TOWN OF FALMOUTH
FALMOUTH, MAINE
BIDDING/CONTRACT DOCUMENTS
AND TECHNICAL SPECIFICATIONS
FOR
SEWER IMPROVEMENTS PHASE 1
FEBRUARY 2022

Prepared By:

Wright-Pierce
11 Bowdoin Mill Island, Suite 140
Topsham, Maine 04086
Phone: 207-725-8721
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SECTION 00100

ADVERTISEMENT FOR BIDS

Town of Falmouth
Falmouth, Maine
West Falmouth Sewer Improvements Phase 1

General Notice

Town of Falmouth (Owner) is requesting Bids for the construction of the following Project:

West Falmouth Sewer Improvements Phase 1

Bids for the construction of the Project will be received at the Falmouth Wastewater Treatment Facility located at 96 Clearwater Drive, Falmouth, ME 04105, until Thursday March 31st, 2022, at 1:00 PM local time. At that time the Bids received will be publicly opened and read.

The Project includes the following Work:

Replacement of existing sanitary sewers on Middle Road and Lunt Road, installation of new sanitary sewer on Woods Road, installation of new sanitary sewer force main on Pinehurst Drive, Woodlands Drive and Woods Road, and upgrades to the Falmouth Road Pump Station.

Owner anticipates that the Project’s total bid price will be approximately $6,000,000.

Bidder to note that Owner will be flexible issuing Notice to Proceed for this Contract based on feedback from the awarded Contractor related to equipment and material lead times, staffing constraints and/or schedule concerns.

Obtaining the Bidding Documents

The Issuing Office is Wright-Pierce. Information and Bidding Documents for the Project can be found at the following designated website:

https://www.wright-pierce.com/projects

Bidding Documents may be downloaded from the designated website at a cost of $60 per download. Paper copies of the Bidding Documents may be ordered from this website at an additional cost at the Bidders option.

To be considered a responsive Bidder, the Bidder shall have obtained at least one set of Bidding Documents from the Issuing Office using the name that is to appear on the Bid Form. The designated website will be updated periodically with addenda, lists of plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website. It is the Bidder’s responsibility to check the designated website for addenda.

Pre-bid Conference

A pre-bid conference call will be held on Thursday March 17th, 2022, at 1:00 PM local time. A URL link and dial-in phone number for the conference call will be emailed to all registered plan holders prior to the pre-bid meeting.
Bid Bond
A bid must be accompanied by Bid security made payable to Owner in an amount of 5% of Bidder’s maximum bid price and in the form of a certified check or Bid bond issued by surety meeting the requirements of the General Conditions. No bid may be withdrawn for at least 60 days after receipt of bids unless released by the Owner.

Agency Not a Party
This contract is expected to be funded in whole or in part by the State of Maine Department of Environmental Protection (DEP) Clean Water State Revolving Loan Fund (CWSRF) program. Neither the State of Maine nor any of its departments, agencies, or employees is or will be a party to this contract. The word “agency” in the contract documents refers to the DEP and all other involved funding agencies.

SRF Disadvantaged Business Enterprises Program
The contractor must comply with the Disadvantaged Business Enterprises (DBE) SRF special requirements contained in the CWSRF Supplementary Conditions. Failure of the successful bidder to complete the pre-award requirements of this program may result in finding that the bidder is non-responsible and therefore not entitled to award of this contract.

Federal Requirements
The contractor must comply with all Federal Requirements per the CWSRF Supplementary Conditions.

Davis-Bacon and Related Acts
The contractor must comply with Davis-Bacon (DB) and Davis-Bacon Related Acts (DBRA) as stated in the CWSRF Supplementary Conditions. All laborers and mechanics employed by the contractor and subcontractors on this project shall not be paid less than the prevailing wage rates contained in the wage determination published in the bidding documents. Any laborers and mechanics not listed in the wage determination shall be paid at least as much as the lowest wage rate for other similar trade classifications already contained in the wage determination published in the bidding documents.

The Contractor and subcontractors shall use the Elation Systems software, made available by the State of Maine Department of Environmental Protection, for uploading their certified weekly payroll. Payroll noncompliance and other related payroll issues identified by the software shall be resolved by the contractor/subcontractor in the software and in a timely manner to maintain compliance with Davis Bacon requirements throughout the project.

American Iron and Steel
The Contractor shall comply with the Use of American Iron and Steel requirements on this project.
Instructions to Bidders

For all further requirements regarding funding agency notifications, funding agency requirements, bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner: Town of Falmouth
By: Nathan Poore
Title: Town Manager
SECTION 00200

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions.

1.02 Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. **Issuing Office**—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder’s responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.04 Bidder may register as a plan holder and obtain complete sets of Bidding Documents, in the number and format stated in the Advertisement or invitation to bid, from the Issuing Office. Bidders may rely that sets of Bidding Documents obtained from the Issuing Office are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.05 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as plan holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder’s failure to obtain Addenda from a plan room.

2.06 **Electronic Documents**

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.
1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf). It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor’s means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder’s reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 Deleted.

3.02 Deleted.

3.03 Bidder is to submit the following information with its Bid to demonstrate Bidder’s qualifications to perform the Work:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder’s state or other contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.04 A Bidder’s failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.05 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder’s qualifications.

3.06 To be considered a responsive Bidder, the Contractor shall have obtained at least one set of Bidding Documents from the Issuing Office. The Bid will not be awarded to a Bidder unless a record for obtaining at least one set of Bidding Documents exists in the Issuing Office. To meet
ARTICLE 4—PRE-BID CONFERENCE

4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.

4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER’S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 Site and Other Areas
   A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 Existing Site Conditions
   A. Subsurface and Physical Conditions; Hazardous Environmental Conditions
      1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:
         a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.
         b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.
         c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
         d. Technical Data contained in such reports and drawings.
      2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. **Underground Facilities:** Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 **Other Site-related Documents**

A. No other Site-related documents are available.

5.04 **Site Visit and Testing by Bidders**

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

B. All access to the Site must be coordinated through the following Owner or Engineer contact for visiting the Site: Dan Marks, Wastewater Superintendent; dmarks@falmouthme.org; (207) 781-4462. Bidder must conduct the required Site visit during normal working hours.

C. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

D. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner’s authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

E. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

F. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 **Owner’s Safety Program**

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 **Other Work at the Site**

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.
ARTICLE 6—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

6.01 Express Representations and Certifications in Bid Form, Agreement

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder’s examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing via electronic mail (email). Contact information and submittal procedures for such questions are as follows:

A. Bryanna Denis, PE, Project Manager; bryanna.denis@wright-pierce.com

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven working days prior to the date for opening of Bids may not be answered. Addenda will be issued not later than five working days before the bid opening. Bidders are responsible for determining that they have received all Addenda issued.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five percent of Bidder’s maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents. Bid security must be at least 5% of the Bidder’s maximum Bid price.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner’s
damages in the case of a damages-form bond. Such forfeiture will be Owner’s exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Deleted.

9.03 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND “OR EQUAL” ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or “or-equal” items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or “or-equal” item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

11.02 If requested by the Owner, the apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed.

11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case
apparent Successful Bidder will submit a substitute, Bidder’s Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

11.05 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”

11.06 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

11.07 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

11.08 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

11.09 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

11.10 A Bid by an individual must show the Bidder’s name and official address.

11.11 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

11.12 All names must be printed in ink below the signatures.

11.13 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.
ARTICLE 11—GUIDELINES

11.14 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

11.15 The Bid must contain evidence of Bidder’s authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

11.16 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder’s licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder’s state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 12—BASIS OF BID

12.01 Lump Sum with Unit Prices and Alternates

A. Bidders must submit a Bid on a lump sum basis for each lump sum item, and on a unit price basis for each unit price item of Work listed in the Bid Form for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.

B. The “Bid Price” (sometimes referred to as the extended price) for each unit price Bid item will be the product of the “Estimated Quantity”, which Owner or its representative has set forth in the Bid Form, for the item and the corresponding “Bid Unit Price” offered by the Bidder. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

D. The total of all unit price “Bid Prices” and all lump sum items will be used by Owner for Bid comparison purposes.

ARTICLE 13—SUBMITTAL OF BID

13.01 Deleted.

13.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED.” A mailed Bid must be addressed to the location designated in the Advertisement.

13.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.
ARTICLE 14—MODIFICATION AND WITHDRAWAL OF BID

14.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

14.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

14.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 15—OPENING OF BIDS

15.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 16—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

16.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 17—EVALUATION OF BIDS AND AWARD OF CONTRACT

17.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

17.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

17.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

17.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Base Bid.

17.05 Evaluation of Bids

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
B. Deleted.

C. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

D. Deleted.

E. Deleted.

17.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

17.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

17.08 All protests arising from the Owner’s procurement practices must be submitted to the Owner as soon as practical. Owner will investigate the basis for the protest, seek advice of legal counsel, document all meeting and actions, and attempt to resolve the protest promptly and equitably.

ARTICLE 18—BONDS AND INSURANCE

18.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner’s requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

18.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

18.03 The successful bidder must submit Performance and Payment Bonds to the Owner prior to contract award. Detailed information can be found in the General Conditions. The successful bidder must submit Liability and Property Insurance certificates to the Owner prior to contract award. Detailed information can be found in the General Conditions and the Supplementary Conditions.

ARTICLE 19—SIGNING OF AGREEMENT

19.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful
ARTICLE 20—SALES AND USE TAXES

20.01 Owner is exempt from Maine state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes must not be included in the Bid. Refer to Paragraph 2C-7.10 of the Supplementary Conditions for additional information.

20.02 The Owner is exempt from Maine state sales and use taxes on all materials to be incorporated in the work. Said taxes shall not be included in the bid. Detailed information can be found in the General Conditions and the CWSRF Supplementary Conditions.

ARTICLE 21—DELETION OF ITEMS

21.01 Owner reserves the right to reduce project scope by the elimination of Bid items, reduction of quantities on unit price Bid items, or deleting elements of lump sum Bid items. No adjustment to other Bid items prices will be permitted. In the case of reduction of quantities on unit price items, the unit price will not be adjusted. Such adjustments to project scope will be determined prior to award of the Contract and will be negotiated with the apparent Successful Bidder only. If such negotiations are not satisfactory to Owner, Owner will reject all Bids.

ARTICLE 22—FEDERAL REQUIREMENTS

22.01 If the contract price is in excess of $100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) apply.

22.02 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.

22.03 American Iron and Steel requirements apply to this project.

ARTICLE 23—SPECIAL LEGAL REQUIREMENTS

24.01 This contract is expected to be funded in whole or in part by the State of Maine Department of Environmental Protection (DEP) Clean Water State Revolving Loan Fund (CWSRF) program. Neither the State of Maine nor any of its departments, agencies, or employees is or will be a party to this contract. The word “agency” in the contract documents refers to the DEP and all other involved funding agencies.

24.02 Nondiscrimination in Employment: Each Bidder will be required to comply with the President's Executive Order No. 11246 and any amendments or supplements to this Executive Order.

24.03 The Contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 40 CFR part 33, Disadvantaged Business Enterprises (DBE), in the award and administration of subcontracts. Failure by the Contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

1. During the bidding period, the Contractor is required to make the good faith efforts as described in the CWSRF Supplementary Conditions if they will be awarding subcontracts. Contractors should initiate solicitation efforts early in the bidding period.

2. The Contractor must comply with the following provisions when submitting their bid:

(a) The contractor must complete and submit EPA Form 6100–4, ‘DBE Program Subcontractor Utilization Form’ (copy attached) as part of the prime contractor’s bid or...
INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

Additional contractor determinations. Note, only DBE subcontractors should be listed. If no DBE subcontractors are to be used, the contractor must still complete and submit the form.

(b) The contractor must have each of its proposed DBE subcontractors complete the EPA Form 6100–3, ‘DBE Program Subcontractor Performance Form’ (copy attached). The completed forms must be submitted as part of the prime contractor’s bid or proposal package to the Owner.

3. Prior to contract award, as the Successful Bidder, the Contractor must comply with the following provisions:

(a) The contractor must submit to the Owner documentation of its good faith efforts (such as copies of solicitation letters and emails) and data relied upon in formulating its fair share objectives. Solicitation documentation must include proof of receipt. The records must be submitted to the Owner even if the goals were met.

(b) The contractor must submit to the Owner a bidders list of all firms that bid or quote on subcontracts, including both MBE/WBEs and non-MBE/WBEs. The purpose of a bidders list is to provide contractors who conduct competitive bidding with as accurate a database as possible about the universe of MBE/WBE and non-MBE/WBE subcontractors. The list must include the following information:

(1) Entity's name with point of contact;
(2) Entity's mailing address, telephone number, and e-mail address;
(3) The procurement on which the entity bid or quoted, and when; and
(4) Entity's status as an MBE/WBE or non-MBE/WBE.

Additional information and forms may be found in the CWSRF Supplementary Conditions.

24.04 The eligibility of successful bidder will be verified through the federal government’s Excluded Parties List System prior to Maine Department of Environmental Protection approval of the contract award. Furthermore, by entering into the contract, the contractor shall certify that no part of the contract shall be subcontracted to a Debarred or Suspended person or firm. Detailed information may be found in the CWSRF Supplementary Conditions.

24.05 Not used.

24.06 The contractor must comply with Davis-Bacon (D-B) and Davis-Bacon Related Acts (DBRA). All laborers and mechanics employed by the contractor and subcontractors on this project shall not be paid less than the prevailing wage rates contained in the wage determination published in these bidding documents. All laborers and mechanics not listed in the wage determination but employed by the contractor and subcontractors on this project shall be paid at least as much as the lowest wage rate for other similar trade classifications already contained in the wage determination published in these bidding documents. A form 1444 submission will be required to obtain additional employee rate classifications, after contract award. No allowances or extra considerations on behalf of any contractor or subcontractor will be permitted subsequently by reason of error or oversight on account of Department of Labor wage determinations. The contractor and subcontractors shall pay all employees weekly. The contractor and subcontractors shall submit weekly certified payrolls to the owner or designated representative, including a payroll summary with signed certification form WH-347. Detailed information and forms can be found in the CWSRF Supplementary Conditions.

The Contractor and subcontractors shall use the Elation Systems software, made available by the State of Maine Department of Environmental Protection, for uploading their certified weekly payroll. Payroll noncompliance and other related payroll issues identified by the software shall be resolved by the
contractor/subcontractor in the software and in a timely manner to maintain compliance with Davis Bacon requirements throughout the project.

24.07 The contractor must comply with all Federal requirements found in the CWSRF Supplementary Conditions.

24.08 All laborers and mechanics employed or working upon the construction site of the project shall be paid not less than the prevailing State minimum wage rate regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

24.09 The Contractor shall comply with the Use of American Iron and Steel in accordance with Public Law 113-76, Section 436. The law and its requirements and guidance, including certification forms, can be found in the SRF supplementary conditions.

END OF SECTION
SECTION 00410

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to:

Town of Falmouth 271 Falmouth Road, Falmouth, ME 04105

West Falmouth Sewer Improvements Phase 1

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor’s license number as evidence of Bidder’s State Contractor’s License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data;

G. Signed Compliance Statement (Section 00406).

H. Signed Certification of Non-Segregated Facilities (SC-40).

I. Signed Labor Union Notice (SC-41).

J. A tabulation of Subcontractors, Suppliers and other persons and organizations required to be identified in this Bid.

K. Maine DEP Form 6100-4, “DBE Subcontractor Utilization Form”

L. Maine DEP Form 6100-3, “DBE Subcontractor Performance Form” for each proposed DBE subcontractor.

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 Base Bid Items

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum, unit price and allowance items.
B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for each separately identified item, and

2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents (estimated “**”).

## BID SCHEDULE

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<th>Item No.</th>
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<th>Unit</th>
<th>Quantity</th>
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<td>13</td>
<td>Middle Road Culvert Replacement</td>
<td>LS</td>
<td>1</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>14</td>
<td>Relocate Existing Water Main</td>
<td>LF*</td>
<td>40</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>15</td>
<td>Pipe Trench Insulation</td>
<td>LF*</td>
<td>600</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>16</td>
<td>Removal and Disposal of AC Pipe</td>
<td>LF*</td>
<td>2,900</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>17</td>
<td>Abandon and Demolish Sewer Pipes and Manholes</td>
<td>LS</td>
<td>1</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>18</td>
<td>Sanitary Sewer Manholes (4-Ft Diameter)</td>
<td>VF*</td>
<td>190</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>19</td>
<td>Sanitary Sewer Manholes (5-Ft Diameter)</td>
<td>VF*</td>
<td>25</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>20</td>
<td>Force Main Air Release and Drain Manholes</td>
<td>EA*</td>
<td>6</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>21</td>
<td>Manhole Drop Connections</td>
<td>VF*</td>
<td>8</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>22</td>
<td>Initial Pavement (Binder Course Without Overlay)</td>
<td>TON*</td>
<td>1,850</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>23</td>
<td>Final Pavement (Finish Course Without Overlay)</td>
<td>TON*</td>
<td>730</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>23a</td>
<td>Final Pavement (Finish Course with Overlay Woods Rd. Only)</td>
<td>TON*</td>
<td>950</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>23b</td>
<td>Driveway Aprons -Woods Road Only</td>
<td>TON*</td>
<td>25</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>24</td>
<td>Driveway Aprons (Hand Placed)</td>
<td>TON*</td>
<td>25</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>25</td>
<td>Bituminous Curb</td>
<td>LF</td>
<td>1,500</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>26</td>
<td>Traffic Control</td>
<td>LS</td>
<td>1</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>27</td>
<td>Test Pit Excavitation</td>
<td>EA*</td>
<td>32</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>28</td>
<td>Landscaping</td>
<td>LS</td>
<td>1</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>29</td>
<td>Electrical Service Entrance Allowance – Falmouth Road Pump Station</td>
<td>ALLOW</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>30</td>
<td>Top Flange and Web Painting – Spur Bridge</td>
<td>LS</td>
<td>1</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>31</td>
<td>Bottom Flange Painting – Spur Bridge</td>
<td>LS</td>
<td>1</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>Total Base Bid</td>
<td></td>
<td></td>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>
3.02 Bid Alternates

A. Bidder will complete the Work in accordance with the Contract Documents for the following bid alternate items.

<table>
<thead>
<tr>
<th>Alternate A [Deduct]</th>
<th>Type 2 Concrete Coating for Falmouth Road Pump Station Wetwell</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

3.03 Total Bid (Base Bid Plus Bid Alternate A)

<table>
<thead>
<tr>
<th>Total Bid (Base Bid Plus Bid Alternate A)</th>
<th>$</th>
</tr>
</thead>
</table>

ARTICLE 4—DELETED

ARTICLE 5—DELETED

ARTICLE 6—TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Deleted.

6.03 Deleted.

6.04 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7—BIDDER’S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 Bid Acceptance Period

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

7.02 Instructions to Bidders

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

7.03 Receipt of Addenda

A. Bidder hereby acknowledges receipt of the following Addenda:

<table>
<thead>
<tr>
<th>Addendum Number</th>
<th>Addendum Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ARTICLE 8—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

8.01 Bidder’s Representations

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.

2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work, including all American Iron and Steel requirements.

4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder’s (Contractor’s) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.
8.02  Bidder’s Certifications

A.  The Bidder certifies the following:

1.  This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2.  Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3.  Bidder has not solicited or induced any individual or entity to refrain from bidding.

4.  Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
   a.  Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
   b.  Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
   c.  Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.
   d.  Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

____________________________________________________________________________
(typed or printed name of organization)

By: ________________________________
(individual’s signature)

Name: ________________________________
(typed or printed)

Title: ________________________________
(typed or printed)

Date: ________________________________
(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: ________________________________
(individual’s signature)

Name: ________________________________
(typed or printed)

Title: ________________________________
Date: ________________________________ (typed or printed)

Address for giving notices:

____________________________________

Bidder’s Contact:

Name: ___________________________________________ (typed or printed)

Title: ___________________________________________ (typed or printed)

Phone: ____________________________________________

Email: ____________________________________________

Address: ___________________________________________ (typed or printed)

Bidder’s Contractor License No.: (if applicable) ________________________________

END OF SECTION
### BID BOND (PENAL SUM FORM)

<table>
<thead>
<tr>
<th>Bidder</th>
<th>Surety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong> [Full formal name of Bidder]</td>
<td><strong>Name:</strong> [Full formal name of Surety]</td>
</tr>
<tr>
<td><strong>Address:</strong> (principal place of business): [Address of Bidder’s principal place of business]</td>
<td><strong>Address:</strong> (principal place of business): [Address of Surety’s principal place of business]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner</th>
<th>Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong> [Full formal name of Owner]</td>
<td><strong>Project:</strong> (name and location): [Owner project/contract name, and location of the project]</td>
</tr>
<tr>
<td><strong>Address:</strong> (principal place of business): [Address of Owner’s principal place of business]</td>
<td><strong>Bid Due Date:</strong> [Enter date bid is due]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Penal Sum:</strong> [Amount]</td>
</tr>
<tr>
<td><strong>Date of Bond:</strong> [Date]</td>
</tr>
</tbody>
</table>

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

<table>
<thead>
<tr>
<th>Bidder</th>
<th>Surety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Full formal name of Bidder)</strong></td>
<td><strong>(Full formal name of Surety) (corporate seal)</strong></td>
</tr>
<tr>
<td><strong>By:</strong></td>
<td><strong>By:</strong></td>
</tr>
<tr>
<td><strong>(Signature)</strong></td>
<td><strong>(Signature) (Attach Power of Attorney)</strong></td>
</tr>
<tr>
<td><strong>Name:</strong></td>
<td><strong>Name:</strong></td>
</tr>
<tr>
<td><strong>(Printed or typed)</strong></td>
<td><strong>(Printed or typed)</strong></td>
</tr>
<tr>
<td><strong>Title:</strong></td>
<td><strong>Title:</strong></td>
</tr>
<tr>
<td><strong>Attest:</strong></td>
<td><strong>Attest:</strong></td>
</tr>
<tr>
<td><strong>(Signature)</strong></td>
<td><strong>(Signature)</strong></td>
</tr>
<tr>
<td><strong>Name:</strong></td>
<td><strong>Name:</strong></td>
</tr>
<tr>
<td><strong>(Printed or typed)</strong></td>
<td><strong>(Printed or typed)</strong></td>
</tr>
<tr>
<td><strong>Title:</strong></td>
<td><strong>Title:</strong></td>
</tr>
</tbody>
</table>

**Notes:** (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder’s and Surety’s liability. Recovery of such penal sum under the terms of this Bond will be Owner’s sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation will be null and void if:

3.1. Owner accepts Bidder’s Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2. All Bids are rejected by Owner, or

3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety’s written consent.

