface Soils

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB3-1-6	D-SB4-1-6	D-SB5-1-6	D-SB6-1-6	D-SB7-1-6	D-SB8-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	41	ND	ND	ND	ND	30 J
Total PCBs	1,000	1,000	41	ND	ND	ND	ND	30

Notes:

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P = Contrentration <25% Difference The TGC Columns

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 8 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Subsurface Soils

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB9-1-6	D-SB10-1-6	D-SB11-1-6	D-SB12-1-6	D-SB13-1-6	D-SB14-1-6
			8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	58	22J	770	37 J	ND	27 J
Total PCBs	1,000	1,000	58	22	770	37	ND	27

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PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB15-1-6	D-SB16-1-6	D-SB17-1-6	D-SB18-1-6	D-SB19-1-6	D-SB20-1-6
			8/22/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	630	ND
Aroclor 1260	NS	NS	87	ND	31 J	370	850	31 J
Total PCBs	1,000	1,000	87	ND	31	370	**1,480**	31

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PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB21-1-6	D-SB22-1-6	D-SB23-1-6	D-SB24-1-6	D-SB25-1-6	D-SB26-1-6
			8/23/2017	8/23/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aroclor 1248	NS	NS	ND	2,200	110	1,500	1,300	1,200
Aroclor 1254	NS	NS	ND	2,800	110	2,400	1,300	940
Aroclor 1260	NS	NS	ND	630	59	470	250	550
Total PCBs	1,000	1,000	ND	**5,630**	279	**4,370**	**2,850**	**2,690**

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Table 8 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Subsurface Soils

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB27-1-6	D-SB28-1-6	D-SB29-1-6	D-SB30-1-8	D-SB31-1-8	D-SB32-1-8
			8/24/2017	8/24/2017	8/24/2017	8/25/2017	8/25/2017	8/25/2017
			1-6 feet	1-6 feet	1-6 feet	1-8 feet	1-8 feet	1-8 feet
Aroclor 1248	NS	NS	51	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	110	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	30 JP	550	ND	ND	ND	ND
Total PCBs	1,000	1,000	191	550	ND	ND	ND	ND

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Table 8 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Subsurface Soils

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB33-1-8	D-SB34-1-8	D-SB35-1-8	D-SB36-1-8	D-SB37-1-8	D-SB38-1-6
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/29/2017
			1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-6 feet
Aroclor 1248	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1254	NS	NS	ND	ND	ND	ND	ND	ND
Aroclor 1260	NS	NS	ND	ND	ND	ND	33 J	29 J
Total PCBs	1,000	1,000	ND	ND	ND	ND	33	29

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Table 8 - Summary of Polychlorinated Biphenyls (PCBs) Detected in Subsurface Soils

PCB	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth				
			D-SB39-1-6	D-SB40-1-6	D-SB41-1-6	D-SB42-1-6	D-SB43-1-6
			8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aroclor 1248	NS	NS	ND	68	ND	ND	930
Aroclor 1254	NS	NS	ND	ND	ND	ND	1,600
Aroclor 1260	NS	NS	28 J	80	1,100	ND	330
Total PCBs	1,000	1,000	28	148	**1,100**	ND	**2,860**

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Table 9 - Summary of Metals Detected in Subsurface Soils

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			F-SB1-1-6	F-SB2-1-6	F-SB3-1-6	F-SB4-1-6	D-SB1-1-6	D-SB2-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aluminum	NS	NS	5,640	7,950	10,600	6,530	8,830	14,900
Antimony	NS	NS	1.1 J	1.3 J	ND	ND	ND	ND
Arsenic	16	16	3.6	9.1	6.5	6.8	11.8	10.1
Barium	400	400	53.5	115	104	75	224	192
Beryllium	72	590	0.33	0.59	0.68	0.35 J	0.94	2.19
Cadmium	4.3	9.30	0.32 J	1.11	0.76	0.47 J	1.17	1.74
Calcium	NS	NS	141,000	69,400	65,500	60,300	49,300	101,000
Chromium (Total)	180	1,500	9.5	15.1	30.5	13.3	20.3	30.1
Cobalt	NS	NS	2.9 J	5.3 J	7.4	4.7 J	5.1 J	4.0 J
Copper	270	270	31.9	34.1	38.6	23.5	70.1	68
Iron	NS	NS	9,100	42,400	28,000	21,800	21,300	21,500
Lead	400	1,000	87.1	80	74.3	127	*623*	92.8
Magnesium	NS	NS	8,340	10,600	21,000	21,800	7,270	15,400
Manganese	2,000	10,000	288	656	717	511	425	856
Mercury	0.81	2.8	0.077	0.115	0.123	0.324	0.222	0.113
Nickel	310	310	6.9	15.3	23.8	12.2	13.7	14
Potassium	NS	NS	1,210	1,470	4,460	1,730	1,440	3,170
Selenium	180	1,500	ND	1.6	0.7 J	ND	1.0 J	2
Silver	180	1,500	0.1 J	0.2 J	0.2 J	ND	0.4 J	0.3 J
Sodium	NS	NS	310	230	350	220	300	550
Thallium	NS	NS	3.8	0.8 J	0.7 J	ND	ND	2.4
Vanadium	NS	NS	12.5	22.2	28.6	23.0	23.9	21.8
Zinc	10,000	10,000	115	261	182	123	410	200

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Table 9 - Summary of Metals Detected in Subsurface Soils