6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.

11. The term “Bid” as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION
SECTION 00450

QUALIFICATIONS STATEMENT

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

<table>
<thead>
<tr>
<th>Legal Name of Business:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Office</td>
</tr>
<tr>
<td>Name:</td>
</tr>
<tr>
<td>Title:</td>
</tr>
<tr>
<td>Business address of corporate office:</td>
</tr>
<tr>
<td>Local Office</td>
</tr>
<tr>
<td>Name:</td>
</tr>
<tr>
<td>Title:</td>
</tr>
<tr>
<td>Business address of local office:</td>
</tr>
</tbody>
</table>

1.02 Provide information on the Business’s organizational structure:

<table>
<thead>
<tr>
<th>Form of Business:</th>
<th>☐ Sole Proprietorship ☐ Partnership ☐ Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>Provide a separate Qualification Statement for each Joint Venturer.</td>
<td></td>
</tr>
<tr>
<td>Date Business was formed:</td>
<td>State in which Business was formed:</td>
</tr>
<tr>
<td>Is this Business authorized to operate in the Project location?</td>
<td>☐ Yes ☐ No ☐ Pending</td>
</tr>
<tr>
<td>Identify all Affiliation:</td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Name of business:</td>
<td>Affiliation:</td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Name of business:</td>
<td>Affiliation:</td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
</tbody>
</table>
1.03 Provide information regarding the Business’s officers, partners, and limits of authority.

<table>
<thead>
<tr>
<th>Name:</th>
<th>Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorized to sign contracts: □ Yes □ No</td>
<td>Limit of Authority: $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name:</th>
<th>Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorized to sign contracts: □ Yes □ No</td>
<td>Limit of Authority: $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name:</th>
<th>Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorized to sign contracts: □ Yes □ No</td>
<td>Limit of Authority: $</td>
</tr>
</tbody>
</table>

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

<table>
<thead>
<tr>
<th>Name of License:</th>
<th>Licensing Agency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>License No:</td>
<td>Expiration Date:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of License:</th>
<th>Licensing Agency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>License No:</td>
<td>Expiration Date:</td>
</tr>
</tbody>
</table>

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business’s Diverse Business Certification, if any. Provide evidence of current certification.

<table>
<thead>
<tr>
<th>Certification</th>
<th>Certifying Agency</th>
<th>Certification Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Advantaged Business Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Minority Business Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Woman-Owned Business Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Small Business Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Disabled Business Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Veteran-Owned Business Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Service-Disabled Veteran-Owned Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ HUBZone Business (Historically Underutilized) Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ARTICLE 4—SAFETY

4.01 Provide information regarding Business’s safety organization and safety performance.

Name of Business’s Safety Officer:

<table>
<thead>
<tr>
<th>Safety Certifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification Name</td>
</tr>
<tr>
<td>Issuing Agency</td>
</tr>
<tr>
<td>Expiration</td>
</tr>
</tbody>
</table>

4.02 Provide Worker’s Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

<table>
<thead>
<tr>
<th>Year</th>
<th>Company</th>
<th>EMR</th>
<th>TRFR</th>
<th>MH</th>
<th>Company</th>
<th>EMR</th>
<th>TRFR</th>
<th>MH</th>
</tr>
</thead>
</table>

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business’s financial stability. If required in the “Submit” check box below, provide a copy of the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:

Business address:

Date of Business’s most recent financial statement: ☐ Submit

Date of Business’s most recent audited financial statement: ☐ Submit

Financial indicators from the most recent financial statement:

Contractor’s Current Ratio (Current Assets ÷ Current Liabilities)

Contractor’s Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)
ARTICLE 6—SURETY INFORMATION

6.01  Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

<table>
<thead>
<tr>
<th>Surety Name:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surety is a corporation organized and existing under the laws of the state of:</td>
<td></td>
</tr>
<tr>
<td>Is surety authorized to provide surety bonds in the Project location?</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>Is surety listed in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury?</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>Mailing Address (principal place of business):</td>
<td></td>
</tr>
<tr>
<td>Physical Address (principal place of business):</td>
<td></td>
</tr>
<tr>
<td>Phone (main):</td>
<td>Phone (claims):</td>
</tr>
</tbody>
</table>

ARTICLE 7—INSURANCE

7.01  Provide information regarding Business’s insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

<table>
<thead>
<tr>
<th>Name of insurance provider, and type of policy (CLE, auto, etc.):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance Provider</td>
<td>Type of Policy (Coverage Provided)</td>
</tr>
<tr>
<td>Are providers licensed or authorized to issue policies in the Project location?</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>Does provider have an A.M. Best Rating of A-VII or better?</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>Mailing Address (principal place of business):</td>
<td></td>
</tr>
<tr>
<td>Physical Address (principal place of business):</td>
<td></td>
</tr>
<tr>
<td>Phone (main):</td>
<td>Phone (claims):</td>
</tr>
</tbody>
</table>
ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

<table>
<thead>
<tr>
<th>Average number of current full-time employees:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate of revenue for the current year:</td>
</tr>
<tr>
<td>Estimate of revenue for the previous year:</td>
</tr>
</tbody>
</table>

8.02 Provide information regarding the Business’s previous contracting experience.

<table>
<thead>
<tr>
<th>Years of experience with projects like the proposed project:</th>
</tr>
</thead>
<tbody>
<tr>
<td>As a general contractor:</td>
</tr>
</tbody>
</table>

Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:

- Been disqualified as a bidder by any local, state, or federal agency within the last 5 years?
  - Yes □ No
- Been barred from contracting by any local, state, or federal agency within the last 5 years?
  - Yes □ No
- Been released from a bid in the past 5 years?
  - Yes □ No
- Defaulted on a project or failed to complete any contract awarded to it?
  - Yes □ No
- Refused to construct or refused to provide materials defined in the contract documents or in a change order?
  - Yes □ No
- Been a party to any currently pending litigation or arbitration?
  - Yes □ No

Provide full details in a separate attachment if the response to any of these questions is Yes.

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business’s experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business’s key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business’s safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.
E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business:

____________________________________________________________________________________

(typed or printed name of organization)

By:

____________________________________________________________________________________

(individual’s signature)

Name:

____________________________________________________________________________________

(typed or printed)

Title:

____________________________________________________________________________________

(typed or printed)

Date:

____________________________________________________________________________________

(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

____________________________________________________________________________________

(individual’s signature)

Name:

____________________________________________________________________________________

(typed or printed)

Title:

____________________________________________________________________________________

(typed or printed)

Address for giving notices:

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

Designated Representative:

Name:

____________________________________________________________________________________

(typed or printed)

Title:

____________________________________________________________________________________

(typed or printed)

Address:

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

Phone:  

____________________________________________________________________________________

Email:  

____________________________________________________________________________________
## Schedule A—Current Projects

<table>
<thead>
<tr>
<th>Name of Organization</th>
<th>Project Owner</th>
<th>Project Name</th>
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<table>
<thead>
<tr>
<th>General Description of Project</th>
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<tr>
<th>Project Cost</th>
<th>Date Project</th>
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<table>
<thead>
<tr>
<th>Key Project Personnel</th>
<th>Project Manager</th>
<th>Project Superintendent</th>
<th>Safety Manager</th>
<th>Quality Control Manager</th>
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<th>Telephone</th>
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<th>Construction Manager</th>
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<tr>
<th>Construction Manager</th>
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</table>
### Schedule B—Previous Experience with Similar Projects

<table>
<thead>
<tr>
<th>Name of Organization</th>
<th>Project Owner</th>
<th>Project Name</th>
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<tbody>
<tr>
<td>General Description of Project</td>
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</table>
### Schedule B—Previous Experience with Similar Projects

<table>
<thead>
<tr>
<th>Name of Organization</th>
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<tbody>
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</tr>
</thead>
<tbody>
<tr>
<td>Key Project Personnel</td>
<td>Project Manager</td>
</tr>
</tbody>
</table>

| Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference) | |
|---|---|---|---|---|
| Name | Title/Position | Organization | Telephone | Email |
| Owner | | |
| Designer | | |
| Construction Manager | | |

<table>
<thead>
<tr>
<th>Name</th>
<th>Project Owner</th>
<th>Project Name</th>
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<tbody>
<tr>
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</table>

| Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference) | |
|---|---|---|---|---|
| Name | Title/Position | Organization | Telephone | Email |
| Owner | | |
| Designer | | |
| Construction Manager | | |

<table>
<thead>
<tr>
<th>Name</th>
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<td>Key Project Personnel</td>
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| Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference) | |
|---|---|---|---|---|
| Name | Title/Position | Organization | Telephone | Email |
| Owner | | |
| Designer | | |
| Construction Manager | | |
### Schedule C—Key Individuals

#### Project Manager

<table>
<thead>
<tr>
<th>Name of individual</th>
<th>Years of experience as project manager</th>
<th>Years of experience with this organization</th>
<th>Number of similar projects as project manager</th>
<th>Number of similar projects in other positions</th>
</tr>
</thead>
</table>

#### Current Project Assignments

<table>
<thead>
<tr>
<th>Name of assignment</th>
<th>Percent of time used for this project</th>
<th>Estimated project completion date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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#### Reference Contact Information (listing names indicates approval to contact named individuals as a reference)

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<thead>
<tr>
<th>Name</th>
<th>Name</th>
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</table>

#### Project Superintendent

<table>
<thead>
<tr>
<th>Name of individual</th>
<th>Years of experience as project superintendent</th>
<th>Years of experience with this organization</th>
<th>Number of similar projects as project superintendent</th>
<th>Number of similar projects in other positions</th>
</tr>
</thead>
</table>

#### Current Project Assignments

<table>
<thead>
<tr>
<th>Name of assignment</th>
<th>Percent of time used for this project</th>
<th>Estimated project completion date</th>
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</table>
### Safety Manager

<table>
<thead>
<tr>
<th>Name of individual</th>
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<tbody>
<tr>
<td>Years of experience as project manager</td>
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<tr>
<td>Years of experience with this organization</td>
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<tr>
<td>Number of similar projects as project manager</td>
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<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
<th>Organization</th>
<th>Telephone</th>
<th>Email</th>
<th>Project</th>
<th>Candidate’s role on project</th>
</tr>
</thead>
<tbody>
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### Quality Control Manager

<table>
<thead>
<tr>
<th>Name of individual</th>
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<tbody>
<tr>
<td>Years of experience as project superintendent</td>
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<tr>
<td>Years of experience with this organization</td>
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<tr>
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END OF SECTION
SECTION 00460

COMPLIANCE STATEMENT

EXECUTIVE ORDER 11246

Date: ____________________

This statement relates to a proposed contract with the ______________________, who expects to finance the contract with assistance from an agency of agencies of the United States Government. I am the undersigned bidder or prospective contractor. I represent that -----

1. I ☐ have, ☐ have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.

2. If I have participated in such a contract or subcontract, I ☐ have, ☐ have not, filed all compliance reports that I have been required to file in connection with the contract or subcontract.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to the office where the reports are required to be filed.

__________________________________________
Signature of Bidder or Prospective Contractor

Address: ______________________________________
Street, P.O. Box, etc.

__________________________________________
City, State and Zip Code

(This page to be completed by the Bidder and submitted with the Bid Form)

END OF SECTION
Date of Issuance: 
Owner: Town of Falmouth
Owner’s Project No.: 
Engineer: Wright-Pierce
Engineer’s Project No.: 14070D
Project: West Falmouth Sewer Improvements Phase 1
Contract Name: 
Bidder: 
Bidder’s Address: 

You are notified that Owner has accepted your Bid dated [date] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

[Describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is $[Contract Price]. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

[Number of copies sent] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [number of copies sent] counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): [Describe other conditions that require Successful Bidder’s compliance]

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: [Full formal name of Owner]
By (signature):
Name (printed):
Title:
Copy: Engineer

END OF SECTION
SECTION 00520
AGREEMENT BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between Town of Falmouth (“Owner”) and [name of contracting entity] (“Contractor”).

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Replacement of existing sanitary sewers on Middle Road and Lunt Road, installation of new sanitary sewer on Woods Road, installation of new sanitary sewer force main on Pinehurst Drive, Woodlands Drive and Woods Road, and upgrades to the Falmouth Road Pump Station.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: West Falmouth Sewer Improvements Phase 1

ARTICLE 3—ENGINEER

3.01 The Owner has retained Wright-Pierce (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Engineer.

ARTICLE 4—CONTRACT TIMES

4.01 Time is of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.03 Contract Times: Days

A. The Work will be substantially complete within 400 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 450 days after the date when the Contract Times commence to run.

4.04 4.05 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also
recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. **Substantial Completion:** Contractor shall pay Owner $1,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. **Completion of Remaining Work:** After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $500 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner’s sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

C. **DELETED**

**ARTICLE 5—CONTRACT PRICE**

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work, at the prices stated in Contractor’s Bid, attached hereto as an exhibit.

**ARTICLE 6—PAYMENT PROCEDURES**

6.01 **Submittal and Processing of Payments**

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 **Progress Payments; Retainage**

A. Owner shall make progress payments on the basis of Contractor’s Applications for Payment on or about the last day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments
previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. 95 percent of the value of the Work completed (with the balance being retainage).

   1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion of the entire construction to be provided under the Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to 98 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer’s estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 Final Payment

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

   1. The final two percent of the value of the Work shall be retained for a period of one year from the date of Substantial Completion.

6.04 Consent of Surety

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 Interest

A. All amounts not paid when due will bear interest at the rate of prime plus 2 percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 Contents

A. The Contract Documents consist of all of the following:

   1. This Agreement.

   2. Bonds:

      a. Performance bond (together with power of attorney).

      b. Payment bond (together with power of attorney).

   3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of 35 sheets with each sheet bearing the following general title: West Falmouth Sewer Improvements Phase 1.
7. Addenda (numbers [number] to [number], inclusive).
8. Exhibits to this Agreement (enumerated as follows):
   a. Contractor’s Bid
   b. [list exhibits]
9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
   a. Notice to Proceed.
   b. Work Change Directives.
   c. Change Orders.
   d. Field Orders.
   e. Warranty Bond, if any.
B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
C. There are no Contract Documents other than those listed above in this Article 7.
D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 Contractor’s Representations
A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
   1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
   2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
   3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
   4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the
Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor’s safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. Contractor’s entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 Contractor’s Certifications

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. “corrupt practice” means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 Standard General Conditions

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee.
IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on [indicate date on which Contract becomes effective] (which is the Effective Date of the Contract).

Owner:

(typed or printed name of organization)

By: ________________________________  (individual’s signature)

Date: ________________________________  (date signed)

Name: ________________________________  (typed or printed)

Title: ________________________________  (typed or printed)

Attest: ________________________________  (individual’s signature)

Title: ________________________________  (typed or printed)

Address for giving notices: ________________________________

Designated Representative:

Name: ________________________________  (typed or printed)

Title: ________________________________  (typed or printed)

Address: ________________________________

Phone: ________________________________

Email: ________________________________

(If [Type of Entity] is a corporation, attach evidence of authority to sign. If [Type of Entity] is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

Contractor:

(typed or printed name of organization)

By: ________________________________  (individual’s signature)

Date: ________________________________  (date signed)

Name: ________________________________  (typed or printed)

Title: ________________________________  (typed or printed)

Attest: ________________________________  (individual’s signature)

Title: ________________________________  (typed or printed)

Address for giving notices: ________________________________

Designated Representative:

Name: ________________________________  (typed or printed)

Title: ________________________________  (typed or printed)

Address: ________________________________

Phone: ________________________________

Email: ________________________________

License No.: ________________________________  (where applicable)

State: ________________________________
SECTION 00550

NOTICE TO PROCEED

Owner: Town of Falmouth
Engineer: Wright-Pierce
Contractor: 
Project: West Falmouth Sewer Improvements Phase 1

Owner’s Project No.: 
Engineer’s Project No.: 14070D
Contractor’s Project No.: 

Contract Name: 
Effective Date of Contract: 

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [date Contract Times are to start] pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement: [Select one of the following two alternatives, insert dates or number of days, and delete the other alternative.]

The date by which Substantial Completion must be achieved is [date for Substantial Completion, from Agreement], and the date by which readiness for final payment must be achieved is [date for readiness, from Agreement].

[or]

The number of days to achieve Substantial Completion is [number of days, from Agreement] from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of [date, calculated from commencement date above]; and the number of days to achieve readiness for final payment is [number of days, from Agreement] from the commencement date of the Contract Times, resulting in a date for readiness for final payment of [date, calculated from commencement date above].

Before starting any Work at the Site, Contractor must comply with the following:

[Note any access limitations, security procedures, or other restrictions]

Owner: [Full formal name of Owner]

By (signature): 

Name (printed): 

Title: 

Date Issued: 

Copy: Engineer

END OF SECTION
## SECTION 00610

### PERFORMANCE BOND

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Surety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong> [Full formal name of Contractor]</td>
<td><strong>Name:</strong> [Full formal name of Surety]</td>
</tr>
<tr>
<td><strong>Address (principal place of business):</strong> [Address of Contractor’s principal place of business]</td>
<td><strong>Address (principal place of business):</strong> [Address of Surety’s principal place of business]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong> [Full formal name of Owner]</td>
<td><strong>Description (name and location):</strong> [Owner’s project/contract name, and location of the project]</td>
</tr>
<tr>
<td><strong>Mailing address (principal place of business):</strong> [Address of Owner’s principal place of business]</td>
<td><strong>Contract Price:</strong> [Amount from Contract]</td>
</tr>
<tr>
<td><strong>Effective Date of Contract:</strong> [Date from Contract]</td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
<th>Bond</th>
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</thead>
<tbody>
<tr>
<td><strong>Bond Amount:</strong> [Amount]</td>
</tr>
<tr>
<td><strong>Date of Bond:</strong> [Date]</td>
</tr>
<tr>
<td><em>(Date of Bond cannot be earlier than Effective Date of Contract)</em></td>
</tr>
<tr>
<td><strong>Modifications to this Bond form:</strong> ☐ None ☐ See Paragraph 16</td>
</tr>
</tbody>
</table>

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

<table>
<thead>
<tr>
<th>Contractor as Principal</th>
<th>Surety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>By:</strong></td>
<td><strong>By:</strong> <em>(Full formal name of Surety) (corporate seal)</em></td>
</tr>
<tr>
<td><strong>Name:</strong></td>
<td><strong>Name:</strong> <em>(Signature) (Attach Power of Attorney)</em></td>
</tr>
<tr>
<td><strong>Title:</strong></td>
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<tr>
<td><strong>Attest:</strong></td>
<td><strong>Attest:</strong> <em>(Signature)</em></td>
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<tr>
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</tr>
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</table>

**Notes:** (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.
1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety’s obligation under this Bond will arise after:

3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor’s performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner’s notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety’s receipt of the Owner’s notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner’s right, if any, subsequently to declare a Contractor Default;

3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety’s obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety’s expense take one of the following actions:

5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2. additional legal, design professional, and delay costs resulting from the Contractor’s Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety’s liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
14. Definitions

14.1. **Balance of the Contract Price**—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2. **Construction Contract**—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3. **Contractor Default**—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4. **Owner Default**—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5. **Contract Documents**—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: [Describe modification or enter “None”]

END OF SECTION
### SECTION 00615

#### PAYMENT BOND

<table>
<thead>
<tr>
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<th>Surety</th>
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<td><strong>Description (name and location):</strong> [Owner’s project/contract name, and location of the project]</td>
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<tr>
<td><strong>Mailing address (principal place of business):</strong> [Address of Owner’s principal place of business]</td>
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<tr>
<td><strong>Effective Date of Contract:</strong> [Date, from Contract]</td>
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</table>

**Bond**

| Bond Amount: | [Amount] |
| Date of Bond: | [Date] |
| *(Date of Bond cannot be earlier than Effective Date of Contract)* |

Modifications to this Bond form:

☐ None  ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

<table>
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**Notes:**

1. Provide supplemental execution by any additional parties, such as joint venturers.
2. Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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EJCDC® C-615, Payment Bond.
Copyright © 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.
Page 1 of 4 14070D
1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety’s obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner’s property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety’s expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety’s obligations to a Claimant under this Bond will arise after the following:

   5.1. Claimants who do not have a direct contract with the Contractor

      5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

      5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

   5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant’s obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety’s expense take the following actions:

   7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

   7.2. Pay or arrange for payment of any undisputed amounts.

   7.3. The Surety’s failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney’s fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety’s total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney’s fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner’s priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

16.1. Claim—A written statement by the Claimant including at a minimum:

16.1.1. The name of the Claimant;

16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

16.1.4. A brief description of the labor, materials, or equipment furnished;
16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. Claimant—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. Construction Contract—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. Owner Default—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. Contract Documents—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: [Describe modification or enter “None”]

END OF SECTION
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

Prepared By

Endorsed By

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# STANDARD GENERAL CONDITIONS
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STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term’s singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. Addenda—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. Agreement—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. Application for Payment—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. Bid—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. Bidder—An individual or entity that submits a Bid to Owner.

6. Bidding Documents—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. Bidding Requirements—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. Change Order—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. Change Proposal—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. Claim

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the
requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer’s decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer’s decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. Constituent of Concern—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. Contract—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. Contract Documents—Those items so designated in the Agreement, and which together comprise the Contract.

14. Contract Price—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. Contract Times—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. Contractor—The individual or entity with which Owner has contracted for performance of the Work.

17. Cost of the Work—See Paragraph 13.01 for definition.

18. Drawings—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. Effective Date of the Contract—The date, indicated in the Agreement, on which the Contract becomes effective.

20. Electronic Document—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. Electronic Means—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the
recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. **Engineer**—The individual or entity named as such in the Agreement.

23. **Field Order**—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. **Hazardous Environmental Condition**—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
   a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
   b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
   c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. **Laws and Regulations; Laws or Regulations**—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. **Liens**—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. **Milestone**—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. **Notice of Award**—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.

29. **Notice to Proceed**—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. **Owner**—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. **Progress Schedule**—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor’s plan to accomplish the Work within the Contract Times.

32. **Project**—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
33. **Resident Project Representative**—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. **Samples**—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. **Schedule of Submittals**—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.

36. **Schedule of Values**—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.

37. **Shop Drawings**—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. **Site**—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. **Specifications**—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. **Subcontractor**—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. **Submittal**—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers’ instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. **Substantial Completion**—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion of such Work.
43. Successful Bidder—The Bidder to which the Owner makes an award of contract.

44. Supplementary Conditions—The part of the Contract that amends or supplements these General Conditions.

45. Supplier—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. Technical Data

a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. Underground Facilities—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. Unit Price Work—Work to be paid for on the basis of unit prices.

49. Work—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. Work Change Directive—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.
1.02 **Terminology**

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. **Intent of Certain Terms or Adjectives**: The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. **Day**: The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. **Defective**: The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
   1. does not conform to the Contract Documents;
   2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
   3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. **Furnish, Install, Perform, Provide**
   1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
   2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
   3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
   4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
F. **Contract Price or Contract Times:** References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

**ARTICLE 2—PRELIMINARY MATTERS**

2.01 **Delivery of Performance and Payment Bonds; Evidence of Insurance**

A. **Performance and Payment Bonds:** When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. **Evidence of Contractor’s Insurance:** When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. **Evidence of Owner’s Insurance:** After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 **Copies of Documents**

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 **Before Starting Construction**

A. **Preliminary Schedules:** Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work
into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 Preconstruction Conference; Designation of Authorized Representatives

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 Acceptance of Schedules

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor’s full responsibility therefor.

2. Contractor’s Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor’s Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 Electronic Transmittals

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient’s use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.
ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 Intent

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:
   1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
   2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 Reference Standards

A. Standards Specifications, Codes, Laws and Regulations
   1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

   2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility
inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies

1. **Contractor’s Verification of Figures and Field Measurements**: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. **Contractor’s Review of Contract Documents**: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

   a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Requirements of the Contract Documents

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer’s written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 Reuse of Documents

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner’s express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 Starting the Work

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 Reference Points

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer’s judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the
established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04  Progress Schedule

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05  Delays in Contractor’s Progress

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor’s performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor’s sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.
D. Contractor’s entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor’s entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days’ increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 Availability of Lands

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner’s interest therein as necessary for giving notice of or filing a mechanic’s or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor’s operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor’s performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. Removal of Debris During Performance of the Work: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment
and machinery, and surplus materials and shall restore to original condition all property not
designated for alteration by the Contract Documents.

D. **Loading of Structures**: Contractor shall not load nor permit any part of any structure to be
loaded in any manner that will endanger the structure, nor shall Contractor subject any part
of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 **Subsurface and Physical Conditions**

A. **Reports and Drawings**: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site
   that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those
drawings depicting existing surface or subsurface structures at or adjacent to the Site
(except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. **Underground Facilities**: Underground Facilities are shown or indicated on the Drawings,
pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A.
Information and data regarding the presence or location of Underground Facilities are not
intended to be categorized, identified, or defined as Technical Data.

C. **Reliance by Contractor on Technical Data**: Contractor may rely upon the accuracy of the
Technical Data expressly identified in the Supplementary Conditions with respect to such
reports and drawings, but such reports and drawings are not Contract Documents. If no such
express identification has been made, then Contractor may rely upon the accuracy of the
Technical Data as defined in Paragraph 1.01.A.46.b.

D. **Limitations of Other Data and Documents**: Except for such reliance on Technical Data,
Contractor may not rely upon or make any claim against Owner or Engineer, or any of their
officers, directors, members, partners, employees, agents, consultants, or subcontractors,
with respect to:

1. the completeness of such reports and drawings for Contractor’s purposes, including, but
   not limited to, any aspects of the means, methods, techniques, sequences, and
   procedures of construction to be employed by Contractor, and safety precautions and
   programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown
   or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as
   record drawings from other projects at or adjacent to the Site, or Owner’s archival
   documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such
   other data, interpretations, opinions, or information.
5.04  **Differing Subsurface or Physical Conditions**

A. **Notice by Contractor:** If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. **Engineer’s Review:** After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor’s resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer’s findings, conclusions, and recommendations.

C. **Owner’s Statement to Contractor Regarding Site Condition:** After receipt of Engineer’s written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer’s written findings, conclusions, and recommendations, in whole or in part.

D. **Early Resumption of Work:** If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer’s review or Owner’s issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. **Possible Price and Times Adjustments**

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in
Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor’s entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor’s making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor’s entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner’s issuance of the Owner’s written statement to Contractor regarding the subsurface or physical condition in question.

F. Underground Facilities; Hazardous Environmental Conditions: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 Underground Facilities

A. Contractor’s Responsibilities: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;
3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. Notice by Contractor: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. Engineer’s Review: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor’s resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer’s findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. Owner’s Statement to Contractor Regarding Underground Facility: After receipt of Engineer’s written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer’s written findings, conclusions, and recommendations in whole or in part.

E. Early Resumption of Work: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer’s review or Owner’s issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. Possible Price and Times Adjustments

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown
or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor’s entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor’s entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner’s issuance of the Owner’s written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor’s remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 Hazardous Environmental Conditions at Site

A. Reports and Drawings: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures
of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner’s written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special
conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner’s own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual’s or entity’s own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor’s obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or
Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 Insurance—General Provisions

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by
Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party’s full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party’s obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner’s option, may purchase and maintain Owner’s own liability insurance. Owner’s liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner’s liability policies for any of Contractor’s obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker’s compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor’s liability policies) on each Subcontractor’s commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor’s entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner’s termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party’s interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.
L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor’s interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor’s liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 Contractor’s Insurance

A. Required Insurance: Contractor shall purchase and maintain Worker’s Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. General Provisions: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;
2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
5. include all necessary endorsements to support the stated requirements.

C. Additional Insureds: The Contractor’s commercial general liability, automobile liability, employer’s liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);
4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor’s acts or omissions, or the acts and omissions of those working on Contractor’s behalf, in the performance of Contractor’s operations.

6.04 Builder’s Risk and Other Property Insurance

A. Builder’s Risk: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder’s risk insurance upon the Work on a completed value basis, in the amount of the Work’s full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder’s risk insurance are set forth in the Supplementary Conditions.

B. Property Insurance for Facilities of Owner Where Work Will Occur: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder’s risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. Property Insurance for Substantially Complete Facilities: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder’s risk insurance. The builder’s risk insurance may terminate upon written confirmation of Owner’s procurement of such property insurance.

D. Partial Occupancy or Use by Owner: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder’s risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder’s risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. Insurance of Other Property; Additional Insurance: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder’s risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor’s expense.

6.05 Property Losses; Subrogation

A. The builder’s risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against
Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder’s risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner’s existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer’s rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner’s property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder’s risk insurance, installation floater, and any other property insurance applicable to the Work.
6.06  **Receipt and Application of Property Insurance Proceeds**

A. Any insured loss under the builder’s risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder’s risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

**ARTICLE 7—CONTRACTOR’S RESPONSIBILITIES**

7.01  **Contractor’s Means and Methods of Construction**

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor’s responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor’s expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor’s determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02  **Supervision and Superintendence**

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03  **Labor; Working Hours**

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.
B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor’s employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor’s own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner’s written consent, which will not be unreasonably withheld.

7.04 Services, Materials, and Equipment

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 “Or Equals”

A. Contractor’s Request; Governing Criteria: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or equal” item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an “or equal” item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

   a. in the exercise of reasonable judgment Engineer determines that the proposed item:

      1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. **Contractor’s Expense**: Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.

C. **Engineer’s Evaluation and Determination**: Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal,” which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. **Effect of Engineer’s Determination**: Neither approval nor denial of an “or-equal” request will result in any change in Contract Price. The Engineer’s denial of an “or-equal” request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. **Treatment as a Substitution Request**: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 **Substitutes**

A. **Contractor’s Request; Governing Criteria**: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
   a. will certify that the proposed substitute item will:
      1) perform adequately the functions and achieve the results called for by the general design;
      2) be similar in substance to the item specified; and
      3) be suited to the same use as the item specified.
   b. will state:
      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
   c. will identify:
      1) all variations of the proposed substitute item from the item specified; and
      2) available engineering, sales, maintenance, repair, and replacement services.
   d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. **Engineer’s Evaluation and Determination:** Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer’s determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. **Special Guarantee:** Owner may require Contractor to furnish at Contractor’s expense a special performance guarantee or other surety with respect to any substitute.

D. **Reimbursement of Engineer’s Cost:** Engineer will record Engineer’s costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
E. **Contractor’s Expense**: Contractor shall provide all data in support of any proposed substitute at Contractor’s expense.

F. **Effect of Engineer’s Determination**: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer’s denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 **Concerning Subcontractors and Suppliers**

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor’s retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor’s obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor’s Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner’s requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 Patent Fees and Royalties

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the
Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 Permits
A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor’s Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 Taxes
A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 Laws and Regulations
A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor’s compliance with any Laws or Regulations.
B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor’s responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor’s Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 Record Documents
A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available
to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner’s safety programs, if any. Any Owner’s safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor’s safety program with which Owner’s and Engineer’s employees and representatives must comply while at the Site.

I. Contractor’s duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor’s duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 Hazard Communication Programs

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor’s response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor’s response, a Work Change Directive or Change Order will be issued.

7.16 Submittals

A. Shop Drawing and Sample Requirements

1. Before submitting a Shop Drawing or Sample, Contractor shall:
   a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
   b. determine and verify:
      1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
      2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
      3) all information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
   c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor’s obligations under the Contract Documents with respect to Contractor’s review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. Submittal Procedures for Shop Drawings and Samples: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. Shop Drawings
   a. Contractor shall submit the number of copies required in the Specifications.
   b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. Samples
   a. Contractor shall submit the number of Samples required in the Specifications.
   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer’s review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Engineer’s Review of Shop Drawings and Samples

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer’s review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer’s review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer’s review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. Engineer’s review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer’s review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer’s review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer’s receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer’s time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer’s charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer’s charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
c. Engineer’s review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 Contractor’s General Warranty and Guarantee

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor’s warranty and guarantee.

B. Owner’s rights under this warranty and guarantee are in addition to, and are not limited by, Owner’s rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor’s warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor’s obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor’s obligation to perform the Work in accordance with the Contract Documents, or a release of Owner’s warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;
6. The issuance of a notice of acceptability by Engineer;
7. The end of the correction period established in Paragraph 15.08;
8. Any inspection, test, or approval by others; or
9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor’s performance obligations to Owner for the Work described in the assigned contract.

7.18 **Indemnification**

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers’ compensation acts, disability benefit acts, or other employee benefit acts.

7.19 **Delegation of Professional Design Services**

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor’s design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer’s review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;
2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

**ARTICLE 8—OTHER WORK AT THE SITE**

8.01 Other Work

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner’s employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner’s employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner’s employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate
with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor’s Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor’s Work. Contractor’s failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor’s Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 Coordination

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner’s employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 Legal Relationships

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner’s employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price
will be conditioned on Contractor assigning to Owner all Contractor’s rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor’s entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner’s contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner’s employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor’s failure to take reasonable and customary measures with respect to Owner’s other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor’s failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor’s actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER’S RESPONSIBILITIES

9.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 Replacement of Engineer

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer’s status under the Contract Documents will be that of the former Engineer.

9.03 Furnish Data

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.
9.04 **Pay When Due**
A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 **Lands and Easements; Reports, Tests, and Drawings**
A. Owner’s duties with respect to providing lands and easements are set forth in Paragraph 5.01.
B. Owner’s duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
C. Article 5 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 **Insurance**
A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 **Change Orders**
A. Owner’s responsibilities with respect to Change Orders are set forth in Article 11.

9.08 **Inspections, Tests, and Approvals**
A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 **Limitations on Owner’s Responsibilities**
A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

9.10 **Undisclosed Hazardous Environmental Condition**
A. Owner’s responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 **Evidence of Financial Arrangements**
A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner’s obligations under the Contract (including obligations under proposed changes in the Work).

9.12 **Safety Programs**
A. While at the Site, Owner’s employees and representatives shall comply with the specific applicable requirements of Contractor’s safety programs of which Owner has been informed.
B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.
ARTICLE 10—ENGINEER’S STATUS DURING CONSTRUCTION

10.01 Owner’s Representative

A. Engineer will be Owner’s representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner’s representative during construction are set forth in the Contract.

10.02 Visits to Site

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer’s efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer’s visits and observations are subject to all the limitations on Engineer’s authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer’s visits or observations of Contractor’s Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 Resident Project Representative

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer’s consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 Engineer’s Authority

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer’s authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer’s authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner’s delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer’s authority as to changes in the Work is set forth in Article 11.
E. Engineer’s authority as to Applications for Payment is set forth in Article 15.

10.05 Determinations for Unit Price Work

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 Decisions on Requirements of Contract Documents and Acceptability of Work

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 Limitations on Engineer’s Authority and Responsibilities

A. Neither Engineer’s authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer’s review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 Compliance with Safety Program

A. While at the Site, Engineer’s employees and representatives will comply with the specific applicable requirements of Owner’s and Contractor’s safety programs of which Engineer has been informed.
ARTICLE 11—CHANGES TO THE CONTRACT

11.01 Amending and Supplementing the Contract

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer’s recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 Change Orders

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner’s acceptance of defective Work under Paragraph 14.04 or Owner’s correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer’s recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 Work Change Directives

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive’s effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.
B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 Field Orders

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 Owner-Authorized Changes in the Work

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer’s recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor’s safety obligations under the Contract Documents or Laws and Regulations.

11.06 Unauthorized Changes in the Work

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 Change of Contract Price

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:
1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor’s fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. Contractor’s Fee: When applicable, the Contractor’s fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor’s fee will be 15 percent;

   b. For costs incurred under Paragraph 13.01.B.3, the Contractor’s fee will be 5 percent;

   c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor’s fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

   d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

   e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

   f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor’s fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.
11.08 Change of Contract Times

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 Change Proposals

A. Purpose and Content: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. Change Proposal Procedures

1. Submittal: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. Supporting Data: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
   a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
   b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

   The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. Engineer’s Initial Review: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. Engineer’s Full Review and Action on the Change Proposal: Upon receipt of Contractor’s supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor’s supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal in whole or in part, Contractor may, at its own cost, and following prior consultation with Engineer, prepare a new and supplemental Change Proposal in the event that Contractor believes that any proposed change in Contract Times or Contract Price, or other proposed relief, is warranted.
Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer’s inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. **Binding Decision**: Engineer’s decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. **Resolution of Certain Change Proposals**: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. **Post-Completion**: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 **Notification to Surety**

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor’s responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

**ARTICLE 12—CLAIMS**

12.01 **Claims**

A. **Claims Process**: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer’s decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. **Submittal of Claim**: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor’s knowledge
and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. **Review and Resolution:** The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. **Mediation**

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator’s fees and costs.

E. **Partial Approval:** If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. **Denial of Claim:** If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. **Final and Binding Results:** If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

**ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

13.01 **Cost of the Work**

A. **Purposes for Determination of Cost of the Work:** The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. **Costs Included:** Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers’ compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers’ field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor’s Cost of the Work and fee will be determined in the same manner as Contractor’s Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor’s employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are
consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. Construction Equipment Rental

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price (“changed Work”), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder’s risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor’s fee.
g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. Costs Excluded: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor’s officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor’s principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor’s fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor’s principal and branch offices other than Contractor’s office at the Site.

4. Any part of Contractor’s capital expenses, including interest on Contractor’s capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor’s Fee

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
   a. Contractor’s fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
   b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor’s fee will be determined as follows:
      1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
      2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor’s fee for any Work covered by a Change
Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. **Documentation and Audit:** Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor’s accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor’s fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 **Allowances**

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. **Cash Allowances:** Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor’s costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. **Owner’s Contingency Allowance:** Contractor agrees that an Owner’s contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 **Unit Price Work**

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor’s overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer’s preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer’s written decision
thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
   a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
   b. Contractor’s unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor’s costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

**ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK**

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor’s safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner’s and Engineer’s acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor’s purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor’s expense unless Contractor had given Engineer timely notice of Contractor’s intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

A. Contractor’s Obligation: It is Contractor’s obligation to assure that the Work is not defective.

B. Engineer’s Authority: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. Notice of Defects: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. Correction, or Removal and Replacement: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. Preservation of Warranties: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner’s special warranty and guarantee, if any, on said Work.

F. Costs and Damages: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,
losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer’s confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner’s evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer’s observation, and then replace the covering, all at Contractor’s expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer’s request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor’s full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 Owner May Stop the Work

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,
or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days’ written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor’s services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner’s representatives, agents and employees, Owner’s other contractors, and Engineer and Engineer’s consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor’s defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner’s rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

A. Basis for Progress Payments: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. Applications for Payments

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation.
establishing full payment by Contractor for the materials and equipment; (b) at Owner’s request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner’s interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor’s legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer’s reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer’s recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer’s observations of the executed Work as an experienced and qualified design professional, and on Engineer’s review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer’s knowledge, information and belief:
   a. the Work has progressed to the point indicated;
   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
   c. the conditions precedent to Contractor’s being entitled to such payment appear to have been fulfilled in so far as it is Engineer’s responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer’s review of Contractor’s Work for the purposes of recommending payments nor Engineer’s recommendation of any payment, including final payment, will impose responsibility on Engineer:
   a. to supervise, direct, or control the Work;
   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
   c. for Contractor’s failure to comply with Laws and Regulations applicable to Contractor’s performance of the Work;
   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer’s opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer’s opinion to protect Owner from loss because:
   a. the Work is defective, requiring correction or replacement;
   b. the Contract Price has been reduced by Change Orders;
   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
   a. Claims have been made against Owner based on Contractor’s conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor’s conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor’s failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner’s refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 Contractor’s Warranty of Title

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 Substantial Completion

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time
submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor’s notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner’s objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner’s use or occupancy of the Work following Substantial Completion, review the builder’s risk insurance policy with respect to the end of the builder’s risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner’s use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 Partial Use or Occupancy

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without
significant interference with Contractor’s performance of the remainder of the Work, subject
to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy
any such part of the Work that Owner believes to be substantially complete. If and when
Contractor agrees that such part of the Work is substantially complete, Contractor,
Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for
that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor
considers any such part of the Work substantially complete and request Engineer to issue
a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall
make an inspection of that part of the Work to determine its status of completion. If
Engineer does not consider that part of the Work to be substantially complete, Engineer
will notify Owner and Contractor in writing giving the reasons therefor. If Engineer
considers that part of the Work to be substantially complete, the provisions of
Paragraph 15.03 will apply with respect to certification of Substantial Completion of that
part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to
compliance with the requirements of Paragraph 6.04 regarding builder’s risk or other
property insurance.

15.05 Final Inspection

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is
complete, Engineer will promptly make a final inspection with Owner and Contractor and will
notify Contractor in writing of all particulars in which this inspection reveals that the Work, or
agreed portion thereof, is incomplete or defective. Contractor shall immediately take such
measures as are necessary to complete such Work or remedy such deficiencies.

15.06 Final Payment

A. Application for Payment

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections
identified during the final inspection and has delivered, in accordance with the Contract
Documents, all maintenance and operating instructions, schedules, guarantees, bonds,
certificates or other evidence of insurance, certificates of inspection, annotated record
documents (as provided in Paragraph 7.12), and other documents, Contractor may make
application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered)
by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work,
      materials, and equipment has passed to Owner free and clear of any Liens or other
      title defects, or will so pass upon final payment.
d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien
   rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved
   by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor
   that: (a) the releases and receipts include all labor, services, material, and equipment for
   which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other
   indebtedness connected with the Work for which Owner might in any way be responsible,
   or which might in any way result in liens or other burdens on Owner's property, have been
   paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release
   or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner
   to indemnify Owner against any Lien, or Owner at its option may issue joint checks
   payable to Contractor and specified Subcontractors and Suppliers.