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB3-1-6	D-SB4-1-6	D-SB5-1-6	D-SB6-1-6	D-SB7-1-6	D-SB8-1-6
			8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/21/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aluminum	NS	NS	10,600	21,000	9,950	9,160	17,600	9,680
Antimony	NS	NS	ND	ND	189	10.7	1.4 J	1.7 J
Arsenic	16	16	11.8	10.7	**17**	**19.1**	**18.4**	12.7
Barium	400	400	137	198	**1,530**	305	381	216
Beryllium	72	590	1.28	1.49	0.94	0.81	2.75	0.72
Cadmium	4.3	9.30	1.14	0.28 J	**26.20**	2.48	1.18	0.73
Calcium	NS	NS	82,600	76,300	54,900	83,200	93,900	47,200
Chromium (Total)	180	1,500	25.1	24.3	97.8	98.3	17.9	38.3
Cobalt	NS	NS	4.2 J	3.1 J	6.3	6.2	3.0 J	5.6 J
Copper	270	270	42.3	17.8	183	162	155	74.7
Iron	NS	NS	20,600	37,800	59,400	31,200	25,700	24,000
Lead	400	1,000	106	113	**3,400**	258	*452*	307
Magnesium	NS	NS	12,800	12,700	7,910	6,720	10,900	6,780
Manganese	2,000	10,000	667	*6,880*	783	*2,380*	1,960	955
Mercury	0.81	2.8	0.124	ND	ND	0.235	0.356	0.297
Nickel	310	310	12.7	8.5	24.7	16.8	12.4	16.6
Potassium	NS	NS	2,600	2,240	1,090	1,290	1,300	1,420
Selenium	180	1,500	1.9	4.1	3.1	3.2	3.6	1.5
Silver	180	1,500	0.4 J	ND	0.4 J	0.6 J	0.4 J	1.2 J
Sodium	NS	NS	290	970	1,310	450	640	400
Thallium	NS	NS	2.5	ND	ND	2.6	ND	ND
Vanadium	NS	NS	24.1	41.0	36.6	65.7	16.4	23.0
Zinc	10,000	10,000	226	37	1,270	603	179	261

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			D-SB9-1-6	D-SB10-1-6	D-SB11-1-6	D-SB12-1-6	D-SB13-1-6	D-SB14-1-6
			8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017	8/22/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aluminum	NS	NS	6,250	7,560	13,000	6,490	9,890	7,630
Antimony	NS	NS	ND	ND	ND	ND	ND	ND
Arsenic	16	16	4.3	5.1	4.6	6	5	6.3
Barium	400	400	90.6	87.2	128	115	64.7	178
Beryllium	72	590	0.33	0.64	1.47	0.43	0.6	0.46
Cadmium	4.3	9.30	0.30 J	0.46 J	0.23 J	0.46 J	0.23 J	0.48 J
Calcium	NS	NS	43,700	100,000	67,800	33,600	91,000	44,000
Chromium (Total)	180	1,500	9.6	117	11.9	11.6	9.3	13.4
Cobalt	NS	NS	2.9 J	3.6 J	3.9 J	5.0 J	3.2 J	4.5 J
Copper	270	270	15.1	34.2	28.8	42.4	23.4	48
Iron	NS	NS	10,600	39,800	12,700	21,700	10,500	15,500
Lead	400	1,000	*447*	102	51.6	113	210	*687*
Magnesium	NS	NS	11,100	14,200	10,300	9,340	21,400	7,460
Manganese	2,000	10,000	285	*2,440*	1,800	272	311	265
Mercury	0.81	2.8	0.187	0.245	0.131	0.441	0.119	0.12
Nickel	310	310	7.2	17.7	12.3	12.4	8.3	12.6
Potassium	NS	NS	910	1,160	1,330	1,360	1,330	1,090
Selenium	180	1,500	ND	1.9	1.3	0.9 J	0.6 J	0.6 J
Silver	180	1,500	0.07 J	0.09 J	ND	0.1 J	ND	ND
Sodium	NS	NS	210	270	390	180	320	310
Thallium	NS	NS	ND	0.8 J	ND	ND	ND	ND
Vanadium	NS	NS	14.3	47.9	14.4	15.9	13.6	18.1
Zinc	10,000	10,000	110	143	98.7	118	77.1	219

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			D-SB15-1-6	D-SB16-1-6	D-SB17-1-6	D-SB18-1-6	D-SB19-1-6	D-SB20-1-6
			8/22/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017	8/23/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aluminum	NS	NS	6,380	5,420	15,400	8,460	9,910	14,000
Antimony	NS	NS	ND	ND	ND	ND	46.8	ND
Arsenic	16	16	2.9	6.2	4.5	6.1	8.3	6.7
Barium	400	400	59	81.9	102	106	124	146
Beryllium	72	590	0.9	0.42	1.86	0.88	0.58	2.05
Cadmium	4.3	9.30	0.29 J	0.83	0.14 J	0.92	0.82	0.26 J
Calcium	NS	NS	91,700	47,200	100,000	91,600	54,000	104,000
Chromium (Total)	180	1,500	8.4	22.5	9.6	13.8	33.4	9.2
Cobalt	NS	NS	1.8 J	3.5 J	1.8 J	4.0 J	6.4	2.5 J
Copper	270	270	15.7	68.3	17.6	53.9	67.1	21.9
Iron	NS	NS	8,440	13,200	10,300	15,200	19,200	12,000
Lead	400	1,000	44	96.6	55.2	178	364	124
Magnesium	NS	NS	18,800	14,500	15,000	22,200	15,700	18,200
Manganese	2,000	10,000	495	424	1,300	499	766	1,010
Mercury	0.81	2.8	0.076	0.093	0.13	0.278	0.391	0.09
Nickel	310	310	6.1	10	5.6	11.7	18.6	6.8
Potassium	NS	NS	870	770	1,570	1,290	1,530	1,230
Selenium	180	1,500	0.7 J	0.7 J	1.2	0.9 J	1.0 J	0.8 J
Silver	180	1,500	ND	0.4 J	ND	0.1 J	0.1 J	ND
Sodium	NS	NS	330	260	960	340	180	560
Thallium	NS	NS	1.9	ND	1.3	1.6	ND	ND
Vanadium	NS	NS	13.3	11.5	13.9	14.6	23.2	10.9
Zinc	10,000	10,000	65.6	220	74.6	187	192	76