B. **Engineer’s Review of Final Application and Recommendation of Payment:** If, on the basis
   of Engineer’s observation of the Work during construction and final inspection, and Engineer’s
   review of the final Application for Payment and accompanying documentation as required by
   the Contract Documents, Engineer is satisfied that the Work has been completed and
   Contractor’s other obligations under the Contract have been fulfilled, Engineer will, within 10
   days after receipt of the final Application for Payment, indicate in writing Engineer’s
   recommendation of final payment and present the final Application for Payment to Owner
   for payment. Such recommendation will account for any set-offs against payment that are
   necessary in Engineer’s opinion to protect Owner from loss for the reasons stated above with
   respect to progress payments. Otherwise, Engineer will return the Application for Payment to
   Contractor, indicating in writing the reasons for refusing to recommend final payment, in
   which case Contractor shall make the necessary corrections and resubmit the Application for
   Payment.

C. **Notice of Acceptability:** In support of its recommendation of payment of the final Application
   for Payment, Engineer will also give written notice to Owner and Contractor that the Work is
   acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. **Completion of Work:** The Work is complete (subject to surviving obligations) when it is ready
   for final payment as established by the Engineer’s written recommendation of final payment
   and issuance of notice of the acceptability of the Work.

E. **Final Payment Becomes Due:** Upon receipt from Engineer of the final Application for Payment
   and accompanying documentation, Owner shall set off against the amount recommended by
   Engineer for final payment any further sum to which Owner is entitled, including but not
   limited to set-offs for liquidated damages and set-offs allowed under the provisions of this
   Contract with respect to progress payments. Owner shall pay the resulting balance due to
   Contractor within 30 days of Owner’s receipt of the final Application for Payment from
   Engineer.

15.07 **Waiver of Claims**

A. By making final payment, Owner waives its claim or right to liquidated damages or other
   damages for late completion by Contractor, except as set forth in an outstanding Claim,
appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 Correction Period

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor’s repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner’s written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor’s failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
F. Contractor’s obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 Owner May Suspend Work

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor’s persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor’s disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor’s repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days’ written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,
attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor’s services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 Owner May Terminate for Convenience

A. Upon 7 days’ written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 Contractor May Stop Work or Terminate

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days’ written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The
provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor’s stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

A. Disputes Subject to Final Resolution: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. Final Resolution of Disputes: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
2. agree with the other party to submit the dispute to another dispute resolution process; or
3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 Giving Notice

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient’s place of business;
2. by registered or certified mail, postage prepaid, to the recipient’s place of business; or
3. by e-mail to the recipient, with the words “Formal Notice” or similar in the e-mail’s subject line.

18.02 Computation of Times

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.
18.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 Limitation of Damages

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver

A. A party’s non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 Assignment of Contract

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 Successors and Assigns

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.
These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

**CONTENTS OF SUPPLEMENTARY CONDITIONS**

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<thead>
<tr>
<th>Section No.</th>
<th>Section Title</th>
<th>Page No.</th>
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<tr>
<td>SC-1 to SC-18</td>
<td>Supplementary Conditions Amendments to General Conditions</td>
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<td>SC-20</td>
<td>State Funding Agency Requirements</td>
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<td>SC-41</td>
<td>SC-41 Notice to Labor Unions</td>
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</tbody>
</table>
ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

SC-1.01.A.3 APPLICATION FOR PAYMENT

Add the following language to the end of Paragraph 1.01.A.3:

The Application for Payment form to be used on this Project is EJCDC No. C-620 or similar approved format. The Agency must approve all Applications for Payment before payment is made.

SC-1.01.A.8 CHANGE ORDER

Add the following language to the end of Paragraph 1.01.A.8:

The Change Order form to be used on this Project is EJCDC No. C-941. Agency approval is required before Change Orders are effective.

SC-1.01 A.30 OWNER

Add the following to the end of Paragraph 1.01.A.30 of the General Conditions:

Owner is referred to as Grantee in certain sections of these Contract Documents. Owner and Grantee are one and the same.

SC-1.01 A.50 WORK CHANGE DIRECTIVE

Add the following language at the end of the last sentence of Paragraph 1.01.A.50

The Work Change Directive form to be used on this Project is EJCDC C-940 (2018). A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

SC-1.01 A.53 NON-RESIDENT CONTRACTOR

Add the following paragraph immediately after Paragraph 1.01.A.52 of the General Conditions, which is to read as follows:

53. Non-Resident Contractor -
   a. A person who is not a resident in the State where the proposed construction is to be located, or
   b. Any partnership that has no member thereof resident in the State where the proposed construction is to be located.
   c. Any corporation established under laws other than those of the State in which the proposed construction is located.

ARTICLE 2—PRELIMINARY MATTERS

2.01 Delivery of Bonds and Evidence of Insurance

Add a new paragraph immediately after Paragraph 2.01.C of the General Conditions, which is to read as follows:

D. Non-Resident Contractor: The Contractor, if a corporation established under laws other than the State in which the proposed construction is located, shall file with the Owner, notice of the name of its resident attorney, appointed as required by the laws of the State
in which the proposed construction is located. The Contractor, if a resident of a State other than that in which the proposed construction is located and not a corporation, shall file, at the time of execution of the Agreement, with the Owner a written appointment of a resident of the State in which the construction is located, having an office or place of business therein, to be his/her true and lawful attorney upon whom all lawful processes in any actions or proceedings against him/her may be served; and in such writing, which shall set forth said attorney’s place of residence, shall agree that any lawful process against him/her which is served on said attorney shall be of the same legal force and validity as if served on him/her and that the authority shall continue in force so long as any liability remains outstanding against him/her in said State. The power of attorney shall be filed in the office of the Secretary of State if required, and copies certified by the Secretary shall be sufficient evidence thereof. Such appointment shall continue in force until revoked by an instrument in writing, designating in a like manner some other person upon whom such processes may be served, which instrument shall be filed in the manner provided herein for the original appointment.

2.02 Copies of Documents

SC-2.02 Delete Paragraph 2.02.A. in its entirety and replace with the following paragraph:

Owner shall furnish to Contractor 4 printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional copies will be furnished upon request at the cost of reproduction.

2.06 Electronic Transmittals

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

B. Electronic Documents Protocol: The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol (“EDP” or “Protocol”) for exchange of electronic transmittals.

1. Basic Requirements

   a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.

   b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

   c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.

   d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the
requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.

e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party’s use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.

f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. **System Infrastructure for Electronic Document Exchange**

a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 10 MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.

2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party’s individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the
issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.

e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.

f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

h. The Owner will operate a Project information management system (also referred to in this EDP as “Project Website”) for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project related information. The following conditions and standards will govern use of the Project Website:

1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;

2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;

3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and

4) Include any other Project Website attributes that may be pertinent to Contractor’s use of the facility and pricing of such use.

C. Software Requirements for Electronic Document Exchange; Limitations

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.
a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.

2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No changes in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

SC-4.01 Delete Paragraph 4.01.A in its entirety and insert the following in its place:

A. The Contract Times will commence to run on the day indicated in the Notice to Proceed. A Notice to Proceed may be issued at any time within 30 calendar days after the Effective Date of the Agreement.

SC-4.01 Delete the last sentence of Paragraph 4.01.A

4.03 Reference Points

SC-4.03 Add a new paragraph immediately after Paragraph 4.03A of the General Conditions which is to read as follows:B. Engineer may check the lines, elevations, reference marks, batter boards, etc., set by Contractor, and Contractor shall correct any errors disclosed by such check. Such a check shall not be considered as approval of Contractor’s work and shall not relieve Contractor of the responsibility for accurate construction of the entire Work. Contractor shall furnish personnel to assist Engineer in checking lines and grades.

4.05 Delays in Contractor’s Progress

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. Weather-Related Delays

a. If “abnormal weather conditions” as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in...
SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information listed in SC 4.05.C.5.b.

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 Subsurface and Physical Conditions

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

<table>
<thead>
<tr>
<th>Report Title</th>
<th>Date of Report</th>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration Log Sheet</td>
<td></td>
<td>Geotechnical test probe data</td>
</tr>
<tr>
<td>Proposed Sewer Main – Falmouth, Maine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely: [If there are no such drawings, so indicate in the table, but do not delete the table.]

<table>
<thead>
<tr>
<th>Drawings Title</th>
<th>Date of Drawings</th>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Woodlands Falmouth, Maine</td>
<td>March 1987</td>
<td>General road layout and alignment</td>
</tr>
<tr>
<td>By E.C. Jordan Co., Inc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Town of Falmouth, Maine Collector Sewers – Lunt Road to Middle Road Contract No. 3</td>
<td>July 1969</td>
<td>General road layout and alignment</td>
</tr>
<tr>
<td>By E.C. Jordan Co., Inc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at Falmouth Wastewater Treatment Facility 96 Clear Water Drive Falmouth, Maine 04105 during regular business hours, or may request copies from Engineer.

5.06 Hazardous Environmental Conditions
SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

<table>
<thead>
<tr>
<th>Report Title</th>
<th>Date of Report</th>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

<table>
<thead>
<tr>
<th>Drawings Title</th>
<th>Date of Drawings</th>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town of Falmouth, Maine Collector Sewers – Lunt Road to Middle Road Contract No. 3 By E.C. Jordan Co., Inc</td>
<td>July 1969</td>
<td>General location and extent of existing Asbestos-Cement gravity sewer pipe</td>
</tr>
</tbody>
</table>

ARTICLE 6—BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. Required Performance Bond Form: The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).

2. Required Payment Bond Form: The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

6.03 Contractor’s Insurance

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. Other Additional Insureds: As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: Engineer’s Consultants, as specifically identified in Article 1

E. Workers’ Compensation and Employer’s Liability: Contractor shall purchase and maintain workers’ compensation and employer’s liability insurance, including, as applicable, United States Longshoreman and Harbor Workers’ Compensation Act, Jones Act, stop-gap employer’s liability coverage for monopolistic states, and foreign voluntary workers’ compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

<table>
<thead>
<tr>
<th>Workers’ Compensation and Related Policies</th>
<th>Policy limits of not less than:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers’ Compensation</td>
<td>Statutory</td>
</tr>
<tr>
<td>State</td>
<td></td>
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</tbody>
</table>
### Workers’ Compensation and Related Policies

<table>
<thead>
<tr>
<th>Applicable Federal (e.g., Longshoreman’s)</th>
<th>Statutory</th>
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<tbody>
<tr>
<td>Foreign voluntary workers’ compensation (employer’s responsibility coverage), if applicable</td>
<td>Statutory</td>
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</table>

### Employer’s Liability

<table>
<thead>
<tr>
<th>Each accident</th>
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</thead>
<tbody>
<tr>
<td>Each employee</td>
<td>$500,000</td>
</tr>
<tr>
<td>Policy limit</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>

F. **Commercial General Liability—Claims Covered:** Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. **Commercial General Liability—Form and Content:** Contractor’s commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
   a. Such insurance must be maintained for three years after final payment.
   b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor’s contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 “Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured” or its equivalent.
H. Commercial General Liability—Excluded Content: The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of “insured contract” (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured’s vicarious liability, strict liability, or statutory liability (other than worker’s compensation).
6. Any limitation or exclusion based on the nature of Contractor’s work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. Commercial General Liability—Minimum Policy Limits

<table>
<thead>
<tr>
<th>Commercial General Liability</th>
<th>Policy limits of not less than:</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Aggregate</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Products—Completed Operations Aggregate</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>Personal and Advertising Injury</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Bodily Injury and Property Damage—Each Occurrence</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>

J. Automobile Liability: Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

<table>
<thead>
<tr>
<th>Automobile Liability</th>
<th>Policy limits of not less than:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodily Injury</td>
<td></td>
</tr>
<tr>
<td>Each Person</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Each Accident</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Property Damage</td>
<td></td>
</tr>
<tr>
<td>Each Accident</td>
<td>$2,000,000</td>
</tr>
</tbody>
</table>

K. Umbrella or Excess Liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer’s liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

<table>
<thead>
<tr>
<th>Excess or Umbrella Liability</th>
<th>Policy limits of not less than:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Occurrence</td>
<td>$5,000,000</td>
</tr>
</tbody>
</table>
L. Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements: Contractor may meet the policy limits specified for employer’s liability, commercial general liability, and automobile liability through the primary insurance policy’s policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein.

M. Contractor’s Pollution Liability Insurance: Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor’s operations and completed operations. This insurance must be maintained for no less than three years after final completion.

<table>
<thead>
<tr>
<th>Contractor’s Pollution Liability</th>
<th>Policy limits of not less than:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Occurrence/Claim</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>General Aggregate</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>

N. Contractor’s Professional Liability Insurance: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

<table>
<thead>
<tr>
<th>Contractor’s Professional Liability</th>
<th>Policy limits of not less than:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Claim</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Annual Aggregate</td>
<td>$1,000,000</td>
</tr>
</tbody>
</table>

6.04  Builder’s Risk and Other Property Insurance

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. Builder’s Risk Requirements: The builder’s risk insurance must:

1. be written on a builder’s risk “all risk” policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition
SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder’s risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

5. extend to cover damage or loss to insured property while in transit.

6. allow for the waiver of the insurer’s subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner’s procurement of property insurance following Substantial Completion, whichever occurs first.

10 include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder’s risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as “insureds.” In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

a. Engineer and Engineer’s consultants as listed in SC-1.01.

b. Woodlands Homeowners Association, PO Box 66731 Falmouth ME 04105

c. The Woodlands Club, 39 Woods Road Falmouth ME 04105
ARTICLE 7—CONTRACTOR’S RESPONSIBILITIES

7.03 Labor; Working Hours

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be 7:00 AM to 5:00 PM for work within the Woodlands housing development.

2. Regular working hours in all other project locations outside of the Woodlands housing development will be 7:00 AM to 7:00 PM.

3. Owner’s legal holidays are State mandated holidays.

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state “...all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday.”

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer’s services (including those of the Resident Project Representative, if any), Owner’s representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

3. For purposes of administering the foregoing requirement, additional overtime costs are defined as 1.5 times the regular hourly rate.

SC-7.04 Add the following new paragraph immediately after Paragraph 7.04.D:

E. All Iron and Steel products must meet American Iron and Steel requirements.

F. For projects utilizing a De Minimis waiver, Contractor shall maintain an itemized list of non-domestically produced iron or steel incidental components and ensure that the cost is less than 5% of total materials cost for project.

SC-7.05 “Or Equals”

Add the following at the end of Paragraph 7.05.B

Contractor shall include a Manufacturer’s Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

Add a new subparagraph SC-7.05.B.1 immediately after subparagraph 7.05.B:

1. It shall be Contractor’s responsibility to coordinate all submittals to Engineer for approval to eliminate any conflicts which might arise due to the use of “or equal” items. Any additional costs incidental to the use of “or equal” items shall be paid by Contractor.
SC-7.06 Substitutes

Add a new subparagraph SC-7.06.E.1 immediately after subparagraph 7.06.E:

1. It shall be Contractor’s responsibility to coordinate all submittals to Engineer for approval to eliminate any conflicts which might arise due to the use of substitutes. Any additional costs incidental to the use of substitutes shall be paid by Contractor.

SC-7.09 Permits

Add the following subparagraph immediately after Paragraph 7.09.A:1. Local permit fees for permits required from the Town of Falmouth will be waived.

Add the following paragraph immediately after Paragraph 7.09.A:

B. The following permits/approvals have been or will be obtained by the Owner. Copies of the permit approvals are in the Appendices of the Bidding Documents. Full copies of the permit applications and approvals will be on file at the Owner’s Offices. It is the responsibility of the Contractor to be familiar with and comply with the applicable provisions of each permit as they apply to the work:

1. Maine Department of Environmental Protection NRPA Permit-by-Rule
2. U.S. Army Corps of Engineers Self-Verification Permit

7.10 Taxes

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

B. Owner is exempt from payment of sales and compensating use taxes of the State of Maine and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.

2. Owner’s exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

ARTICLE 8—ENGINEER’S STATUS DURING CONSTRUCTION

10.03 Resident Project Representative

SC-10.03 Add the following new paragraph immediately after Paragraph 10.03.B:

C. The Resident Project Representative (RPR) will be Engineer’s representative at the Site. RPR’s dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR’s dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

1. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor’s safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. Safety Compliance: Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR’s own personal safety while at the Site.

3. Liaison
   a. Serve as Engineer’s liaison with Contractor. Working principally through Contractor’s authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
   b. Assist Engineer in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s on-Site operations.
   c. Assist in obtaining from Owner additional details or information, when required for Contractor’s proper execution of the Work.

4. Review of Work; Defective Work
   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
   b. Observe whether any Work in place appears to be defective.
   c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. Inspections and Tests
   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
   b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. Payment Requests: Review Applications for Payment with Contractor.

7. Completion
   a. Participate in Engineer’s visits regarding Substantial Completion.
   b. Assist in the preparation of a punch list of items to be completed or corrected.
   c. Participate in Engineer’s visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
   d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including “or-equal” items).
ARTICLE 2—LIMITATIONS

2. Exceed limitations of Engineer’s authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 9—CLAIMS

No changes to this Article.

ARTICLE 10—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

10.01 Cost of the Work

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

   a. For purposes of this paragraph, “small tools and hand tools” means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

SC-13.03 UNIT PRICE WORK

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

   E. Adjustments in Unit Price

      1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

         a. the extended price of a particular item of Unit Price Work amounts to five percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement.

      2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor’s costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

      3. Adjusted unit prices will apply to all units of that item.
ARTICLE 11—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.03 Defective Work

SC 14.03 Add new paragraph immediately after Paragraph 14.03.F

G. Installation of materials that are non-compliant with American Iron and Steel requirements shall be considered defective work.

ARTICLE 12—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

SC-15.01 PROGRESS PAYMENTS

SC-15.01 Add the following language at the end of Paragraph 15.01.B.4:

No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage or invest the retainage for the benefit of the Contractor.

SC-15.01 Add new paragraph immediately after Paragraph 15.01.B.4:

5. The Application for Payment form to be used on this Project is EJCDC C-620. The Agency must approve all Applications for Payment before Payment is made.

SC-15.01 Add new paragraph immediately after Paragraph 15.01.B.5:

6. By submitting an Application for Payment based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials are compliant with American Iron and Steel requirements. Manufacturer’s Certification letter for materials satisfy this requirement. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

SC-15.01 Add the following paragraph immediately after Paragraph 15.01.C.2.c:

a. The materials presented for payment in an Application for Payment comply with American Iron and Steel requirements.

SC-15.01 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

The Application for Payment with Engineer’s recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC-15.01 Add the following new paragraph after Paragraph 15.01.B.2: For All Stored Materials:

i. The Contractor shall submit the Manufacturer’s short-term and long-term storage and shall have established a written program to implement the Manufacturer’s required storage procedures, including written schedule for all required maintenance activities.
ii. For each payment requisition that includes payment for stored materials, Contractor shall include the following documentation:
   1) Identification of the item(s), including model number, serial number and photographs.
   2) Copy of the updated maintenance schedule including certification that all required maintenance has been performed.
   3) Lien waivers for the preceding monthly payments.

iii. Contractor shall furnish evidence that payment for stored materials has in fact been paid to the respective supplier(s) within sixty days of payment by Owner. Failure to provide such evidence of payment may result in the withdrawal of previous approval(s) and removal of the cost of related materials and equipment from the next submitted Application for Payment.

b. For Off-Site Stored Materials:
   i. Payment for off-site stored materials will be determined on a case-by-case basis at the discretion of the Owner and, if considered acceptable by Owner, the off-site facility shall be no more than 2 hours from the job site by car.
   ii. Contractor shall provide the Owner and/or Engineer guaranteed right-of-entry to the storage facility to inspect the stored materials. Contractor shall be responsible for paying travel costs and Engineer’s time associated with inspections.
   iii. Contractor’s Builder’s Risk certificate of insurance shall explicitly identify the off-site storage location as well as transportation of stored materials from the storage facility to the job site.

Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place: 1. Fifteen days after presentation of the Application for Payment to Owner with Engineer’s recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

SC-15.03 SUBSTANTIAL COMPLETION

SC-15.03 Add the following to the end of the Paragraph 15.03.C:

1. Substantial Completion shall only be granted for the Milestones identified in the Agreement.

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

2. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

END OF SECTION
SECTION 00800-SC-20
CWSRF SUPPLEMENTARY CONDITIONS
(MAINE DEP REV OCT 2018)

1. Agency Not a Party

“This contract is expected to be funded in whole or in part by the State of Maine Department of Environmental Protection (DEP) Clean Water State Revolving Loan Fund (CWSRF) program. Neither the State of Maine nor any of its departments, agencies, or employees is or will be a party to this contract. The word “agency” in the contract documents refers to the DEP and all other involved funding agencies.”

2. Contract Award Approval

“The Owner and Contractor shall furnish the documents as required by this contract to the State of Maine Department of Environmental Protection (DEP) Clean Water State Revolving Loan Fund (CWSRF) program for contract award approval. Concurrence by the Agency in the award of the Contract is required before the Contract is effective.”

3. Conflict of Interest

“Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer. Owner’s officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner’s officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.”

4. Gratuities

“If Owner finds after a notice and hearing that Contractor, or any of Contractor’s agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

In the event this Contract is terminated as provided in above paragraph, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this
Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.”

5. Audit and Access to Records

“Owner, Agency, the Comptroller General, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor, which are pertinent to the Contract, for the purpose of making audits, examinations, excerpts and transcriptions. Contractor shall maintain all required records for three years after final payment is made and all other pending matters are closed.”

6. Anti-Kickback

“Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, “Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States”). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.”

7. Clean Air and Pollution Control Acts

“If this Contract exceeds $100,000, Contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 USC 7401 et seq.) and the Federal Water Pollution Control Act as amended (33 USC 1251 et seq.). Contractor will report violations to the Agency and the Regional Office of the EPA.”

8. State Energy Policy

“Contractor shall comply with the Energy Policy and Conservation Act (P.L. 94-163). Mandatory standards and policies relating to energy efficiency, contained in any applicable State Energy Conservation Plan, shall be utilized.”

9. Equal Opportunity Requirements

B. “Contractor’s compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting Contractor’s goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.”

C. “Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number; estimated dollar amount of subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.”

10. Environmental Requirements

“When constructing a project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental constraints:

1. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.

2. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey Maps.

3. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).

4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.”
11. Suspension and Debarment

“The Contractor must comply with Subpart B and Subpart C of 2 CFR Part 180 and Part 1532. By entering into this contract, the contractor certifies that neither the contractor’s firm, nor any person or firm who has an interest in the contractor firm, is a Debarred or Suspended person or firm. Furthermore, by entering into this contract, the contractor shall certify that no part of this contract shall be subcontracted to a Debarred or Suspended person or firm. Contractors may access the federal government’s Excluded Parties List System on the internet for verification of excluded parties.”

12. Taxes

Add the following language to General Conditions Article 6.10:

“The Owner is exempt from Maine state sales and use taxes on all materials to be incorporated in the work. The Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the work. The Owner’s exemption does not apply to construction tools, machinery, equipment, or other property purchased or leased by Contractor or to supplies or materials not incorporated into the work.”

13. State Minimum wages

“All laborers and mechanics employed or working upon the construction site of the project shall be paid not less than the prevailing State minimum wage rate regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. The most current version of the State of Maine poster for Minimum Wage (as per the Department of Labor website) must be posted where it can be easily seen by employees.”

14. Posting Documents

“The contractor shall post documents in accordance with all applicable state and federal labor and employment laws. Posters shall be located and maintained by the Contractor at such place or places on the project site where employees can easily see them. Posters displayed outdoors must be laminated or otherwise protected from the weather. The most current version of workplace posters can be found on the internet on the state and federal Department of Labor websites.”

15. SRF Project Sign

“At the start of the project, the Contractor shall provide and erect a project sign as detailed and specified in the attachment to these supplementary conditions. The location of the sign shall be as directed by the Engineer. No other contractor, subcontractor, or material signs will be permitted on the sign. The Contractor shall maintain and keep the project sign in good condition until the work is completed when the sign will be removed. Provide
adequate supports for the sign as site conditions may require and keep sign a proper distance above prevailing grade to permit public viewing."

“Alternate methods of publicizing may be considered on a project specific basis for projects with a contract value less than $250,000. Prior to the start of the project, the Contractor must obtain Agency approval, through the Owner, for use of a proposed method. Alternate methods that may be considered include: posters or wall signage on public buildings or at a public location, newspaper advertising, online signage, and press releases. Minimum public awareness requirements and sample language can be obtained from the Agency.”

16. SRF Disadvantaged Business Enterprises Program

“The Contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 40 CFR part 33, Disadvantaged Business Enterprises (DBE), in the award and administration of subcontracts. Failure by the Contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

The goals for this project are a minimum of 0.64% certified Minority Business Enterprise (MBE) and a minimum of 1.64% certified Women’s Business Enterprise (WBE) participation. Lists of certified businesses may be found on the following internet websites: EPA Office of Small and Disadvantaged Business Utilization (OSDBU), State of Maine Department of Transportation (DOT), and the United States Small Business Administration (SBA).

The contractor must maintain all records documenting its compliance with the requirements of this part, including documentation of its good faith efforts (such as copies of solicitation letters and emails) and data relied upon in formulating its fair share objectives.

1. During the bidding period, the Contractor is required to make the following good faith efforts if they will be awarding subcontracts:
   (a) Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. This will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
   (b) Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
   (c) Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
   (d) Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
(e) Use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce.
(f) Employ the good faith efforts described above even if the prime contractor has achieved its fair share objectives under subpart D of this part.

2. The Contractor must comply with the following provisions when submitting their bid:
   a) The contractor must complete and submit EPA Form 6100–4, ‘DBE Program Subcontractor Utilization Form’ ([copy attached]) as part of the prime contractor’s bid or proposal package to the Owner. Note, only DBE subcontractors should be listed. If no DBE subcontractors are to be used, the contractor must still complete and submit the form.
   b) The contractor must have each of its proposed DBE subcontractors complete the EPA Form 6100–3, ‘DBE Program Subcontractor Performance Form’ ([copy attached]). The completed forms must be submitted as part of the prime contractor’s bid or proposal package to the Owner.

3. Prior to contract award, as the Successful Bidder, the Contractor must comply with the following provisions:
   a) The contractor must submit to the Owner documentation of its good faith efforts (such as copies of solicitation letters and emails) and data relied upon in formulating its fair share objectives. Solicitation documentation must include proof of receipt. The records must be submitted to the Owner even if the goals were met.
   b) The contractor must submit to the Owner a bidders list of all firms that bid or quote on subcontracts, including both MBE/WBEs and non-MBE/WBEs. The purpose of a bidders list is to provide contractors who conduct competitive bidding with as accurate a database as possible about the universe of MBE/WBE and non-MBE/WBE subcontractors. The list must include the following information:
      (1) Entity’s name with point of contact;
      (2) Entity’s mailing address, telephone number, and e-mail address;
      (3) The procurement on which the entity bid or quoted, and when; and
      (4) Entity’s status as an MBE/WBE or non-MBE/WBE.

4. Following contract award, the Contractor must comply with the following additional provisions:
   a) The contractor must provide EPA Form 6100–2, ‘DBE Program Subcontractor Participation Form’ ([copy attached]) to all DBE subcontractors listed on Form 6100-4. EPA Form 6100–2 gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the prime contractor, how much the DBE subcontractor was paid and any other concerns the DBE subcontractor might have during the course of the project, for example, reasons why the DBE subcontractor believes it was terminated by the prime contractor. If DBE subcontractors choose to complete this form, the completed form should be sent directly to the DEP DBE Coordinator. The address is: Maine Department of Environmental Protection, Attn: Ms. Kelly Stevens, DBE Coordinator, Bureau of Land and Water Quality, Division of Water Quality Management, 17 State House Station, Augusta, Maine 04333-0017.
   b) Complete the CWSRF DEP Progress Report of DBE Subcontractor Utilization Form ([copy attached]) for all contractor pay applications whether or not they include invoiced
amounts from DBE subcontractors. The progress report should be attached to the corresponding pay application for processing through the Owner.
c) Pay subcontractors for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the Owner.
d) Notify the Owner in writing prior to any termination of a DBE subcontractor for convenience by the prime contractor.
e) If a DBE subcontractor fails to complete work under the subcontract for any reason, the prime contractor must employ the good faith efforts described above if soliciting a replacement subcontractor. Documentation of good faith efforts shall be submitted to the Owner upon request.”

17. Davis-Bacon and Related Acts

“The Contractor must comply with the following contract and subcontract provisions of the Davis-Bacon and Davis-Bacon Related acts. **Attachments to these provisions include: the wage determination for this contract, four forms, and a poster.**

1. Applicability of the Davis-Bacon (DB) prevailing wage requirements

Davis-Bacon prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund. If an Owner encounters a unique situation at a site that presents uncertainties regarding DB applicability, the Owner must discuss the situation with the State official before authorizing work on that site.

The Contractor and subcontractors shall use the Elation Systems software, made available by the State of Maine Department of Environmental Protection, for uploading their certified weekly payroll. Payroll noncompliance and other related payroll issues identified by the software shall be resolved by the contractor/subcontractor in the software and in a timely manner to maintain compliance with Davis Bacon requirements throughout the project.

2. Obtaining Wage Determinations

(a) Owners shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the Owner shall monitor [www.wdol.gov](http://www.wdol.gov) weekly to ensure that the wage determination contained in the solicitation remains current. The Owner shall amend the solicitation if DOL issues a modification more that 10 days prior to the closing date, the Owner may request a finding from the State official that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State official will provide a report of its findings to the Owner.
(ii) If the Owner does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State official, at the request of the Owner, obtains an extension of the 90 day period from DOL pursuant to 20 CFR 1.6(c)(3)(iv). The Owner shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the Owner carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the Owner shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Owners shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a Owner’s contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the Owner has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the Owner shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL’s wage determination retroactive to the beginning of the contract or ordering instrument by change order. The Owner’s contractor must be compensated for any increases in wages resulting from the use of DOL’s revised wage determination.


(a) The State official shall insure that the Owner(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressing indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to
exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321, attached) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Additional copies of this poster can be obtained from the US Department of Labor website.

(ii)(A) Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Owner agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), Form 1444 (attached) shall be completed and sent by the Owner to the State official. The State official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State official or will notify the State official within the 30-day period that additional time is necessary. Additional copies of Form 1444 may be obtained from the US Department of Labor website.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or
their representatives, and the Owner do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the State official shall refer the questions, including the views of all interested parties and the recommendation of the State official, to the Administrator for determination. The request shall be sent to the EPA DB Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the State official or will notify the State official within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The Owner shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the State Official may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or
cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act, daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the Owner. Such documentation shall be available on request of the State Official or EPA. As to each payroll copy received, the Owner shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 (attached) is available for this purpose. Additional copies of the form are available from the US Department of Labor Wage and Hour Division Web site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Owner for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the Owner.

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without
rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 (page 2 of the form is attached) shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(E) The Contractor and subcontractors shall use the Elation Systems software, made available by the State of Maine Department of Environmental Protection, for uploading their certified weekly payroll. Payroll noncompliance and other related payroll issues identified by the software shall be resolved by the contractor/subcontractor in the software and in a timely manner to maintain compliance with Davis Bacon requirements throughout the project.

(4) Apprentices and trainees--

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be
greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen
under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Owner, State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).


(a) Contract Work Hours and Safety Standards Act. The Owner shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by
Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The Owner, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Owner shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Owner shall insert in any such contract a clause providing that
the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the State and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a). The Owner shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The Owner must use Standard Form 1445 or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are attached and are available from EPA on request.

(b) The Owner shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Owners must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Owners shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c). The Owner shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The Owner shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the Owner must spot check payroll data within two weeks of each contractor or subcontractor’s submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Owners must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the Owner shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d). The Owner shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Owners must immediately report potential violations of the DB prevailing wage requirements to the EPA DB Regional Coordinator, the State Official, and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/esa/contacts/whd/america2.htm
18. American Iron and Steel (AIS) Requirements

“The Contractor acknowledges, to and for the benefit of the Owner and the State (Maine Department of Environmental Protection), that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund (CWSRF) that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. See attached Public Law 113-76, Section 436. The Contractor hereby represents and warrants, to and for the benefit of the Owner and the State, that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Owner or the State. While the Contractor has no direct contractual privity with the State, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

The Owner shall maintain files on the project site for American Iron and Steel (AIS) manufacturer certifications. The Contractor and subcontractors shall provide step manufacturer certifications to the Owner for each AIS item delivered to the site. The files shall be made available to State and Federal officials for inspection upon request. See sample Step Manufacturer Certification attachment for information that should be included.

The Contractor and its subcontractors shall submit to the Owner, an AIS Compliance Certification (see form attached) with each contractor pay application. The Owner, shall in turn, submit this certification from the Contractor, with their AIS Compliance Certification (see form attached), to the State with the SRF pay requisition.

The nationwide waiver to the American Iron and Steel law permits the use of products when they occur in de minimis incidental components of such projects funded by the Act that may otherwise be prohibited under section 436(a). Funds used for such de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project. It is the State’s interpretation that all CWSRF projects will contain incidental components that might not comply with the law and therefore it is likely that the Owner will use the deminimis waiver. The Contractor is required to provide the necessary documentation. See attached sample de minimis tracking form. Owners should, in consultation with their contractors, determine the items to be covered by this waiver, must retain relevant documentation (i.e., invoices) as to those items in their project files, and must summarize the items to which this waiver is applied, the total cost of incidental components covered by the waiver, and the calculations by which they determined the
total cost of materials used in and incorporated into the project. The Owner shall maintain files on the project site for this documentation. The files shall be made available to State and Federal officials for inspection upon request.”

The Contractor shall refer to the attached guidance taken from an EPA Memorandum. Additional information regarding the AIS requirements can be found on this website http://water.epa.gov/grants_funding/aisrequirement.cfm

19. List of Attachments to the CWSRF Supplementary Conditions

- SRF Project Sign Drawing
- DBE Program Subcontractor Utilization Form - EPA 6100-4
- DBE Program Subcontractor Performance Form - EPA 6100-3
- DBE Program Subcontractor Participation Form - EPA 6100-2
- Progress Report of DBE Subcontractor Utilization Form - DEP form
- Davis Bacon Project Wage Determination (to be made into a poster also)
- Davis Bacon Poster “Employee Rights” WH-1321
- Davis Bacon DOL Form 1444
- Davis Bacon DOL Form 1445
- Davis Bacon DOL form WH-347 page 1 (optional), and page 2 (mandatory)
- Owner’s Davis Bacon Compliance Form
- AIS Covered Products Q & A
- AIS Law
- AIS Certification by Owner
- AIS Certification by Contractor
- AIS Step Manufacturer Certification
- AIS DeMinimis Tracking Form

Electronic copies of the above forms can also be obtained at: http://www.maine.gov/dep/water/grants/srfparag.html#const
General Decision Number: ME20220030 01/07/2022

Superseded General Decision Number: ME20210030

State: Maine

Construction Type: Heavy

County: Cumberland County in Maine.

HEAVY CONSTRUCTION PROJECTS
Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022, Executive Order 14026 generally applies to the contract. The contractor must pay all
covered workers at least $15.00 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022, Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $11.25 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2022.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at www.dol.gov/whd/govcontracts.
<table>
<thead>
<tr>
<th>Description</th>
<th>Rates</th>
<th>Fringes</th>
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<tr>
<td>IRONWORKER, REINFORCING</td>
<td>$ 27.98</td>
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<td>SUME2014-011 01/30/2017</td>
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<tr>
<td>CARPENTER</td>
<td>$ 19.51</td>
<td>6.24</td>
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<tr>
<td>ELECTRICIAN</td>
<td>$ 25.24</td>
<td>7.01</td>
</tr>
<tr>
<td>IRONWORKER, STRUCTURAL</td>
<td>$ 23.47</td>
<td>11.63</td>
</tr>
<tr>
<td>LABORER: Asphalt, Includes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raker, Shoveler, Spreader and Distributor</td>
<td>$ 13.38</td>
<td>1.39</td>
</tr>
<tr>
<td>LABORER: Common or General</td>
<td>$ 15.82</td>
<td>5.16</td>
</tr>
</tbody>
</table>
LABORER: Concrete Worker
(includes removing forms, demolition of existing concrete, and pouring, leveling and finishing concrete)..............................$ 24.35 15.65

LABORER: Pipelayer..................$ 21.84 6.42

OPERATOR:
Backhoe/Excavator/Trackhoe........$ 19.99 9.96

OPERATOR: Bulldozer...............$ 21.06 4.67

OPERATOR: Crane.....................$ 24.74 8.03

OPERATOR: Loader...................$ 21.15 4.33

OPERATOR: Roller....................$ 16.61 3.44

PAINTER (Brush and Roller)........$ 22.18 6.33

TRUCK DRIVER: Dump Truck...........$ 16.21 3.27
WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.
Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were
prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union, which prevailed in the survey for this classification, which in this example would be Plumbers 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates
the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of
each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Division National Office Branch of Wage Surveys. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.
With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material,
etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

   Administrative Review Board  
   U.S. Department of Labor  
   200 Constitution Avenue, N.W.  
   Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=================================================================

END OF GENERAL DECISION"
SECTION SC 36
EQUAL OPPORTUNITY CLAUSE

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or workers' representatives of the contractor's commitment under this section, and shall post copies of the notice in conspicuous places available employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Department and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's non-compliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions
will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Department, the contractor may request the United States to enter into such litigation to protect the interest of the United States.

END OF SECTION
SECTION SC-38

EXECUTIVE ORDER 11246

PART 1 - GENERAL

1.1 DESCRIPTION

A. Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

1. As used in these specifications:
   a. "Covered area" means the geographical area described in the solicitation from which this Contract resulted;
   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
   d. "Minority" includes:
      i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
      ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North American and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the CONTRACTOR, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this Contract resulted.

3. If the CONTRACTOR is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and
to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The CONTRACTOR shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this Contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the CONTRACTOR should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The CONTRACTOR is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the CONTRACTOR has a collective bargaining agreement, to refer either minorities or women shall excuse the CONTRACTOR's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the CONTRACTOR during the training period, and the CONTRACTOR must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The CONTRACTOR shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the CONTRACTOR's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The CONTRACTOR shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the CONTRACTOR's employees are assigned to work. The CONTRACTOR, where possible, will assign two or more women to each construction project. The CONTRACTOR shall specifically ensure that all foremen, superintendents and other on-site supervisory personnel are aware of and carry out the CONTRACTOR's obligation to maintain
such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the CONTRACTOR or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the CONTRACTOR by the union or, if referred, not employed by the CONTRACTOR, this shall be documented in the file with the reason therefore, along with whatever additional actions the CONTRACTOR may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the CONTRACTOR has a collective bargaining agreement has not referred to the CONTRACTOR a minority person or woman sent by the CONTRACTOR, or when the CONTRACTOR has other information that the union referral process has impeded the CONTRACTOR's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the CONTRACTOR's employment needs, especially those programs funded or approved by the Department of Labor. The CONTRACTOR shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the CONTRACTOR's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the CONTRACTOR in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year, and, by posting the company's EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of
these meetings, persons attending, subject matter discussed and disposition of the subject matter.

h. Disseminate the CONTRACTOR's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media and providing written notification to and discussing the CONTRACTOR's EEO policy with other Contractors and Subcontractors with whom the CONTRACTOR does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the CONTRACTOR’s recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source the CONTRACTOR shall send written notification to organizations such as the above, describing the openings, screening procedures and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a CONTRACTOR's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60.3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the CONTRACTOR's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the CONTRACTOR's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through 7p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the CONTRACTOR is
a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through 7p of these Specifications provided that the CONTRACTOR actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the CONTRACTOR's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the CONTRACTOR. The obligation to comply, however, is the CONTRACTOR's and failure of such a group to fulfill an obligation shall not be a defense for the CONTRACTOR's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The CONTRACTOR, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the CONTRACTOR may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the CONTRACTOR has achieved its goals for women generally, the CONTRACTOR may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The CONTRACTOR shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The CONTRACTOR shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The CONTRACTOR shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing Subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any CONTRACTOR who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The CONTRACTOR, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the CONTRACTOR fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 80-4.8.

14. The CONTRACTOR shall designate a responsible official to monitor all employment related activity to ensure that the company's EEO policy is being carried out, to submit reports relating to the provision hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction
trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, Contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g. those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

END OF SECTION
SECTION SC-40
CERTIFICATION OF NONSEGREGATED FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Certification of Nonsegregated Facilities - (Applicable to federally assisted construction Contracts and related Subcontracts exceeding $10,000 which are not exempt from the Equal Opportunity Clause).

The federally assisted construction CONTRACTOR certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction CONTRACTOR certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction CONTRACTOR agrees that a breach of this certification is a violation of the Equal Opportunity clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The federally assisted construction CONTRACTOR agrees that (except where he has obtained identical certifications from proposed Subcontractors for specific time periods) he will obtain identical certifications from proposed Subcontractors prior to the award of Subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

___________________________________________________________________
Signature Date

Name and Title of Signer (Please Type)

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

END OF SECTION
SECTION SC-41

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATIONS OF WORKERS
NONDISCRIMINATION IN EMPLOYMENT

To: ______________________________________________________
   (Name of union or organization of workers)

The undersigned currently holds Contract(s) with ________________________________
   (Name of Applicant)

involving funds or credit of the U. S. Government of (a) subcontract(s) with a prime contractor
holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and in
accordance with Executive Order 11246, dated September 24, 1965, the undersigned is obliged
not to discriminate against any employee or applicant for employment because of race, color,
creed, or national origin. This obligation not to discriminate in employment includes, but is not
limited to, the following:

HIRING, PLACEMENT, UPGRADING, TRANSFER, OR DEMOTION;
RECRUITMENT, ADVERTISING, OR SOLICITATION FOR EMPLOYMENT;
TRAINING DURING EMPLOYMENT; RATES OF PAY OR OTHER FORMS
OF COMPENSATION; SELECTION FOR TRAINING, INCLUDING
APPRENTICESHIP; LAYOFF, OR TERMINATION.

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontract(s)
and Executive Order 11246.

COPIES OF THIS NOTICE WILL BE POSTED BY THE UNDERSIGNED IN
CONSPICUOUS PLACES AVAILABLE TO EMPLOYEES OR APPLICANTS FOR
EMPLOYMENT.