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Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB21-1-6	D-SB22-1-6	D-SB23-1-6	D-SB24-1-6	D-SB25-1-6	D-SB26-1-6
			8/23/2017	8/23/2017	8/24/2017	8/24/2017	8/24/2017	8/24/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aluminum	NS	NS	6,620	7,150	7,810	4,150	3,400	8,170
Antimony	NS	NS	ND	1.4 J	ND	3.0 J	1.4 J	ND
Arsenic	16	16	5.4	7.9	5.1	7	4.5	9.2
Barium	400	400	57.3	60.8	62.1	38	26.3	133
Beryllium	72	590	0.38	0.64	0.59	0.25 J	0.21 J	0.61
Cadmium	4.3	9.30	0.59	*7.65*	0.65	**10.20**	*6.61*	2.04
Calcium	NS	NS	52,500	22,800	17,600	6,760	9,220	63,000
Chromium (Total)	180	1,500	24.4	54.3	26.9	68.9	62.1	19.8
Cobalt	NS	NS	5.3 J	2.4 J	2.1 J	2.2 J	2.0 J	5.9
Copper	270	270	20.3	65.1	29.3	80.4	62.2	49.2
Iron	NS	NS	19,100	33,000	18,000	30,900	24,100	29,000
Lead	400	1,000	46.8	*497*	83.3	*550*	314	321
Magnesium	NS	NS	19,600	4,330	3,530	890	2,080	8,560
Manganese	2,000	10,000	545	1,500	596	1,320	796	463
Mercury	0.81	2.8	0.152	0.147	0.045	0.281	0.088	*0.841*
Nickel	310	310	14.6	19	10.4	21.6	25	14.2
Potassium	NS	NS	1,300	560	980	300	290	1,220
Selenium	180	1,500	ND	1.7	0.77 J	1.7	0.80 J	0.95 J
Silver	180	1,500	0.1 J	1.8	0.1 J	1.9	1.2	1 J
Sodium	NS	NS	250	250	310	110	130	210
Thallium	NS	NS	ND	ND	ND	ND	ND	ND
Vanadium	NS	NS	19.4	14.8	13.7	13.0	10.2	20.8
Zinc	10,000	10,000	143	1,400	150	1,800	985	360

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 9 - Summary of Metals Detected in Subsurface Soils

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB27-1-6	D-SB28-1-6	D-SB29-1-6	D-SB30-1-8	D-SB31-1-8	D-SB32-1-8
			8/24/2017	8/24/2017	8/24/2017	8/25/2017	8/25/2017	8/25/2017
			1-6 feet	1-6 feet	1-6 feet	1-8 feet	1-8 feet	1-8 feet
Aluminum	NS	NS	10,300	9,590	4,780	6,250	8,550	11,300
Antimony	NS	NS	ND	ND	ND	ND	2.2 J	7.1 J
Arsenic	16	16	5.5	7.6	3.2	**19.3**	15	**19.4**
Barium	400	400	83.5	131	34.9	302	222	**592**
Beryllium	72	590	1.44	0.87	0.23 J	0.86	1.21	0.77
Cadmium	4.3	9.30	3.37	0.64	0.30 J	0.33 J	1.80	**15.40**
Calcium	NS	NS	47,000	54,500	55,800	44,100	42,400	69,200
Chromium (Total)	180	1,500	31	14.1	7.6	13.6	38.7	*489*
Cobalt	NS	NS	3.8 J	5.1 J	3.8 J	4.3 J	4.1 J	6.7 J
Copper	270	270	54.5	57.3	17.6	99.2	153	**1,130**
Iron	NS	NS	22,200	22,800	10,200	28,300	21,400	38,400
Lead	400	1,000	182	220	57.3	*758*	*614*	*472*
Magnesium	NS	NS	9,290	9,040	20,500	6,420	5,900	5,240
Manganese	2,000	10,000	888	522	373	339	728	889
Mercury	0.81	2.8	0.011 J	0.21	0.187	0.745	0.173	0.369
Nickel	310	310	16.7	12.7	9.3	15.1	16.5	42.3
Potassium	NS	NS	950	1,220	910	580	910	1,680
Selenium	180	1,500	2	0.87 J	ND	1 J	2.1	2.5
Silver	180	1,500	0.7 J	0.2 J	ND	0.5 J	1.9	50.2
Sodium	NS	NS	380	270	180	450	520	890
Thallium	NS	NS	ND	ND	ND	ND	ND	3.0
Vanadium	NS	NS	13.4	18.7	13.5	15.3	15.1	27.4
Zinc	10,000	10,000	550	200	75.6	205	335	2,190

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

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Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 9 - Summary of Metals Detected in Subsurface Soils

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth					
			D-SB33-1-8	D-SB34-1-8	D-SB35-1-8	D-SB36-1-8	D-SB37-1-8	D-SB38-1-6
			8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/29/2017
			1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-8 feet	1-6 feet
Aluminum	NS	NS	7,020	5,410	6,750	5,030	7,100	10,500
Antimony	NS	NS	2.5 J	5.6 J	2 J	3.2 J	8.8	ND
Arsenic	16	16	**18.7**	15.8	**32.7**	**22.2**	**27.1**	6.7
Barium	400	400	**926**	158	230	288	225	94.4
Beryllium	72	590	0.64	0.82	0.91	0.7	0.7	0.97
Cadmium	4.3	9.30	1.50	0.86	**14.20**	2.29	1.61	0.5 J
Calcium	NS	NS	34,300	5,540	16,200	4,070	11,600	108,000
Chromium (Total)	180	1,500	*215*	16.3	55.9	40.4	101	14.6
Cobalt	NS	NS	5.5 J	4.4 J	5.4 J	6.6	7.9	4.1 J
Copper	270	270	193	46.7	180	**517**	**467**	37.2
Iron	NS	NS	17,600	19,600	30,100	32,900	24,400	15,200
Lead	400	1,000	**9,780**	296	186	*729*	**1,510**	60.5
Magnesium	NS	NS	4,130	630	2,280	620	4,010	18,300
Manganese	2,000	10,000	286	157	173	156	345	594
Mercury	0.81	2.8	0.556	0.103	0.243	0.268	0.122	0.214
Nickel	310	310	20.4	13.2	20.3	38.6	30.1	11.9
Potassium	NS	NS	700	480	680	360	490	1,460
Selenium	180	1,500	2.5	1.3	2.5	2.5	2.1	0.9 J
Silver	180	1,500	0.9 J	0.2 J	2.1	5.6	1 J	0.1 J
Sodium	NS	NS	420	310	370	380	210	530
Thallium	NS	NS	ND	ND	ND	ND	ND	2.5
Vanadium	NS	NS	17.5	20.5	24.6	26.9	40.2	17.8
Zinc	10,000	10,000	727	186	375	550	466	105

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 9 - Summary of Metals Detected in Subsurface Soils