/s/
   ______________________________________________________
   (Contractor or Subcontractor)

   __________________________
   (Date)

END OF SECTION
SECTION 00920

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: Town of Falmouth
Engineer: Wright-Pierce
Contractor: 
Project: West Falmouth Sewer Improvements Phase 1

Owner’s Project No.: 14070D
Engineer’s Project No.: 
Contractor’s Project No.: 

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: [Enter date, as determined by Engineer]

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner’s use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner’s Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner’s Responsibilities]

Amendments to Contractor’s Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor’s Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor’s obligation to complete the Work in accordance with the Contract Documents.

Engineer

By (signature):
Name (printed):
Title:

END OF SECTION

EJCDC® C-625, Certificate of Substantial Completion.
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Guidelines Page 1 of 1

14070D
SECTION 00935

NOTICE OF ACCEPTABILITY OF WORK

Owner: Town of Falmouth
Engineer: Wright-Pierce
Contractor: Contractor
Contract Name: West Falmouth Sewer Improvements Phase 1

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract’s Contract Documents (“Contract Documents”) and of the Agreement between Owner and Engineer for Professional Services dated [date of professional services agreement] (“Owner-Engineer Agreement”). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer’s professional opinion.
3. This Notice has been prepared to the best of Engineer’s knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor’s Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer’s knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor’s performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner’s reservations of rights with respect to completion and final payment.

Engineer

By (signature):

Name (printed):

Title:

END OF SECTION
SECTION 00936

CONSENT OF SURETY TO FINAL PAYMENT

To: __________________________ (Owner)

____________________________

From: ________________________ (Contractor)

____________________________

CONTRACT TITLE: ____________________________________________

BOND NUMBER: _____________________________________________

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the _________________________ (Surety Company) on the bond of the Contractor hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of its obligations to the Owner as set forth in the said Surety Company’s Bond.

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand this _________ day of ________________, 20__.

____________________________
Surety Company Name

____________________________
Signature of Authorized Representative

Attest: (Seal)

____________________________
Printed Name and Title

Note: Power of Attorney should be attached in instances where same applies.

END OF SECTION
SECTION 00937
CONTRACTOR'S AFFIDAVIT

STATE OF ____________________________
COUNTY OF __________________________

Before me, the undersigned, a ____________________________
(Notary Public, Justice of Peace, Alderman)
in and for said County and State personally appeared, ____________________________
(Individual, Partner or duly
Authorized Representative of Corporate Contractor)
who being duly sworn according to law
deposes and says that the cost of all the Work, and outstanding claims and indebtedness of
whatever nature arising out of the performance of the contract between

________________________________________
(Owner)

and ____________________________ of ____________________________
(Contractor)

dated ____________________ for the construction of the ____________________________
(Agreement Date) (Project)

________________________________________
(appurtenant installations have been paid in full.

(Individual, Partner, or duly authorized
representative of corporate contractor)

Sworn to and subscribed before me
This ____________________ day of ____________________, 20__

END OF SECTION
SECTION 00938

CONTRACTOR'S RELEASE

KNOW ALL PERSONS BY THESE PRESENTS that ____________________________ (Contractor)
of ________________, County of ________________ and State of ____________________________
do hereby acknowledge that ____________________________ has this day had, and received of
and from ____________________________ the sum of One Dollar and other valuable considerations in
full and complete satisfaction and payment of all sums of money owed, payable and belonging to
______________________________ by any means whatsoever, for on account of a Contract
Agreement between ____________________________ and ____________________________
dated ____________________________ for ____________________________ (Owner) (Contractor)
(Agreement Date) (Project)

NOW, THEREFORE, the said ____________________________ (Contractor)

(for myself, my heirs, executors and administrators) (for itself, its successors and assigns)
do/does, by these presents remise, release, quit-claim and forever discharge ____________________________
(Owner), of and from all claims and demands, arising from or in connection
with the said contract dated ____________________________, and of and from all, and all manner of action
(Agreement Date) and actions, cause and causes of action and actions, suits, debts, dues, duties, sum and sums of
money, accounts, reckonings, bonds, bills, specialties, covenants, contracts, agreements, promises,
variances, damages, judgments, extents, executions, claims and demand, whatsoever in law or
equity, or otherwise, against ____________________________ its successors and assigns, which (I,
(Owner)
my heirs, executors, or administrators) (it, its successors and assigns) ever had, now have or which
(I, my heirs, executors, or administrators) (it, its successors and assigns) hereafter can, shall or
may have, for, upon or by reason of any matter, cause, or thing whatsoever; from the beginning of
recorded time to the date of these presents.
IN WITNESS WHEREOF, _______________ (Contractor) has caused these presents to be duly executed this _______________ day of ______ 20_____

Signed, Sealed and Delivered in the presence of:

______________________________ (Individual - Contractor)

______________________________ (Individual - Contractor)

______________________________ (Partnership - Contractor)

______________________________ By ____________________________ (seal)

______________________________ (Partner)

______________________________ (Corporate)

______________________________ (Secretary) By ____________________________ (President or Vice President)

(Corp. Seal)

END OF SECTION
SECTION 00939

WAIVER OF LIEN - MATERIALS AND LABOR

STATE OF __________________________
COUNTY OF __________________________

To: __________________________ (Owner)

________________________________________
________________________________________

WHEREAS, __________________________ (the undersigned) have been employed by __________________________ (Contractor) on the __________________________ (Project Name) to furnish the following:

________________________________________
________________________________________

________________________________________ (description of material and services).

NOW THEREFORE, the undersigned, for good and valuable considerations do hereby waive and release any and all lien, or right of lien, or claim to lien on said above project and premises under the Law, in relation to Mechanic's Liens Law, on account of labor and materials, or both, furnished by the undersigned to or on account of the said contract for the said project and premises only so far as that portion of work which has been included in our requisition dated __________________________ and all prior requisitions.

THIS WAIVER AND RELEASE is being made to the undersigned in the amount of $ __________________________ which sum the undersigned certifies to be the balance due the undersigned for all labor, materials or both, furnished by the undersigned to or on account of the said contract as included on Contractor's requisition dated ____________________________.

GIVEN UNDER our hand and seal, this ___________ day of ______________, 20 __.

By: __________________________
Manufacturer, Supplier or Subcontractor Name

________________________________________
Signature of Authorized Representative

________________________________________
Printed Name and Title

END OF SECTION
SECTION 00940

WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner: Town of Falmouth
Engineer: Wright-Pierce
Contractor: [Contractor’s Name]

Project: West Falmouth Sewer Improvements Phase 1

Contractor is directed to proceed promptly with the following change(s):

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to: [Check one or both of the following]

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ [increase] [decrease] [not yet estimated].
Contract Time: _____ days [increase] [decrease] [not yet estimated].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

Recommended by Engineer

By: ____________________________
Title: ____________________________
Date: ____________________________

Authorized by Owner

By: ____________________________
Title: ____________________________
Date: ____________________________
SECTION 00941

CHANGE ORDER NO.: [Number of Change Order]

Owner: Town of Falmouth
Owner’s Project No.: 14070D

Engineer: Wright-Pierce
Engineer’s Project No.: 14070D

Contractor: [Company Name]
Contractor’s Project No.: [Project Number]

Project: West Falmouth Sewer Improvements Phase 1

Date Issued: Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

[Description of the change]

Attachments:

[List documents related to the change]

<table>
<thead>
<tr>
<th>Change in Contract Price</th>
<th>Change in Contract Times [as days or dates]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Contract Price:</td>
<td>Original Contract Times:</td>
</tr>
<tr>
<td>$ __________</td>
<td>Substantial Completion:</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment:</td>
</tr>
<tr>
<td>[Increase] [Decrease]</td>
<td>[Increase] [Decrease] from previously approved Change Orders No. 1 to No. [Number of previous CO]:</td>
</tr>
<tr>
<td>$ __________</td>
<td>Substantial Completion:</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment:</td>
</tr>
<tr>
<td>Contract Price prior to this Change Order:</td>
<td>Contract Times prior to this Change Order:</td>
</tr>
<tr>
<td>$ __________</td>
<td>Substantial Completion:</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment:</td>
</tr>
<tr>
<td>[Increase] [Decrease] this Change Order:</td>
<td>[Increase] [Decrease] this Change Order:</td>
</tr>
<tr>
<td>$ __________</td>
<td>Substantial Completion:</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment:</td>
</tr>
<tr>
<td>Contract Price incorporating this Change Order:</td>
<td>Contract Times with all approved Change Orders:</td>
</tr>
<tr>
<td>$ __________</td>
<td>Substantial Completion:</td>
</tr>
<tr>
<td></td>
<td>Ready for final payment:</td>
</tr>
</tbody>
</table>

Recommended by Engineer (if required)  Accepted by Contractor

By: ___________________________  By: ___________________________
Title: _________________________  Title: _________________________
Date: ________________  Date: ________________

Authorized by Owner  Approved by Funding Agency (if applicable)

By: ___________________________  By: ___________________________
Title: _________________________  Title: _________________________
Date: ________________  Date: ________________

END OF SECTION
SECTION 00942

FIELD ORDER NO.: [Number of Field Order]

<table>
<thead>
<tr>
<th>Owner:</th>
<th>Town of Falmouth</th>
<th>Owner’s Project No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer:</td>
<td>Wright-Pierce</td>
<td>Engineer’s Project No.:</td>
</tr>
<tr>
<td>Contractor:</td>
<td></td>
<td>Contractor’s Project No.:</td>
</tr>
<tr>
<td>Project:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract Name:</td>
<td>West Falmouth Sewer Improvements Phase 1</td>
<td></td>
</tr>
<tr>
<td>Date Issued:</td>
<td></td>
<td>Effective Date of Field Order:</td>
</tr>
</tbody>
</table>

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

- Specification Section(s):
- Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____________________________

Title: __________________________

Date: ___________________________
APPLICATION FOR PAYMENT

Prepared By

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI
Building Knowledge Improving Project Delivery

NUCA
We Dig America
GUIDELINES FOR THE INTENDED USE OF EJCDC C-620,
APPLICATION FOR PAYMENT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

The Application for Payment is used to facilitate periodic progress payments to the Contractor for Work completed and for stored materials and equipment (referred to in this document as "Stored Materials").

For additional information regarding the Application for Payment, see EJCDC® C–700, Standard General Conditions of the Construction Contract (2018), Paragraph 15.01, and EJCDC® C–001, Commentary on the 2018 EJCDC Construction Documents (2018).

2.0 APPLICATION FOR PAYMENT OVERVIEW

This document was prepared in Microsoft Excel due to the number of calculations involved in the preparation of the Application for Payment. The application consists of a Summary worksheet, and 3 supporting worksheets: Lump Sum worksheet, Unit Price worksheet, and Stored Materials worksheet.

2.1 Summary Worksheet — calculates the amount to be paid to the Contractor at the end of each Application for Payment period. This calculation imports numbers from the supporting worksheets to determine the value of the Work completed and Stored Materials, calculate retainage, and deduct amounts previously paid to determine the amount the Contractor should be paid for the current application period. Application periods are typically one month; however these periods may be extended when Contractor’s efforts do not result in the billable completion of Work or storage of materials and equipment during the payment period.

2.2 Lump Sum Worksheet — calculates the total value for completed Work for which compensation is paid on a Lump Sum basis. The schedule of values included in this worksheet reflects a breakdown of lump sum Work items to which Contractor and Engineer have agreed, pursuant to Article 2 of the General Conditions. Costs for Stored Materials associated with lump sum items are included on this worksheet to calculate the total value for completed lump sum Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for materials currently stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

2.3 Unit Price Worksheet — calculates the total value for completed Work for which compensation is paid on a Unit Price basis. The schedule of values included in this spreadsheet is typically a tabulation of Unit Price items from the Agreement. Costs for Stored Materials associated with unit price items are included in this worksheet to calculate the total value for completed Unit Price Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for Materials Currently Stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.
2.4 *Stored Materials Worksheet* — calculates the total value for materials and equipment that have been purchased and are being stored until they are incorporated into the Work. This worksheet adds materials and equipment to the worksheet as they are brought to the site and stored; such Stored Materials are then deducted from the Stored Materials worksheet total as they are incorporated into the Work, providing a running net value for the materials and equipment remaining in storage. The values of Stored Materials must be manually added to the Lump Sum or Unit Price line items. These do not automatically update when changes are made. The amount of materials remaining in storage is eligible for payment but must be tracked separately from Work completed since different retainage rates may apply to Work completed and Stored Materials.

3.0 **Instructions for filling out the Payment Application form**

3.1 Project-specific information is to be entered in the top portion (header) of the Summary worksheet. This same information will automatically be copied to the other worksheets to complete the headers on all other worksheets.

3.2 Outside of the header, data can be entered in non-shaded cells when the sheet is protected. Cells shaded light blue contain equations that will automatically transfer data from other cells or make calculations to complete the worksheet. Altering any of these cells can result in errors in the Application for Payment. It is recommended that the worksheets be protected at all times unless alterations are deliberately being made to the Application for Payment form other than to enter data. See Paragraph 4.0 below for information on Protection of Worksheets.

3.3 Enter information regarding each item in the Lump Sum and/or Unit Price worksheets. For Lump Sum projects, each item should represent an item in the schedule of values prepared by the Contractor and approved by the Engineer/Owner, breaking down the Lump Sum amount into measurable components. For Unit Price contracts, use numbers from the Agreement as the schedule of values. Specific information on the data to be entered into each column may be seen by clicking on the header description for that column. Similar comments may be seen for cells in the "Totals" row that indicates how the number is calculated and where this number is exported to another part of the spreadsheet. See the Commentary for additional information.
3.4 The equations in the Summary worksheet use numbers imported from both the Lump Sum and Unit Price worksheets. Projects will typically either use the Lump Sum or the Unit Price worksheet, but some projects may use both. If one of the worksheets is not used, it should be hidden and not deleted. If it is deleted, Users will need to correct the equations in the Summary worksheet by unprotecting the worksheet and editing the equations. To hide a worksheet, right click on the worksheet tab at the bottom of the worksheet and select "Hide." To unhide a worksheet, right click on any worksheet tab and select "Unhide," and then select the worksheet to unhide and click "Okay." This same process may be used to hide these Guidelines for Use.
4.0 Protection of Worksheets

4.1 The cells in this Workbook that create the forms or contain equations have been coded to "lock" the cells that should not be altered. It is recommended that the Workbook be Protected (cells locked) at all times unless it is necessary to add or delete rows. Directions for adding and deleting rows are provided in the next section. Passwords can be used to lock the Protect / Unprotect settings on spreadsheets, however the worksheets in this workbook do not require a password.

4.2 To unprotect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Unprotect Sheet." To protect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Protect Sheet." This will open a dialog box in which the User is allowed to select protection options. It is recommended that only the top two checkboxes for "Select Locked Cells" and "Select Unlocked Cells" be checked. This will reset the protection for the Worksheet.

5.0 Adding and Deleting Rows

5.1 A limited number of blank rows are provided in the Lump Sum, Unit Price, and Stored Material worksheets. Additional rows may be added to these worksheets by the User. The first step in this process is to unprotected the worksheet as previously discussed. After the sheet is unprotected, move with caution to prevent inadvertently deleting any cells that contain equations. To insert a row, right click in the row heading at the left of the spreadsheet and select "Insert." A new row will be inserted at the location where the cursor was placed in the row heading. If more than one new row is desired, left click and drag the cursor to include the desired number of rows, right click in the selected row headings and then select "Insert." It is important that the line immediately above the "Totals" row not be included in the rows selected. Doing so will require that equations in the "Totals" row be adjusted. When rows are inserted, Excel automatically adjusts the equations to include the new rows, unless the row directly above the "Totals" row is also selected.

5.2 After new rows are inserted, it is important to copy a line from one of the original rows so correct formatting and equations are copied into each new row. To do this, select the row to be copied by clicking the cell in Column A and dragging the cursor to the last column in the table. Then select "Copy" from the menu or type CTRL+C to copy the cells. Excel will show that this row has been copied by showing a moving dashed line around the cells that are to be copied. Then select the new rows into which the information is to be copied as before and select Paste from the menu or type CTRL+V.

5.3 To delete an unused row, right click in the row heading on the left of the spreadsheet for the row to be deleted and select "Delete." The selected row will be deleted. If more than one row is to be deleted, left click and drag the cursor to the desired number of rows to be deleted and then right click to open the menu and select "Delete." Unlike the admonition on adding new rows, it is okay to delete the row just above the "Totals" row.

5.4 After rows have been added or deleted, it is important reset the worksheet protection.
6.0 Saving Files

This file is provided as a Microsoft ® Excel Open XML workbook template (.xltx) to prevent this file from being inadvertently changed. When an application for payment is created for a specific project it should be saved as an Excel workbook (.xlsx) file. To do this, select Save As (F12), type in a new file name and select Excel Workbook (.xlsx) from the drop down Save As Type menu.

7.0 License Agreement

This document is subject to the terms and conditions of the License Agreement, 2018 EJCDC® Construction Series Documents. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at www.ejcic.org and the websites of EJCDC’s sponsoring organizations.
Contractor's Application for Payment

<table>
<thead>
<tr>
<th>Owner:</th>
<th>Owner's Project No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer:</td>
<td>Engineer's Project No.:</td>
</tr>
<tr>
<td>Contractor:</td>
<td>Contractor's Project No.:</td>
</tr>
<tr>
<td>Project:</td>
<td></td>
</tr>
</tbody>
</table>

**Contract:**

<table>
<thead>
<tr>
<th>Application No.:</th>
<th>Application Date:</th>
</tr>
</thead>
</table>

| **Application Period:** From | to |

| **1. Original Contract Price** | $ - |
| **2. Net change by Change Orders** | $ - |
| **3. Current Contract Price (Line 1 + Line 2)** | $ - |
| **4. Total Work completed and materials stored to date**<br>(Sum of Column G Lump Sum Total and Column J Unit Price Total) | $ - |
| **5. Retainage**<br>a. _______ X $ __________ - Work Completed | $ - |
| b. _______ X $ __________ - Stored Materials | $ - |
| c. Total Retainage (Line 5.a + Line 5.b) | $ - |
| **6. Amount eligible to date (Line 4 - Line 5.c)** | $ - |
| **7. Less previous payments (Line 6 from prior application)** | |
| **8. Amount due this application** | $ - |
| **9. Balance to finish, including retainage (Line 3 - Line 4)** | $ - |

**Contractor's Certification**
The undersigned Contractor certifies, to the best of its knowledge, the following:

1. All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
2. Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and
3. All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

**Contractor:**

| Signature: | Date: |

**Recommended by Engineer**

| By: | Title: | Date: |

**Approved by Owner**

| By: | Title: | Date: |

**Approved by Funding Agency**

| By: | Title: | Date: |
### Progress Estimate - Lump Sum Work

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td>Description</td>
<td>Scheduled Value ($)</td>
<td>Work Completed</td>
<td>Materials Currently Stored (not in D or E) ($)</td>
<td>Work Completed and Materials Stored to Date (D + E + F) ($)</td>
<td>% of Scheduled Value (G / C) (%)</td>
<td>Balance to Finish (C - G) ($)</td>
<td></td>
</tr>
<tr>
<td>Item 1</td>
<td>Item 2</td>
<td>Item 3</td>
<td>Item 4</td>
<td>Item 5</td>
<td>Item 6</td>
<td>Item 7</td>
<td>Item 8</td>
<td>Item 9</td>
</tr>
<tr>
<td>Original Contract</td>
<td>$</td>
<td>-</td>
<td>$</td>
<td>-</td>
<td>$</td>
<td>-</td>
<td>$</td>
<td>-</td>
</tr>
</tbody>
</table>

| Original Contract Totals | $ | - | $ | - | $ | - | $ | - |

---

**Contractor’s Application for Payment**

**Application No.:**

**Application Period:** From to

**Application Date:**

**Owner:**

**Owner’s Project No.:**

**Engineer:**

**Engineer’s Project No.:**

**Contractor:**

**Contractor’s Project No.:**

**Project:**

---

**Notes:**

EJCDC C-620 Contractor’s Application for Payment

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### Progress Estimate - Lump Sum Work

#### Contractor’s Application for Payment

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
<td>Description</td>
<td>Scheduled Value ($)</td>
<td>(D + E) From Previous Application ($)</td>
<td>Work Completed</td>
<td>Materials Currently Stored (not in D or E) ($)</td>
<td>Work Completed and Materials Stored to Date (D + E + F) ($)</td>
<td>% of Scheduled Value (G / C) (%)</td>
<td>Balance to Finish (C - G) ($)</td>
</tr>
</tbody>
</table>

#### Change Orders

| Change Order Totals | $ | - | - | $ | - | $ | - | $ | - |

#### Original Contract and Change Orders

<p>| Project Totals | $ | - | - | $ | - | $ | - | $ | - |</p>
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<tr>
<td>Bid Item No.</td>
<td>Description</td>
<td>Item Quantity</td>
<td>Units</td>
<td>Unit Price ($E)</td>
<td>Value of Bid Item ($C \times $E) ($F)</td>
<td>Estimated Quantity Incorporated in the Work ($H \times $G)</td>
<td>Value of Work Completed to Date ($I - $J) ($K)</td>
<td>Materials Currently Stored (not in $G) ($L)</td>
<td>% of Value of Item ($F / $E)</td>
<td>Balance to Finish ($E - $F) ($K)</td>
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## Progress Estimate - Unit Price Work

<table>
<thead>
<tr>
<th>Bid Item No.</th>
<th>Description</th>
<th>Item Quantity</th>
<th>Units</th>
<th>Unit Price ($</th>
<th>Value of Item (C x E) ($)</th>
<th>Estimated Quantity Incorporated in the Work</th>
<th>Value of Work Completed to Date (E x G) ($)</th>
<th>Materials Currently Stored (H + I) ($)</th>
<th>Work Completed and Materials Stored to Date (H + I) ($)</th>
<th>% of Value of Item (J/F)</th>
<th>Balance to Finish (F - J) ($)</th>
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### Change Orders

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

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|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

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|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

**Change Order Totals:**

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<tr>
<th>Item Quantity</th>
<th>Units</th>
<th>Unit Price ($</th>
<th>Value of Item (C x E) ($)</th>
<th>Estimated Quantity Incorporated in the Work</th>
<th>Value of Work Completed to Date (E x G) ($)</th>
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**Original Contract and Change Orders**

| Bid Item No. | Description | Item Quantity | Units | Unit Price ($ | Value of Item (C x E) ($) | Estimated Quantity Incorporated in the Work | Value of Work Completed to Date (E x G) ($) | Materials Currently Stored (H + I) ($) | Work Completed and Materials Stored to Date (H + I) ($) | % of Value of Item (J/F) | Balance to Finish (F - J) ($) |
|--------------|-------------|---------------|-------|---------------|---------------------------|-----------------------------------------------|---------------------------------------------|-------------------------------------------------|--------------------------|--------------------------|
|              |             |               |       |               |                           |                                                |                                             |                                             |                                                 |                          |                          |

**Project Totals:**

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<th>Item Quantity</th>
<th>Units</th>
<th>Unit Price ($</th>
<th>Value of Item (C x E) ($)</th>
<th>Estimated Quantity Incorporated in the Work</th>
<th>Value of Work Completed to Date (E x G) ($)</th>
<th>Materials Currently Stored (H + I) ($)</th>
<th>Work Completed and Materials Stored to Date (H + I) ($)</th>
<th>% of Value of Item (J/F)</th>
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<tr>
<td>Item No.</td>
<td>Description of Materials or Equipment Stored</td>
<td>Storage Location</td>
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<td>Supplier Invoice No.</td>
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<td>Application No. When Materials Placed in Storage</td>
<td>Previous Amount Stored ($</td>
<td>Amount Stored this Period ($</td>
<td>Amount Stored to Date (G+H) ($</td>
<td>Amount Previously Incorporated in the Work ($</td>
<td>Amount Incorporated in the Work this Period ($</td>
<td>Total Amount Incorporated in the Work (J+K) ($)</td>
<td>Materials Remaining in Storage (I-L) ($)</td>
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Note: The table contains columns for storing materials, application numbers, and various financial details. The specific values are not provided in the image.
Temporary Construction Sign for CWSRF & DWSRF Projects

Project Title
(include Town / District name)

Engineer:
Contractor:
Total Project Cost:

Financed by:
CWSRF Program: Maine Department of Environmental Protection
DWSRF Program: Maine Department of Health & Human Services
and Maine Municipal Bond Bank

United States Environmental Protection Agency

This institution is an equal opportunity provider

STATE REVOLVING FUND
State Revolving Loan Fund

BLACK LETTERING

BLUE, PMS 655 FADING TO 30% SCREEN
GREEN, PMS 627 @ 30% SCREEN DARKENING
TO 100% SCREEN THEN BACK TO 30% SCREEN

MINIMUM SIGN DIMENSIONS: 1200 x 2400 x 19 MM (4' x 8' x 3/4'')
EXTERIOR PLYWOOD (A-B GRADE)
MINIMUM LETTERING SIZE: 5 CM (2-INCHES)
Disadvantaged Business Enterprise Program (DBE) Subcontractor Utilization Form

This form is intended to capture the prime contractor’s actual and/or anticipated use of identified certified DBE\(^1\) subcontractors\(^2\) and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

<table>
<thead>
<tr>
<th>Prime Contractor Name</th>
<th>Project Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid /Proposal No.</td>
<td>Assistance Agreement ID No. (if known)</td>
</tr>
<tr>
<td>Address</td>
<td></td>
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<tr>
<td>Telephone No.</td>
<td>Email Address</td>
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<tr>
<td>Issuing/Funding Entity:</td>
<td></td>
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</tbody>
</table>

I have identified potential DBE certified subcontractors:  

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
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</table>

If yes, please complete the table below. If no, please explain:

<table>
<thead>
<tr>
<th>Subcontractor Name/Company Name</th>
<th>Company Address/Phone/Email</th>
<th>Est. Dollar Amt.</th>
<th>Currently DBE Certified?</th>
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\(^1\)A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

\(^2\)Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award or financial assistance.

(DBE Subcontractor Utilization Form) DEP FORM 6100-4
Disadvantaged Business Enterprise Program (DBE) Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Section 33.202 (c).

<table>
<thead>
<tr>
<th>Prime Contractor Signature</th>
<th>Print Name</th>
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</table>
Disadvantaged Business Enterprise Program (DBE) Subcontractor Performance Form

This form is intended to capture the DBE’s description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

<table>
<thead>
<tr>
<th>Subcontractor Name</th>
<th>Project Name</th>
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<th>Bid /Proposal No.</th>
<th>Assistance Agreement ID No. (if known)</th>
<th>Point of Contact</th>
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<th>Telephone No.</th>
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<thead>
<tr>
<th>Prime Contractor Name</th>
<th>Issuing/Funding Entity:</th>
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<table>
<thead>
<tr>
<th>Contract Item Number</th>
<th>Description of Work Submitted to the Prime Contractor Involving Construction, Services, Equipment or Supplies</th>
<th>Price of Work Submitted to the Prime Contractor</th>
</tr>
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DBE Certified By: _____DOT _____SBA

_____Other:______________________________________________________

Meets/exceeds EPA certification standards?

_____YES _____NO _____Unknown

1 A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

2 Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.
Disadvantaged Business Enterprise Program  
(DBE) Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.202 (c).

<table>
<thead>
<tr>
<th>Prime Contractor Signature</th>
<th>Print Name</th>
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<tr>
<th>Subcontractor Signature</th>
<th>Print Name</th>
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Disadvantaged Business Enterprise Program (DBE) Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE\(^1\) subcontractor\(^2\) the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g. in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the DEP DBE Coordinator at any time during the project period of performance.

<table>
<thead>
<tr>
<th>Subcontractor Name</th>
<th>Project Name</th>
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</thead>
<tbody>
<tr>
<td>Bid/Proposal No.</td>
<td>Assistance Agreement ID No. (if known)</td>
</tr>
<tr>
<td>Address</td>
<td>Email Address</td>
</tr>
<tr>
<td>Telephone No.</td>
<td></td>
</tr>
<tr>
<td>Prime Contractor Name</td>
<td>Issuing/Funding Entity:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contract Item Number</th>
<th>Description of Work Received from the Prime Contractor Involving Construction, Services, Equipment or Supplies</th>
<th>Amount Received by Prime Contractor</th>
</tr>
</thead>
</table>

\(^1\) A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

\(^2\) Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.
Please use the space below to report any concerns regarding the above EPA-funded project:

________________________________________________________________________

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STATE OF MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
CWSRF DBE PROGRAM

PROGRESS REPORT OF DBE SUBCONTRACTOR UTILIZATION FORM

TO INSURE PROMPT PAYMENT THE FOLLOWING INFORMATION MUST BE SUBMITTED WITH ALL REIMBURSEMENT REQUESTS WHETHER THEY INCLUDE INVOICED AMOUNTS FROM A QUALIFYING WBE OR MBE PARTICIPANT OR NOT:

Municipality/District:__________________________  SRF #:__________________________

Name of Project:__________________________  Contractor:__________________________

Contractor’s Payment Request No.____  Period covered by the request_____________

The accompanying Reimbursement Request includes the following WBE/MBE participation:

<table>
<thead>
<tr>
<th>Name &amp; Address of WBE/MBE firm to be paid</th>
<th>WBE</th>
<th>MBE</th>
<th>Source of Certification, i.e., DOT, EPA or SBA</th>
<th>Amount to be paid this request</th>
<th>Type of Work</th>
</tr>
</thead>
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This attachment must be signed by an authorized representative of the contractor.

Signature________________________________________  Date____________________________

Name:____________________________________________  Title:__________________________

Address:_____________________________________________________________________

Phone:________________________________________  E-Mail:__________________________
PROJECT WAGE DETERMINATION

Insert here the applicable and most current US Department of Labor wage determination (available on their website) as an attachment to the Davis Bacon Supplementary Conditions

Note: The project wage determination shall also be made into a poster for display on the project site.
EMPLOYEE RIGHTS
UNDER THE DAVIS-BACON ACT
FOR LABORERS AND MECHANICS
EMPLOYED ON FEDERAL OR FEDERALLY
ASSISTED CONSTRUCTION PROJECTS
THE UNITED STATES DEPARTMENT OF LABOR WAGE AND HOUR DIVISION

PREVAILING WAGES
You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this Notice for the work you perform.

OVERTIME
You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.

ENFORCEMENT
Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for up to three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.

APPRENTICES
Apprentice rates apply only to apprentices properly registered under approved Federal or State apprenticeship programs.

PROPER PAY
If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:


or contact the U.S. Department of Labor's Wage and Hour Division.

For additional information:
1-866-4-USWAGE (1-866-487-9243)  TTY: 1-877-889-5627
WWW.WAGEHOUR.DOL.GOV
**REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND RATE**

**CHECK APPROPRIATE BOX**
- SERVICE CONTRACT
- CONSTRUCTION CONTRACT

**OMB Control Number:** 9000-0066  
**Expiration Date:** 4/30/2022

---

**Paperwork Reduction Act Statement** - This information collection meets the requirements of 44 U.S.C. § 3507, as amended by section 2 of the Paperwork Reduction Act of 1995. You do not need to answer these questions unless we display a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 9000-0066. We estimate that it will take .5 hours to read the instructions, gather the facts, and answer the questions. Send only comments relating to our time estimate, including suggestions for reducing this burden, or any other aspects of this collection of information to: U.S. General Services Administration, Regulatory Secretariat Division (M1V1CB), 1800 F Street, NW, Washington, DC 20405.

**INSTRUCTIONS:** The contractor shall complete items 3 through 16, keep a pending copy, and submit the request, in quadruplicate, to the contracting officer.

1. **TO:**  
   - ADMINISTRATOR,  
   - WAGE AND HOUR DIVISION  
   - U.S. DEPARTMENT OF LABOR  
   - WASHINGTON, DC 20210

2. **FROM:** (REPORTING OFFICE)

3. **CONTRACTOR**

4. **DATE OF REQUEST**

5. **CONTRACT NUMBER**

6. **DATE BID OPENED (SEALED BIDDING)**

7. **DATE OF AWARD**

8. **DATE CONTRACT WORK STARTED**

9. **DATE OPTION EXERCISED (IF APPLICABLE) (SERVICE CONTRACT ONLY)**

10. **SUBCONTRACTOR (IF ANY)**

11. **PROJECT AND DESCRIPTION OF WORK (ATTACH ADDITIONAL SHEET IF NEEDED)**

12. **LOCATION (CITY, COUNTY, AND STATE)**

13. **IN ORDER TO COMPLETE THE WORK PROVIDED FOR UNDER THE ABOVE CONTRACT, IT IS NECESSARY TO ESTABLISH THE FOLLOWING RATE(S) FOR THE INDICATED CLASSIFICATION(S) NOT INCLUDED IN THE DEPARTMENT OF LABOR DETERMINATION**

   **NUMBER:**  
   **DATED:**

<table>
<thead>
<tr>
<th>a. LIST IN ORDER: PROPOSED CLASSIFICATION TITLE(S); JOB DESCRIPTION(S); DUTIES; AND RATIONALE FOR PROPOSED CLASSIFICATIONS. (Service contracts only)</th>
<th>b. WAGE RATE(S)</th>
<th>c. FRINGE BENEFITS PAYMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Use reverse or attach additional sheets, if necessary]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. **SIGNATURE AND TITLE OF SUBCONTRACTOR REPRESENTATIVE (IF ANY)**

15. **SIGNATURE AND TITLE OF PRIME CONTRACTOR REPRESENTATIVE**

16. **SIGNATURE OF EMPLOYEE OR REPRESENTATIVE**

**TO BE COMPLETED BY CONTRACTING OFFICER (CHECK AS APPROPRIATE - SEE FAR 22.1019 (SERVICE CONTRACT LABOR STANDARDS) OR FAR 22.406-3 (CONSTRUCTION WAGE RATE REQUIREMENTS))**

- [ ] THE INTERESTED PARTIES AGREE AND THE CONTRACTING OFFICER RECOMMENDS APPROVAL BY THE WAGE AND HOUR DIVISION. AVAILABLE INFORMATION AND RECOMMENDATIONS ARE ATTACHED.
- [ ] THE INTERESTED PARTIES CANNOT AGREE ON THE PROPOSED CLASSIFICATION AND WAGE RATE. A DETERMINATION OF THE QUESTION BY THE WAGE AND HOUR DIVISION IS THEREFORE REQUESTED. AVAILABLE INFORMATION AND RECOMMENDATIONS ARE ATTACHED.

**SIGNATURE OF CONTRACTING OFFICER OR REPRESENTATIVE**

**TITLE AND COMMERCIAL TELEPHONE NUMBER**

**DATE SUBMITTED**

---

**STANDARD FORM 1444 (REV. 4/2013)**

Prescribed by GSA-FAR (48 CFR) 53.222(f)
**LABOR STANDARDS INTERVIEW**

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>EMPLOYEE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LAST NAME</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAME OF PRIME CONTRACTOR</th>
<th>STREET ADDRESS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NAME OF EMPLOYER</th>
<th>CITY</th>
<th>STATE</th>
<th>ZIP CODE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUPERVISOR’S NAME</th>
<th>LAST NAME</th>
<th>FIRST NAME</th>
<th>MI</th>
<th>WORK CLASSIFICATION</th>
<th>WAGE RATE</th>
</tr>
</thead>
</table>

**ACTION**

<table>
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<tr>
<th>CHECK BELOW</th>
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<tbody>
<tr>
<td>YES</td>
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</tbody>
</table>

- Do you work over 8 hours per day?
- Do you work over 40 hours per week?
- Are you paid at least time and a half for overtime hours?
- Are you receiving any cash payments for fringe benefits required by the posted wage determination decision?

**WHAT DEDUCTIONS OTHER THAN TAXES AND SOCIAL SECURITY ARE MADE FROM YOUR PAY?**

<table>
<thead>
<tr>
<th>HOW MANY HOURS DID YOU WORK ON YOUR LAST WORK DAY BEFORE THIS INTERVIEW?</th>
<th>TOOLS YOU USE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DATE OF LAST WORK DAY BEFORE INTERVIEW (YYMMDD)</th>
<th>DATE YOU BEGAN WORK ON THIS PROJECT (YYMMDD)</th>
</tr>
</thead>
</table>

**THE ABOVE IS CORRECT TO THE BEST OF MY KNOWLEDGE**

<table>
<thead>
<tr>
<th>EMPLOYEE’S SIGNATURE</th>
<th>DATE (YYMMDD)</th>
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</table>

<table>
<thead>
<tr>
<th>INTERVIEWER</th>
<th>SIGNATURE</th>
<th>TYPED OR PRINTED NAME</th>
<th>DATE (YYMMDD)</th>
</tr>
</thead>
</table>

**INTERVIEWER’S COMMENTS**

- WORK EMPLOYEE WAS DOING WHEN INTERVIEWED
- ACTION (If explanation is needed, use comments section) YES | NO
- IS EMPLOYEE PROPERLY CLASSIFIED AND PAID?
- ARE WAGE RATES AND POSTERS DISPLAYED?

**FOR USE BY PAYROLL CHECKER**

- IS ABOVE INFORMATION IN AGREEMENT WITH PAYROLL DATA? YES | NO

**COMMENTS**

<table>
<thead>
<tr>
<th>CHECKER</th>
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<tbody>
<tr>
<td>LAST NAME</td>
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AUTHORIZED FOR LOCAL REPRODUCTION
Previous edition not usable

STANDARD FORM 1445 (REV. 12-96)
Prescribed by GSA - FAR (48 CFR) 53.222(g)
### PAYROLL Form WH-347

**For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm**

**Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.**

**Rev. Dec. 2008**

OMB No.: 1235-0008  Expires: 02/28/2010

<table>
<thead>
<tr>
<th>PAYROLL NO.</th>
<th>FOR WEEK ENDING</th>
<th>PROJECT AND LOCATION</th>
<th>PROJECT OR CONTRACT NO.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>(1) NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER</th>
<th>(2) NO. OF OCCURRENCE</th>
<th>(3) WORK CLASSIFICATION</th>
<th>(4) DAY AND DATE</th>
<th>(5) HOURS WORKED EACH DAY</th>
<th>(6) TOTAL HOURS</th>
<th>(7) RATE OF PAY</th>
<th>(8) GROSS AMOUNT EARNED</th>
<th>(9) DEDUCTIONS</th>
</tr>
</thead>
</table>

<table>
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<tr>
<th>(10) NET WAGES PAID FOR WEEK</th>
<th>(11)</th>
<th>(12) OR (13)</th>
<th>(14)</th>
<th>(15)</th>
<th>(16)</th>
<th>(17)</th>
<th>(18)</th>
<th>(19)</th>
<th>(20)</th>
<th>(21)</th>
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### Public Burden Statement

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(i) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W., Washington, D.C., 20210
(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ - Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

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<tr>
<th>EXCEPTION (CRAFT)</th>
<th>EXPLANATION</th>
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REMARKS:

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<tr>
<td>THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 31 OF TITLE 31 OF THE UNITED STATES CODE.</td>
<td></td>
</tr>
</tbody>
</table>
CERTIFICATION by the OWNER
OF COMPLIANCE WITH THE
DAVIS BACON AND RELATED ACTS

Instructions: Use this certification only if Elation Systems Software is being used to monitor Davis Bacon compliance on the project/contract. One certification is required for each SRF loan payment request. Alternatively, one certification can be provided for each prime contractor’s pay application. The Owner should choose, at the beginning of the project, the method of certifying that best fits the project and fill in the pay number and dates accordingly.

Owner Entity Name: ____________________________________________
Project Name: ________________________________________________
Elation Contract ID #: _________________________________________
SRF Loan Payment Request # ______ OR Contractor Pay App # ________

We, the Owner named above, having obtained funding from the State of Maine State Revolving Fund (SRF), for the Wastewater Treatment Works Construction Project named above, hereby declare that all Davis Bacon certified payroll, beginning on _____________ and ending on _______________ has been verified by us and found to be in compliance with the laws of the Davis Bacon and Related Acts, without exception.

_________________________________________  _____________
Signature of Official or Official’s Representative  Date

_____________________
Printed name
Covered Iron and Steel Products

(Guidance taken from EPA Memorandum dated March 20, 2014)

1) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

- Lined or unlined pipes or fittings;
- Manhole Covers;
- Municipal Castings (defined in more detail below);
- Hydrants;
- Tanks;
- Flanges;
- Pipe clamps and restraints;
- Valves;
- Structural steel (defined in more detail below);
- Reinforced precast concrete; and
- Construction materials (defined in more detail below).

2) What does the term ‘primarily iron or steel’ mean?

‘Primarily iron or steel’ places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

3) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.
4) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

5) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

6) What does ‘produced in the United States’ mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

7) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

8) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?
No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

9) What is the definition of ‘municipal castings’?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;
- Meter Boxes;
- Service Boxes;
- Steel Hinged Hatches, Square and Rectangular;
- Steel Riser Rings;
- Trash receptacles;
- Tree Grates;
- Tree Guards;
- Trench Grates; and
- Valve Boxes, Covers and Risers.
10) **What is ‘structural steel’?**

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

11) **What is a ‘construction material’ for purposes of the AIS requirement?**

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

12) **What is not considered a ‘construction material’ for purposes of the AIS requirement?**

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.
13) *If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?*

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

14) *What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?*

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.
USE OF AMERICAN IRON AND STEEL

“SEC. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that—

(1) applying subsection (a) would be inconsistent with the public interest;
(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency’s capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.”
CERTIFICATION BY THE OWNER
OF COMPLIANCE WITH THE
USE OF AMERICAN IRON AND STEEL LAW
enacted on 1/17/2014

(To be attached to each SRF requisition submitted for payment)

We, the Owner named, __________________________, having obtained a loan from the State
of Maine Clean Water State Revolving Fund (CWSRF), to fund the Project named
______________________________, hereby submit to the Department of Environmental
Protection, certification from each contractor working on the Project that the use of American
Iron and Steel in the construction of the Project complies with the law, or that a waiver has been
obtained from the U.S. Environmental Protection Agency. Thereby, it is to the best of the
Owner’s knowledge that the costs being requested with this SRF requisition #____ are in
compliance with the Use of American Iron and Steel Law.

________________________________________  ______________________________________  ______________
Signature of Official       Printed name       Date

Attachment: Certification by Contractor
CERTIFICATION BY CONTRACTOR OF COMPLIANCE WITH THE USE OF AMERICAN IRON AND STEEL LAW enacted on 1/17/2014

(To be attached to each pay application submitted for payment)

We, the Prime Contractor and Subcontractors, as named below, hereby certify that the use of American iron and steel in the construction of the Project named _______________________________, being requested in the pay application (or invoice) #____ and dated __________, complies with the Use of American Iron and Steel Law, or that a waiver has been obtained from the U.S. Environmental Protection Agency.

Prime Contractor Name: ____________________________________________________________

Signature of Official  Printed name  Date
______________________________________________________________________________

Subcontractor Name  Signature of Official  Date
______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________
Sample Step Manufacturer Certification

(Documentation must be provided on company letterhead)

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Manufacturer Certification

Project Name _______________________________

I, ______________________ (company representative), certify that the __________ (melting, bending, coating, galvanizing, cutting, etc.) process for ____________________ (manufacturing or fabricating) the following products and/or materials shipped or provided for the project is in full compliance with the American Iron and Steel requirement as mandated in EPA’s State Revolving Fund Programs.