Metal	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth				
			D-SB39-1-6	D-SB40-1-6	D-SB41-1-6	D-SB42-1-6	D-SB43-1-6
			8/29/2017	8/29/2017	8/29/2017	8/29/2017	8/29/2017
			1-6 feet	1-6 feet	1-6 feet	1-6 feet	1-6 feet
Aluminum	NS	NS	8,420	9,150	4,620	7,650	4,090
Antimony	NS	NS	ND	ND	ND	ND	2.5 J
Arsenic	16	16	5.8	7.1	3	4.3	9.1
Barium	400	400	63	88.4	128	72.5	61.4
Beryllium	72	590	0.56	0.59	0.5	0.49	0.29 J
Cadmium	4.3	9.30	0.31 J	1.13	2.02	0.32 J	**11.30**
Calcium	NS	NS	101,000	12,900	157,000	72,500	18,400
Chromium (Total)	180	1,500	11.6	20.1	6.2	10.9	176
Cobalt	NS	NS	3.7 J	8.4	1.8 J	4.3 J	3.4 J
Copper	270	270	28.4	38.6	15.3	25	109
Iron	NS	NS	12,900	24,300	6,950	12,900	38,100
Lead	400	1,000	122	62.5	61.1	83	*543*
Magnesium	NS	NS	15,200	5,610	11,300	17,100	2,440
Manganese	2,000	10,000	465	353	252	383	1,780
Mercury	0.81	2.8	ND	0.115	0.17	0.239	0.246
Nickel	310	310	10.5	25.2	6	10.9	48
Potassium	NS	NS	1,000	970	780	1,450	410
Selenium	180	1,500	ND	0.7 J	0.5 J	0.6 J	2.1
Silver	180	1,500	ND	0.2 J	ND	0.1 J	1.6
Sodium	NS	NS	230	150	250	250	150
Thallium	NS	NS	2.7	ND	4.4	0.7 J	ND
Vanadium	NS	NS	15.4	18.6	13.2	23.5	17.6
Zinc	10,000	10,000	67.1	183	93.8	89.5	1,960

Notes:

All concentrations are reported in parts per million (ppm or mg/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).

ND = Compound not detected above method detection limit (see attached lab report for mdl's)

NS = No Standard

J = Estimated value

Italicized = Concentration exceeds Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives

Bold - Concentration exceeds Restricted Use (Track 2) Restricted-Residential and Commercial Soil Cleanup Objectives

Table 10 - Summary of Volatile Organic Compounds (VOCs) Detected in Subsurface Soils

	Part 375-6.8 (b) Restricted Use (Track 2) Restricted-Residential Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Commercial Soil Cleanup Objectives (SCOs)	Sample ID, Date Collected, and Depth						
			D-SB7-1-6	D-SB13-5-6	D-SB31-3.5-4.5	D-SB32-2-3	D-SB32-4-5	D-SB33-4.5-5.5	D-SB34-3-4
			8/21/2017	8/22/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017	8/25/2017
			5-6 feet	5-6 feet	3.5-4.5 feet	2-3 feet	4-5 feet	4.5-5.5 feet	3-4 feet
1,2,4-Trimethylbenzene	52,000	190,000	2.9 J	ND	3.7 J	5.2 J	10 J	4.5 J	14
1,3,5-Trimethylbenzene	52,000	190,000	0.96 J	ND	1.9 J	1.1 J	ND	0.99 J	6.1
1,4-Dichlorobenzene	13,000	130,000	1.9 J	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	100,000	500,000	16	ND	8.9	18	200	17	34
Acetone	100,000	500,000	59	ND	56	91	690	85	170
Benzene	4,800	44,000	0.82 J	ND	ND	0.71 J	ND	ND	0.97 J
Dichloromethane	NS	NS	ND	ND	1.7 J	ND	2.8 J	ND	ND
Ethylbenzene	41,000	390,000	ND	ND	ND	0.47 J	ND	ND	0.48 J
Tetrachloroethene (PCE)	19,000	150,000	ND	ND	44	7.4	20 J	6.5	1.9 J
Toluene	100,000	500,000	1.5 J	ND	ND	ND	ND	ND	ND
Vinyl Chloride	900	13,000	ND	ND	ND	ND	ND	ND	3.5 J
cis-1,2-Dichloroethene	100,000	500,000	ND	ND	3.6 J	ND	ND	ND	ND
m,p-Xylenes	NS	NS	ND	ND	ND	ND	ND	ND	1.8 J
n-Butylbenzene	NS	NS	ND	ND	ND	15	ND	1.3 J	5.7 J
n-Propylbenzene	100,000	500,000	ND	ND	ND	12	ND	ND	1.1 J
o-Xylene	NS	NS	ND	ND	0.8 J	0.8 J	ND	ND	2 J
sec-Butylbenzene	100,000	500,000	7.9	ND	4.7 J	35	38	1.6 J	3.7 J
tert-Butylbenzene	100,000	500,000	3 J	ND	7.4	5.9 J	9.6 J	4.6 J	0.78 J
Xylenes (mixed)	100,000	500,000	ND	ND	0.8 J	0.8 J	ND	ND	3.8 J
Total VOCs	NS	NS	103	ND	133	193	970	136	246

Notes:

All concentrations are reported in parts per billion (ppb or ug/kg)

SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR

ND = Compound not detected above method detection limit (see attached lab

NS = No Standard

J = Estimated value

Table 11 - Summary of TO-15 Volatile Organic Compounds (VOCs) and Methane Detected in Soil Vapor

Analyte	Units	NYSDOH AGV	NYSDOH 2003 Upper Fence Limit (Outdoor)	USEPA BASE Data 90th Percentile (Outdoor)	HEI RIOPA 2005 95th Percentile Value (Outdoor)	Sample ID and Date Collected		
						SVP-1	SVP-2	SVP-3
						9/1/2017	9/1/2017	9/1/2017
Methane	ppmV	NC	NC	NC	NC	4,900	5.9	1.6
Dichlorodifluoromethane (Freon 12)	µg/m^3	NC	10	8.1	NC	1.2064	2.1615	2.6642
Ethanol	µg/m^3	NC	34	57	NC	**41.45**	ND	ND
Acetone	µg/m^3	NC	30	43.7	19.6	**43.461**	14.004	ND
Trichlorofluoromethane (Freon 11)	µg/m^3	NC	5.1	4.3	NC	ND	4.1114	0.45
Methylene Chloride	µg/m^3	60	1.6	6.1	2.46	0.77675	ND	ND
Carbon Disulfide	µg/m^3	NC	NC	3.7	NC	*12.926*	ND	*7.9121*
Methyl tert-Butyl Ether (MTBE)	µg/m^3	NC	NC	6.2	22.1	3.408	ND	ND
2-Butanone (MEK)	µg/m^3	NC	5.3	11.3	NC	**10.792**	ND	ND
cis-1,2-Dichloroethylene	µg/m^3	NC	0.4	<1.8	NC	**1.6523**	ND	ND
Ethyl Acetate	µg/m^3	NC	NC	1.5	NC	*4.3959*	ND	ND
Hexane	µg/m^3	NC	2.2	6.4	NC	***28.661***	ND	ND
Chloroform	µg/m^3	NC	0.5	0.6	0.76	ND	***64.536***	***32.258***
Benzene	µg/m^3	NC	4.8	6.6	5.16	2.825	ND	ND
Cyclohexane	µg/m^3	NC	0.9	NC	NC	**3.44**	ND	ND
1,2-Dichloropropane	µg/m^3	NC	0.4	<1.6	NC	ND	ND	***65.76***
Trichloroethylene	µg/m^3	5	0.4	1.3	0.79	**0.81931**	ND	ND
Heptane	µg/m^3	NC	4.5	NC	NC	**7.38**	ND	ND
4-Methyl-2-pentanone (MIBK)	µg/m^3	NC	NC	1.9	NC	*3.2478*	ND	ND
Toluene	µg/m^3	NC	5.1	33.7	19.6	**13.023**	ND	ND
n-Octane	µg/m^3	NC	0.7	1.6	NC	***5.14***	ND	ND
Tetrachloroethylene	µg/m^3	100	0.7	6.5	3.17	***22.06***	**4.412**	***2.4128***
Ethylbenzene	µg/m^3	NC	1	3.5	3.04	**3.3102**	ND	ND
m&p-Xylene	µg/m^3	NC	1	12.8	10	***14.565***	ND	ND
Styrene	µg/m^3	NC	0.5	1.3	1.29	***3.0741***	ND	ND
o-Xylene	µg/m^3	NC	1.2	4.6	3.23	***7.0618***	ND	ND
n-Nonane	µg/m^3	NC	2	2.8	NC	***5.77***	ND	ND
Cumene	µg/m^3	NC	NC	NC	NC	3.9472	ND	ND
alpha-Pinene	µg/m^3	NC	30	<6.2	1.9	***39***	ND	ND
n-Propylbenzene	µg/m^3	NC	1.5	NC	NC	**4.3469**	ND	ND
4-Ethyltoluene	µg/m^3	NC	NC	3	NC	*6.88*	ND	ND
1,3,5-Trimethylbenzene	µg/m^3	NC	0.7	2.7	NC	***64.96***	**1.0493**	ND
1,2,4-Trimethylbenzene	µg/m^3	NC	1.9	5.8	NC	***84.947***	0.80	ND
1,4-Dichlorobenzene	µg/m^3	NC	0.5	1.2	NC	***9.1665***	***12.833***	***4.7666***
d-Limonene	µg/m^3	NC	0.5	3.6	6.54	***373.34***	ND	ND
Naphthalene	µg/m^3	NC	NC	4.9	NC	*9.5915*	ND	ND

Notes:
NC = No criteria
ND = Not detected
Bold = Concentration exceeds NYSDOH Fuel Oil 2003 Upper Fence Limit
Italicized = Concentration exceeds USEPA BASE Data 90th Percentile
Shading = Concentration exceeds HEI RIOPA 2005 95th Percentile

FIGURES

SITE LOCATION

275-901 Furhmann Blvd.
Buffalo, New York

LiRo-Engineers, Inc.
690 Delaware Ave.
Buffalo, New York

BUFFALO OUTER HARBOR CIVIL IMPROVEMENTS SITE LOCATION MAP

FIGURE NO.

1

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WARNING

IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN THOSE WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NO.	DATE	DESCRIPTION

REVISIONS

LiRo Engineers, Inc.
690 Delaware Avenue
Buffalo, New York

PROJ. ENG.:	
DESIGNED BY:	
CHECKED BY:	
DRAWN BY:	A.M.K.
CLIENT:	BUFFALO OUTER HARBOR CIVIL IMPROVEMENTS
DATE:	OCTOBER 2017
SCALE:	AS SHOWN
JOB TITLE AND LOCATION:	BUFFALO OUTER HARBOR CIVIC IMPROVEMENTS
DRAWING TITLE:	PHASE II ESI - AREA D SITE PLAN
LIRO JOB NO.:	17-012-0132
SHEET	OF
FIGURE NO.	2

J:\17-012-0132 ESD Outer Harbor Civil Improvements\Phase II ESA\CAD\AREA D E F\OUTER HARBOR SHALLOW SOIL.dwg 10/20/2017 8:48 AM

WARNING

IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN THOSE WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NO.	DATE	DESCRIPTION

REVISIONS

LiRo Engineers, Inc.
690 Delaware Avenue
Buffalo, New York

PROJ. ENG.:
DESIGNED BY:
CHECKED BY:
DRAWN BY: A.M.K.

CLIENT: BUFFALO OUTER HARBOR CIVIL IMPROVEMENTS

DATE: SEPTEMBER 2017
SCALE: AS SHOWN

JOB TITLE AND LOCATION: BUFFALO OUTER HARBOR CIVIC IMPROVEMENTS

LIRO JOB NO.: 17-012-0132
SHEET OF

DRAWING TITLE: PHASE II ESI - AREA D
LOCATIONS WITH CHEMICALS EXCEEDING
PART 375 SOIL CLEANUP OBJECTIVES - SURFACE SOIL

FIGURE NO. 3

WARNING

IT IS A VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN THOSE WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NO.	DATE	DESCRIPTION

REVISIONS

LiRo Engineers, Inc.
690 Delaware Avenue
Buffalo, New York

PROJ. ENG.:
DESIGNED BY:
CHECKED BY:
DRAWN BY: A.M.K.

CLIENT: BUFFALO OUTER HARBOR CIVIL IMPROVEMENTS

DATE: SEPTEMBER 2017
SCALE: AS SHOWN

JOB TITLE AND LOCATION: BUFFALO OUTER HARBOR CIVIC IMPROVEMENTS

LIRO JOB NO.: 17-012-0132
SHEET OF

DRAWING TITLE: PHASE II ESI - AREA D
LOCATIONS WITH CHEMICALS EXCEEDING
PART 375 SOIL CLEANUP OBJECTIVES - SUBSURFACE SOIL

FIGURE NO. 4

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APPENDIX A

Soil Boring Logs

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-1
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					80%	brown	loose	0-6' sandy SILT, red brick, coal, concrete, slag	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					95%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-1-0-1' @ 1110, D-SB-1-1-6' @ 1120

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-1

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-2
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					90%	brown	loose	0-6' sandy SILT, red brick, coal, pulverized concrete, gravel, slag	FILL	5.1 ppm
										3.9 ppm
										2.1 ppm
										1.8 ppm
5					95%					1.1 ppm
										0.9 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-2-0-1' @ 1130, D-SB-2-1-6' @ 1145

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-2

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-3
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					90%	brown, black	loose	0-6" sandy LOAM; 6"-5' sandy SILT with some clay, red brick, slag, glass; 5-5.75' medium SAND; 5.75-6' clayey SILT, glass	FILL	2.1 ppm
										1.0 ppm
										0.7 ppm
										1.3 ppm
5					95%					0.9 ppm
										0.7 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-3-0-1' @ 1300, D-SB-3-1-6' @ 1310

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-3

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-4
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					85%	brown	somewhat loose	0-3.5' sandy SILT, crushed stone, coal, red brick; 3.5-6' medium SAND, red brick, coal	FILL	0.0 ppm
										2.0 ppm
										1.8 ppm
										2.2 ppm
5					100%					0.9 ppm
										1.1 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-4-0-1' @ 1315, D-SB-4-1-6' @ 1325

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-4

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-5
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	brown, grey	somewhat loose	0-6' sandy GRAVEL, crushed concrete, red brick (moist around 3')	FILL	1.0 ppm
										1.7 ppm
										0.7 ppm
										1.7 ppm
5					95%					1.8 ppm
										0.6 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-5-0-1' @ 1355, D-SB-5-1-6' @ 1405

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-5

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-6
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown, tan	somewhat loose	0-3" sandy LOAM; 3"-2' medium-fine SAND; 2-6' silty CLAY with gravel, coal, pottery, asphalt	FILL	5.1 ppm
										4.9 ppm
										5.8 ppm
										5.2 ppm
5					75%					4.8 ppm
										3.9 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-6-0-1' @ 1500, D-SB-6-1-6' @ 1510

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-6

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-7
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	tan, grey, black	somewhat loose	0-1.5' sandy LOAM; 1.5-4' gravelly SAND, crushed stone, red brick, asphalt/coal; 4-6' sandy GRAVEL, (petroleum odor)	FILL	5.1 ppm
										4.9 ppm
										5.8 ppm
										5.2 ppm
5					75%					4.8 ppm
										3.9 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-7-0-1' @ 1535, D-SB-7-1-6' @ 1545, D-SB-7-5-6' @ 1545 (VOC)

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-7

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-8
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	tan-brown	somewhat firm	0-6' silty CLAY, medium sand lenses, crushed stone, red brick, concrete	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-8-0-1' @ 0930, D-SB-8-1-6' @ 0940

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-8

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-9
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	tan	somewhat firm	0-6' silty CLAY, asphalt, red brick, concrete, sand lenses	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-9-0-1' @ 1000, D-SB-9-1-6' @ 1010

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-9

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-10
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown	somewhat firm	0-6' sandy SILT with some clay, sandy gravel lenses, concrete, metal, red brick, slag	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-10-0-1' @ 1025, D-SB-10-1-6' @ 1035

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-10

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-11
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					80%	brown	somewhat firm	0-6' sandy SILT with clay, sandy gravel lenses, slag, asphalt, red brick, concrete	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					95%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-11-0-1' @ 1055, D-SB-11-1-6' @ 1100

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-11

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-12
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					90%	brown, dark brown	somewhat loose	0-6" silty LOAM; 6"-2' fine-medium SAND (black fabric demarcation barrier @ 2'); 2-5' clayey SILT with gravel, glass; 5-6' sandy SILT, red brick, slag, coal fragments, glass	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-12-0-1' @ 1130, D-SB-12-1-6' @ 1135

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-12

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-13
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor

CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF

BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.

GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					60%	brown	firm	0-6' silty CLAY, slag, concrete, crushed stone, red brick	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					85%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-13-0-1' @ 1335, D-SB-13-1-6' @ 1340, D-SB-13-5-6' @ 1330 (VOC)

PROJECT NO.: 15-029-1054

BORING NO.: D-SB-13

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-14
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor

CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF

BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.

GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown	firm	0-6' clayey SILT, slag, concrete, crushed stone, red brick, medium sand lenses	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					75%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-14-0-1' @ 1410, D-SB-14-1-6' @ 1420

PROJECT NO.: 15-029-1054

BORING NO.: D-SB-14

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-15
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 22, 2017
DATE FINISHED:	August 22, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					85%	brown, tan	somewhat firm	0-6" silty LOAM; 6"-2' sandy SILT (black fabric demarcation barrier @ 2'); 2-6' sandy SILT, red brick, concrete	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-15-0-1' @ 1445, D-SB-15-1-6' @ 1500

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-15

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-16
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor

CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF

BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.

GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown, tan	somewhat firm	0-6" silty LOAM; 6"-2' sandy SILT (black fabric demarcation barrier @ 2'); 2-6' sandy SILT, red brick, concrete	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-16-0-1' @ 0920, D-SB-16-1-6' @ 0925

PROJECT NO.: 15-029-1054

BORING NO.: D-SB-16

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-17
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					95%	brown-black	somewhat loose	0-6' sandy SILT, red brick, concrete, sand lenses, metal	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					90%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-17-0-1' @ 1000, D-SB-17-1-6' @ 1010

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-17

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-18
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	dark brown	somewhat loose	0-6' sandy SILT with gravel, red brick, concrete, slag	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					85%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-18-0-1' @ 1030, D-SB-18-1-6' @ 1045

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-18

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-19
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					90%	dark brown	somewhat loose	0-2' silty SAND; 2-6' silty SAND, red brick, concrete, slag	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					80%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-19-0-1' @ 1125, D-SB-19-1-6' @ 1130

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-19

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-20
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	brown	somewhat loose	0-6' sandy GRAVEL, red brick, glass, asphalt	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-20-0-1' @ 1225, D-SB-20-1-6' @ 1230

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-20

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-21
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown	somewhat loose	0-2' sandy LOAM with silt, red brick; 2-4' medium-fine SAND with some silt, red brick; 4-6' medium-fine SAND with some silt	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-21-0-1' @ 1440, D-SB-21-1-6' @ 1445

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-21

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-22
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 23, 2017
DATE FINISHED:	August 23, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					85%	brown, dark brown/reddish brown	loose	0-1' silty LOAM; 1-4' fine SAND, red brick; 4-6' fine SAND, plastic, concrete	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					65%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-22-0-1' @ 1515, D-SB-22-1-6' @ 1520

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-22

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-23
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					70%	dark brown, black	somewhat loose	0-6' sandy SILT, slag, concrete, red/yellow brick	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					85%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-23-0-1' @ 0925, D-SB-23-1-6' @ 0930

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-23

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-24
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					80%	dark brown, black	somewhat loose	0-6' fine sandy SILT, slag, red brick	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-24-0-1' @ 1005, D-SB-24-1-6' @ 1010

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-24

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-25
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	dark brown, black	somewhat loose	0-6" sandy LOAM; 6"-6' fine sandy SILT, slag, red brick, glass	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-25-0-1' @ 1040, D-SB-25-1-6' @ 1045

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-25

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-26
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					55%	brown, black, grey, black	somewhat loose	0-6" sandy LOAM; 6"-1' sandy SILT; 1-4' concrete with rebar; 4-6' fine sandy SILT	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					90%					1.1 ppm
										1.8 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-26-0-1' @ 1125, D-SB-26-1-6' @ 1130

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-26

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-27
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor

CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF

BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.

GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					50%	dark brown, black, brown	somewhat loose	0-6" silty LOAM; 6"-1' sandy SILT; 1-2.5' concrete; 2.5-6' silty CLAY with sand, red/yellow brick, slag	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.8 ppm
5					85%					0.1 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-27-0-1' @ 1310, D-SB-27-1-6' @ 1315

PROJECT NO.: 15-029-1054

BORING NO.: D-SB-27

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-28
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	tan	somewhat firm	0-3" silty LOAM; 3"-6' silty CLAY with sand, concrete, slag, metal, plastic	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					75%					1.7 ppm
										5.6 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-28-0-1' @ 1420, D-SB-28-1-6' @ 1425

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-28

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-29
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 24, 2017
DATE FINISHED:	August 24, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					85%	dark brown, brown	somewhat firm	0-1' sandy LOAM; 1-6' silty CLAY, crushed stone, red/yellow brick, asphalt, slag, fine sand lenses	FILL	0.0 ppm
										0.1 ppm
										2.9 ppm
										5.3 ppm
5					100%					2.1 ppm
										2.9 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-29-0-1' @ 1515, D-SB-29-1-6' @ 1520

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-29

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-30
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					50%	grey/brown	loose	0-8' sandy GRAVEL, asphalt, slag, concrete, red/yellow brick, wood last 1'	FILL	0.9 ppm
										1.9 ppm
										0.9 ppm
										2.9 ppm
5					55%					1.5 ppm
										1.7 ppm
										2.9 ppm
										4.4 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-30-0-1' @ 0935, D-SB-30-1-8' @ 0940

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-30

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-31
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					80%	brown	somewhat loose	0-8' silty SAND with gravel, coarse black sand lenses, asphalt, slag, red/yellow brick, wood	FILL	0.8 ppm
										18.9 ppm
										19.4 ppm
										39.4 ppm
5					50%					36.0 ppm
										NA
										22.7 ppm
										NA
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-31-0-1' @ 1000, D-SB-31-1-8' @ 1005, D-SB-31-3.5-4.5' @ 1000 (VOC)
Petroleum odor

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-31

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-32
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	black	somewhat loose	0-8' coarse sandy GRAVEL, crushed stone, asphalt, slag	FILL	0.8 ppm
										1.7 ppm
										27.5 ppm
										0.8 ppm
5					85%					73.4 ppm
										61.0 ppm
										54.4 ppm
										43.2 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-32-0-1' @ 1040, D-SB-32-1-8' @ 1045, D-SB-32-2-3' @ 1035 (VOC), D-SB-32-4-5' @1040 (VOC)
Petroleum odor

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-32

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-33
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	black	somewhat loose	0-8' sandy GRAVEL, crushed stone, asphalt, slag, fine black sand lenses	FILL	0.4 ppm
										4.5 ppm
										28.3 ppm
										8.6 ppm
5					90%					51.4 ppm
										55.7 ppm
										6.8 ppm
										5.8 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-33-0-1' @ 1125, D-SB-33-1-8' @ 1130, D-SB-33-4.5-5.5' @ 1120 (VOC)

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-33

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-34
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	black	somewhat loose	0-8' sandy GRAVEL, concrete, slag, fine black sand lenses, glass	FILL	0.4 ppm
										0.3 ppm
										3.2 ppm
										10.2 ppm
5					85%					3.7 ppm
										9.0 ppm
										0.7 ppm
										0.4 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-34-0-1' @ 1150, D-SB-34-1-8' @ 1155, D-SB-34-3-4' @ 1145 (VOC)

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-34

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-35
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					90%	dark brown, black	somewhat loose	0-2' sandy SILT; 2-8' sandy GRAVEL, slag, red/yellow brick, wood, ash	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-35-0-1' @ 1330, D-SB-35-1-8' @ 1335

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-35

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-36
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown, black	somewhat loose	0-2.5' fine sandy SILT; 2.5-8' coarse gravelly SAND, ash, slag, red/yellow brick, glass, coal	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					90%					0.2 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-36-0-1' @ 1405, D-SB-36-1-8' @ 1410

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-36

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-37
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 25, 2017
DATE FINISHED:	August 25, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	dark brown, black	somewhat loose	0-1' fine sandy SILT; 1-8' coarse sandy GRAVEL, ash, slag, red/yellow brick, glass, coal	FILL	5.4 ppm
										0.5 ppm
										0.0 ppm
										0.0 ppm
5					85%					0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
								End of boring @ 8' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-37-0-1' @ 1440, D-SB-37-1-8' @ 1445

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-37

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-38
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 29, 2017
DATE FINISHED:	August 29, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	tan, tan, brown	somewhat firm	0-1' clayey SILT with sand, crushed stone; 1-3' silty CLAY with gravel; 3-6' silty SAND, asphalt, crushed stone, glass, slag	FILL	5.0 ppm
										9.0 ppm
										1.1 ppm
										3.1 ppm
5					75%					6.1 ppm
										2.1 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-38-0-1' @ 0855, D-SB-38-1-6' @ 0900

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-38

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-39
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 29, 2017
DATE FINISHED:	August 29, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	tan	loose	0-6' sandy SILT, red/yellow brick, asphalt, slag, crushed stone	FILL	1.2 ppm
										1.8 ppm
										0.8 ppm
										1.1 ppm
5					80%					0.5 ppm
										1.6 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-39-0-1' @ 0930, D-SB-39-1-6' @ 0935

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-39

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-40
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 29, 2017
DATE FINISHED:	August 29, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	black, tan	loose, somehwhat firm	0-3.5' sandy SILT with gravel, slag, coal; 3.5-6' silty CLAY	FILL	3.3 ppm
										1.5 ppm
										0.8 ppm
										0.3 ppm
5					90%					0.8 ppm
										1.3 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-40-0-1' @ 1000, D-SB-40-1-6' @ 1005

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-40

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-41
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 29, 2017
DATE FINISHED:	August 29, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
						6620DT	
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					60%	brown	somewhat loose	0-6' sandy SILT with gravel, glass, asphalt, coal, slag	FILL	0.5 ppm
										0.2 ppm
										0.2 ppm
										0.4 ppm
5					70%					0.3 ppm
										0.1 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-41-0-1' @ 1025, D-SB-41-1-6' @ 1030

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-41

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-42
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 29, 2017
DATE FINISHED:	August 29, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					65%	brown	somewhat loose	0-6' sandy SILT with gravel, trace of clay, red/yellow brick, glass, asphalt, coal, slag	FILL	0.1 ppm
										0.5 ppm
										0.3 ppm
										0.8 ppm
5					90%					0.8 ppm
										0.4 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-42-0-1' @ 1100, D-SB-42-1-6' @ 1105

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-42

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	D-SB-43
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA D
GROUND ELEVATION:	N/A
DATE STARTED:	August 29, 2017
DATE FINISHED:	August 29, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	tannish brown, black	somewhat loose	0-1' sandy SILT; 1-6' very fine SAND/SILT, red/yellow brick, slag,	FILL	0.1 ppm
										0.5 ppm
										0.3 ppm
										0.8 ppm
5					85%					0.8 ppm
										0.4 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: D-SB-43-0-1' @ 1145, D-SB-43-1-6' @ 1150

PROJECT NO.: 15-029-1054
BORING NO.: D-SB-43

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	F-SB-1
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA F
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					75%	brown	somewhat loose	0-1' grass/sandy LOAM	FILL	0.0 ppm
						light brown	somewhat loose	1-6' silty SAND, brick, crushed stone, pulverized concrete		0.0 ppm
										0.0 ppm
										0.0 ppm
5					100%					0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: F-SB-1-0-1' @ 0900, F-SB-1-1-6' @ 0910

PROJECT NO.: 15-029-1054
BORING NO.: F-SB-1

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	F-SB-2
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA F
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		2"	
				WT.			
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					80%	brown	somewhat loose	0-6" grass/sandy LOAM; 6"-4' silty SAND, red brick, crushed stone, coal fragments, crushed concrete	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					90%	orangey brown	firm	4-6' clayey SILT with sand	CL	0.0 ppm
										0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: F-SB-2-0-1' @ 0925, F-SB-2-1-6' @ 0930

PROJECT NO.: 15-029-1054
BORING NO.: F-SB-2

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	F-SB-3
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA F
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

	CAS.	SAMPLER	TUBE
TYPE		6620DT	
DIA.		2"	
WT.			
FALL			

DATE	TIME	LEVEL	TYPE

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					80%	brown, tan, brown	somewhat loose	0-2" grass/sandy LOAM; 2"-1.5' crushed stone; 1.5-3.5' silty SAND; 3.5-4' crushed stone; 4-5' crushed asphalt, coal	FILL	0.0 ppm
										0.0 ppm
										0.0 ppm
										0.0 ppm
5					90%					0.0 ppm
						brown, grey	firm	5-5.5' sandy SILT with gravel, moist; 5.5-6' silty CLAY	CL	0.0 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: F-SB-3-0-1' @ 0950, F-SB-3-1-6' @ 1000

PROJECT NO.: 15-029-1054
BORING NO.: F-SB-3

LiRo Engineers, Inc.

TEST BORING LOG

BORING NO:	F-SB-4
SHEET:	1 of 1
JOB NO.:	17-012-0132
LOCATION:	AREA F
GROUND ELEVATION:	N/A
DATE STARTED:	August 21, 2017
DATE FINISHED:	August 21, 2017
DRILLER:	SJB/Empire Geo Serv. Inc.
GEOLOGIST:	Kris Charney
REVIEWED BY:	

PROJECT NAME: Buffalo Outer Harbor
CLIENT: Towbridge Wolf Michaels Landscape Architects, LLF
BORING CONTRACTOR: SJB/Empire Geo Serv. Inc.
GROUNDWATER: Not Encountered

DATE	TIME	LEVEL	TYPE	TYPE	CAS.	SAMPLER	TUBE
				DIA.		6620DT	
				WT.		2"	
				FALL			

DEPTH FEET	STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					95%	black	loose	0-6' gravelly SAND (possibly foundry sand), slag, coal	FILL	1500 ppm
										234 ppm
										221 ppm
										173 ppm
5					75%					109 ppm
										55.1 ppm
								End of boring @ 6' bgs		
10										
15										
20										
25										
30										
35										

COMMENTS: Samples collected: F-SB-4-0-1' (plus VOC) @ 1020, F-SB-4-1-6' @ 1030

PROJECT NO.: 15-029-1054
BORING NO.: F-SB-4

APPENDIX B

Analytical Laboratory Reports

(Included on Attached CD)