Item, Products and/or Materials:

1. ______________________

2. ______________________

3. ______________________

Such process took place at the following location: _________________________________(address)

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

_________________________ ________________________ ____________
Company representative Signature Date
The EPA has issued a public interest waiver for De Minimis incidental components. An Owner wishing to use this waiver should consult with their contractor(s) to maintain an itemized list to track the components covered under De Minimis. The Owner may create their own format for the list or use this sample form.

Owner: ___________________________ Loan #: ___________________________

Project Name: ___________________________

NOTE: The De Minimis waiver is only applicable to the cost of materials for the entire project. Do not include other project costs (labor, installation costs, etc.) in the “Total Cost of Materials”. The total cost of a material may be based on estimated, or if available, actual costs.

Funds used for de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

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<th>Manufacturer &amp; Component Description</th>
<th>Part/Model #</th>
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<th>Cost per Unit (if applicable)</th>
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Total Cost of Materials: ___________________________ 5% Limit: ___________________________ 1% limit: ___________________________

Use additional sheets as necessary

Total Cost of Components deemed to be De Minimis: ___________________________

Completed by: ___________________________

Company: ___________________________

Name: ___________________________ Title: ___________________________

Signature: ___________________________ Date: ___________________________
PART 1 - GENERAL

1.1 DESCRIPTION:
   A. Location: Work under this Contract includes, but is not limited to, locations within the public road right-of-way and easements for the gravity sewer on Middle Road, Woods Road, and Lunt Road, the force main on Pinehurst Drive, Woodlands Drive and Woods Road, and at the Falmouth Road Pump Station.
   B. Work Included (but not limited to):
      1. Gravity Sewer
         a. Demolish and/or cap and abandon existing gravity sewer main, manholes and appurtenances along Middle Road from Lunt Road to the existing sewer manhole on the north side of the Maine Turnpike Authority’s Middle Road Bridge and sewer service laterals to the limits as shown on the Drawings.
         b. Provide and install about 3,900 linear feet of new 15-inch PVC gravity sewer main, manholes and appurtenances along Middle Road and Lunt Road.
         c. Provide and install about 250 linear feet of new 15-inch pre-insulated ductile iron suspended sewer on the Maine Turnpike Authority’s Middle Road Bridge.
         d. Provide and install about 530 linear feet of new 12-inch PVC sewer on Woods Road as shown on the Drawings.
         e. Reconnect gravity sewer service laterals and appurtenances to the new gravity sewer main as shown on the Drawings.
         f. Provide trench paving to the limits shown on the Drawings.
      2. Sewer Force Main
         a. Provide and install about 6,000 linear feet of new 8-inch HDPE force main pipe, drain and air release manholes and appurtenances as shown on the Drawings.
         b. Provide trench paving to the limits shown on the Drawings.
      3. Storm Drain
         a. Replace existing Skitterygusset Creek storm drain culvert crossing on Middle Road as specified and as shown on the Drawings.
         b. Provide trench paving to the limits shown on the Drawings.
      4. Provide full road width finish course overlay paving on Woods Road from the Falmouth Public Works Building entrance on Woods Road to the intersection of Woodlands Drive, as noted on the Drawings.
      5. Falmouth Road Pump Station
         a. Demolition of existing pump station building, electrical components, conduits and wiring, pumps, process piping, existing concrete wet well top slab and site features not to be reused as shown on the Drawings.
b. Provide and install two new submersible non-clog sewage pumps and associated process piping within the existing pump station wet well as indicated on the Drawings.

c. Provide and install new 10-foot diameter precast concrete cover and access hatch over the existing wet well.

d. Provide and install new precast concrete pump station valve vault and associated process piping, valves and appurtenances as shown on the Drawings.

e. Provide and install new exterior diesel generator system with integral fuel tank and skin-tight sound-attenuated enclosure, associated electrical appurtenances, and concrete equipment pad.

f. Provide and install piping, equipment systems, structures, instrumentation, control and electrical systems, and awning over the electrical systems backboard, as indicated on the Drawings.

g. Site work, driveway paving and landscaping.

h. Other appurtenances as shown on the Drawings and specified herein.


7. All related site work including trench excavation, ledge excavation (as applicable), groundwater dewatering, disposal of excess excavated materials, installation and removal of temporary erosion and sedimentation control measures, filter fabric, riprap, bedding, backfill, compaction, grading, road/drive subbase, paving, loam and seeding and landscaping.

8. Miscellaneous painting to north-most girder of Maine Turnpike Authority’s (MTA) Middle Road Bridge that is supporting the Town of Falmouth’s suspended gravity sewer in accordance with MTA’s painting Specifications included in these Contract Documents.

9. Other miscellaneous work shown on the Drawings and in the Specifications for a complete and operational system.

C. Related Work Specified Elsewhere:

1. Construction Schedules: Section 01310.

D. Coordination:

1. See Section 01050 for information on contract coordination.

E. Site Access Limitations:

1. Permanent and temporary construction easement limits are shown on the plans. Work shall be limited to within the permanent and temporary easement areas.

F. Schedule Restrictions:

1. In-water work for the Skitterygusset Creek culvert crossing on Middle Road is to be limited to be within the work window of July 15th to September 30th.

2. Night work will be required for the gravity sewer replacement work at the intersection of Falmouth Road and Middle Road and for the Skitterygusset Creek storm drain culvert replacement on Middle Road. Coordinate with Section 01570 Traffic Regulation.

3. Tree cutting and/or clearing is prohibited between June 1st and July 31st during the Northern Long-eared Bat roosting season.
4. Refer to Appendix A for work scheduling restrictions on Maine Turnpike Authority property.

G. Removals, Relocations and Rearrangements
1. Examine the existing site for the work of all trades which will influence the cost of the work under the general bid. This work shall include removals, relocations and rearrangements which may interfere with, disturb or complicate the performance of the work under the general bid involving systems, equipment and related service lines, which shall continue to be utilized as part of the finished project. The Contractor is responsible for all coordination in this regard.

2. Provide in the general bid a sufficient amount to include all removals, relocations, rearrangements and reconnections herein specified, necessary or required to provide approved operation and coordination of the combined new and existing systems and equipment.

3. Provide in the bid a sufficient amount to include all temporary facilities required to maintain flows during the construction period, including bypass pumping, temporary piping, temporary metering, etc. The cost shall include the cost for all labor, tools, equipment and materials necessary.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 MAINTAIN EXISTING WORKS

A. Continuous Operations Criteria:
1. The Contractor shall conduct operations in such a manner and sequence which shall neither result in a disruption of, nor interfere with, the functional workings of any existing utilities.

2. The Contractor shall furnish, install and operate any piping, equipment and appurtenances necessary to provide the temporary services/facilities required during construction including, but not limited to, bypass pumping, flow barriers, cofferdams, and diversions. Temporary facilities, if required, shall have pumping capacity equal to or greater than the existing maximum capacity of the piping as determined by their size and slope.

3. The Owner will operate and maintain all existing systems and equipment not modified or impacted by the project. The Contractor shall notify and coordinate with the Owner whenever Contractor’s temporary facilities or construction will interface with existing utilities.

4. The Contractor shall be responsible for the operation and maintenance of all new and temporary facilities until such time as the new facilities are accepted by the Owner.

B. Minimize Interference
1. The Contractor shall at all times conduct operations so as to interfere as little as possible with existing works. The Contractor shall develop a program, in cooperation with the Engineer and interested officials, which shall provide for
the construction and putting into service of the new works in the most orderly manner possible. This program shall be adhered to except as deviations therefrom are expressly permitted.

2. Work of connecting with, cutting into and reconstructing existing pipes or structures shall be planned to interfere with the operation of the existing facilities for the shortest possible time and when the demands on the facilities best permit such interference. It may be necessary to work outside of normal working hours to minimize interference. Before starting work which will interfere with the operation of existing facilities, the Contractor shall do all possible preparatory work and shall see that all tools, materials, and equipment are made ready and at hand.

3.2 CONSTRUCTION SEQUENCE

A. Construction of the proposed facilities will disrupt the existing structures and operations. To maintain continuous operations, the construction must be divided into phases or sequenced appropriately. The Contractor shall take note of the following construction sequencing notes and restrictions:

1. **Falmouth Road Pump Station bypassing:** The Contractor may use the existing pig launcher fittings in the pig launcher manhole located at the Falmouth Road Pump Station site to bypass incoming sewer flows to the station from the upstream gravity sewer.

2. **Falmouth Road Pump Station submersible pump installation:** The existing suction-lift type pumps at the Falmouth Road Pump Station are not rated for the increased TDH conditions expected once the extension of the discharge force main from Pinehurst Drive to Woods Road is completed. Therefore, the Contractor is required to install and provide interim testing of the new submersible pumps at the Falmouth Road Pump Station for proper operation prior to connecting the new 8-inch force main extension to the existing 6-inch force main. The Contractor shall coordinate setting interim operating speeds of the new submersible pumps with the Owner, Engineer and submersible pump Manufacturer’s Representative to avoid exceeding the hydraulic capacity of the Pinehurst Drive Pump Station, into which the Falmouth Road Pump Station currently discharges. Once the 8-inch force main extension is connected to the existing 6-inch force main, the Contractor shall be responsible for the re-testing of the pumps and final pumping system under the new operating conditions, as specified.

3. **New sewer force main connection:** Contractor shall be responsible for connecting new 8-inch force main extension to existing 6-inch force main as shown on the Drawings. The new force main connection shall be made only after complete installation, testing, and acceptance of the new 8-inch force main extension along Pinehurst Drive, Woodlands Drive and Woods Road, and the complete installation, testing and acceptance of the new 12-inch gravity sewer on Woods Road. For the purpose of intercepting and connecting the existing 6-inch force main to the new 8-inch force main extension, as shown on the Drawings, the Contractor may temporarily store sewer flows in the Falmouth Road Pump Station wetwell, allowing the existing 6-inch force main pipe to drain by gravity back to the wetwell. If storage time exceeds wetwell capacity
at Falmouth Road Pump Station, Contractor is responsible to remove stored wastewater from the pump station wetwell during the force main connection to prevent a sanitary sewer overflow. Any flows removed from the Falmouth Road Pump Station wetwell may be disposed of at the Falmouth Wastewater Treatment Facility at 96 Clearwater Drive in Falmouth, Maine. The Contractor’s attention is also directed to the existing check valve for the existing 6-inch Falmouth Road Pump Station force main located in the existing force main manhole at the intersection of Woodville Road and Pinehurst Drive that may be used to limit back-draining of upstream force main flows. The condition and functionality of this check valve has not been confirmed by the Owner or Engineer and the Contractor assumes all risk relating to the Contractor’s reliance upon this check valve to facilitate the Contractor’s performance of the Work.

B. The Contractor shall submit to the Engineer for review and acceptance a complete schedule of the proposed sequence of construction operations prior to commencing any work. This schedule shall include the Contractor’s plans for doing the work.

C. The Contractor shall submit to the Engineer a written request to deviate from the above sequence with adequate supporting information to demonstrate to the Engineer that the continuity and degree of treatment will not be adversely affected.

3.3 SCHEDULE LIMITATIONS AND WORK RESTRICTIONS/ REQUIREMENTS

A. Work Hours:
   1. Work hours are defined in the Section 00700 (General Conditions) and Section 00800 (Supplemental Conditions).
   2. All Work shall be prohibited on Saturdays, Sundays, and legal holidays.
   3. All Work on weekdays within easements on the Woodlands housing development shall be performed between the hours of 7:00 AM and 5:00 PM, except during emergencies and as otherwise noted in this Section.
   4. All Work on weekdays in other project areas shall be performed between the hours of 7:00 AM and 7:00 PM, except during emergencies and as otherwise noted in this Section.
   5. All Work within the intersection of Falmouth Road and Middle Road and for the Skitterygusset Creek storm drain culvert replacement on Middle Road shall be performed between the hours of 7:00 PM and 7:00 AM.
   6. The Contractor shall request permission to work outside the work hours specified above at least 72-hours in advance of the proposed work. The Contractor shall not commence work outside of the work hours specified above unless or until granted such permission from the Owner and Engineer.

B. Temporary Facilities Plan:
   1. A project Temporary Facilities Plan shall be submitted prior to the Pre-Construction Meeting. The Temporary Facilities Plan shall identify the approach for maintaining continuous operations for each impacted utility. Refer to Section 01500.
C. Maintain Services:
   1. Maintain all existing sewer and water services as specified.

D. Traffic Control Plan:
   1. A project-specific Traffic Control Plan shall be submitted prior to the Pre-
      Construction Meeting (refer to Section 01570). The Traffic Control Plan shall
      identify traffic management requirements for each distinct component of the
      project.
   2. Contractor shall provide one lane for the passage of traffic within any work
      zone unless approved by the Owner.
   3. Contractor shall maintain access to all residences and businesses at all times.
   4. Contractor shall maintain access for emergency services vehicles, garbage
      collection, mail services, and snow removal service to all residences and
      businesses at all times. Contractor shall coordinate with these service providers.
   5. Contractor shall maintain access for bus routes, schools, day care facilities, etc.
      at all times. Contractor shall coordinate efforts with local school district to
      ensure access.
   6. Contractor to note the need for a

E. Special Coordination Requirements:
   1. Portions of the work are on private property. Easements have been obtained for
      this work and are shown on the Drawings. The property owners may have a
      project representative that will participate in project meetings. Work restrictions
      and requirements specified herein. Contractor shall comply will all conditions
      outlined in the easements.

F. Pavement and Roadway Maintenance:
   1. The Contractor shall maintain pipe trenches with compacted gravel until
      pavement operations can be completed.
   2. No excavation in paved roadways shall be allowed after November 15th of the
      calendar year.
   3. All streets shall be paved prior to November 15th of the calendar year. Any
      temporary pavement placed prior to November 15th shall be removed during the
      following construction season.
   4. No permanent pavement may be placed before April 1st of the calendar year.
   5. Contractor shall be responsible for snow removal within the trench, and at the
      Falmouth Road Pump Station site, once the Contractor has mobilized to the site,
      for the duration of the Contract.

G. Contractor’s Construction Trailer and Temporary Facilities (For work in
   Woodlands housing development)
   1. If Contractor intends to locate temporary construction office trailer within the
      Woodlands housing development property, the trailer may be placed on the
      emergency access road extending beyond the cul-de-sac- of Pinehurst Lane at
      the intersection of Woodville Road. Woodville Road/emergency access road
      gate will be closed and secured after construction hours.
2. If Contractor intends to store equipment and materials within the Woodlands housing development, equipment and supply staging may be stored on the emergency access road extending beyond the cul-de-sac of Pinehurst Lane at the intersection of Woodville Road. Chemical bathroom facilities shall be located in the same area. A 12-foot-wide lane must be maintained at all times on the emergency access road for emergency vehicle access. No construction materials will be left on roadsides of Pinehurst Lane and Woodlands Drive overnight. Large equipment such as an excavator may be left overnight on the roadsides of WHA and Woodlands Club property. No such equipment may be left on any residential lot during non-work hours.

END OF SECTION
SECTION 01045
CUTTING, CORING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included - This section establishes general requirements pertaining to cutting, excavating, coring, fitting, and patching of the Work required to:
   1. Make alterations to existing structures.
   2. Make the parts fit properly.
   3. Replace work not conforming to requirements of the Contract Documents.
   4. Contractor is responsible for all cutting, coring, and rough and finish patching. Contractor shall coordinate the work of any and all subcontracting trades performing the work.
   5. Contractor is responsible for reviewing with the Owner and Engineer and receiving permission to proceed prior to cutting and coring and patching.
B. Related Work Specified Elsewhere:
   1. Pipe Sleeves and Seals are specified in Section 15092.
C. Quality Assurance:
   1. Perform all cutting, coring and patching in strict accordance with pertinent requirements of these Specifications, and in the event no such requirements are determined, in conformance with the Engineer's written direction.
D. Submittals:
   1. In accordance with the requirements specified in Section 01340. Provide the following information at least 30 days prior to cutting or coring:
      a. Identification and qualifications of cutting/coring subcontractor(s) including: company name, business address contact information, or if by Contractor, indicated as such.
      b. Key plan and schedule of cuts/cores indicating the: location of the cut/core, size (i.e., wall, floor, roof, etc.), equipment to be used and identification of any potential obstructions or embedded conduits and wiring.
   2. Request for the Engineer's consent to proceed:
      a. Prior to cutting which affects structural safety, submit written request to the Engineer for permission to proceed with cutting.
      b. Should conditions of the work, or schedule, indicate a required change of materials or methods for cutting and patching, Contractor shall notify the Engineer and secure written permission prior to proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Materials for replacement of work shall be equal to those of adjacent construction and shall comply with the pertinent sections of these Specifications.
B. Concrete and grout for rough patching shall be as specified in Divisions 3.

PART 3 - EXECUTION

3.1 CONDITIONS
A. Inspection:
   1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, coring, backfilling, and patching.
   2. After uncovering the work, inspect conditions affecting installation of new work.
B. Discrepancies:
   1. If uncovered conditions are not as anticipated, immediately notify the Engineer and secure needed directions.
   2. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION PRIOR TO CUTTING AND CORING
A. Provide all required protection including, but not necessarily limited to, shoring, bracing and support to maintain structural integrity of the work.
B. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
C. All holes cut through concrete walls or slabs shall be core drilled unless otherwise approved. No structural members shall be cut without approval of the Engineer and all such cutting shall be done in a manner directed by him. No holes may be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.
   1. The Contractor shall submit the documentation to the Engineer for review and comment before proceeding with penetration of the concrete surface.

3.3 CORING
A. Coring shall be performed with an approved non-impact rotary tool with diamond core drills. Size of holes shall be suitable for pipe, conduit, sleeves, equipment or mechanical seals to be installed.
B. All equipment shall conform to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring and maintenance.
C. Provide protection for existing equipment, utilities and critical areas against water or other damage caused by drilling operation.
D. Slurry or tailings resulting from coring operations shall be vacuumed or otherwise removed from the area following drilling. Slurry or tailings shall not be allowed to enter floor drains.
E. Work area (e.g., adjacent walls, floors, ceilings, pipes, conduits, etc.) shall be cleaned to remove splash residues from coring operation.

3.4 CUTTING
A. Cutting shall be performed with a concrete wall saw and diamond saw blades of proper size.
B. Provide for control of slurry generated by sawing operation on both sides of wall.
C. When cutting a reinforced concrete wall, the cutting shall be done so as not to damage bond between the concrete and reinforcing steel left in structure. Cut shall be made so that steel neither protrudes nor is recessed from face of the cut.
D. Adequate bracing of area to be cut shall be installed prior to start of cutting. Check area during sawing operations for partial cracking and provide additional bracing as required to prevent a partial release of cut area during sawing operations.
E. Provide equipment of adequate size to remove cut panel.
F. Slurry or tailings resulting from cutting operations shall be vacuumed or otherwise removed from the area following drilling. Slurry or tailings shall not be allowed to enter floor drains.
G. Work area (e.g., adjacent walls, floors, ceilings, pipes, conduits, etc.) shall be cleaned to remove splash residues from cutting operation.

3.5 PERFORMANCE
A. Perform all required excavating and backfilling as required under pertinent sections of these specifications. Perform cutting, coring and demolition by methods which will prevent damage to other portions of the work and will provide proper surfaces to receive installation of repair and/or new work. Perform fitting and adjustment of products to provide finished installation complying with the specified tolerances and finishes.
B. Coring or cutting which exposes cut surfaces of reinforcing steel or structural steel shall be coated. Coating shall be 10 mil (dry film thickness) applied in two 5 mil (dry film thickness) coats of a single component moisture cured coal tar urethane or two part coal tar epoxy corrosion barrier. Alternately the exposed steel can be cut back two inches from the surface and a non-shrink grout applied over the steel flush to the concrete core or cut surface.
C. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown.
D. Finish patching shall match existing surfaces as approved.

END OF SECTION
SECTION 01050

COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION
A. Contractor is required to work in close proximity to Owner's existing facilities. The Contractor, under this Contract, will be responsible for coordinating construction activities with Owner to ensure that services, facilities, and safe working conditions are maintained.
B. Other Construction Contractors will be interfacing with this Contract and working within the work area and in the vicinity of this Contract. The Contractor, under this contract, shall act as Construction Coordinator and shall coordinate construction activities with other Contractors working for Owner.
C. Any damage to existing structures, equipment and property, accepted equipment or structures, and property or work in progress by others; as a result of the Contractor's or his subcontractor's operations shall be made good by the Contractor at no additional cost to the Owner.

1.2 COORDINATION WITH OTHERS
A. Town of Falmouth:
   1. Contractor shall coordinate access, egress, detours and traffic control, if required, at the site with the Falmouth Police Department. The Contractor shall notify Falmouth Police, Fire Department and Rescue Squad at least 24 hours in advance of any street closings or detours.
   2. The Contractor shall be responsible for coordinating all work around Town-owned storm drainage facilities with the Town Public Works Department and shall bear all costs of inspection requirements, temporary facilities relocation and other requirements.
B. Falmouth Sewer Department:
   1. Contractor shall coordinate all work on Town property with the Wastewater Treatment Facility personnel.
   2. The Contractor shall be responsible for coordinating and maintaining public services to all public and private properties.
   3. Town will assist Contractor with homeowner notification related to upcoming work that affects their sewer service. Contractor shall provide the Town with 14-day notice prior to connection, replacements of sewer services.
C. Portland Water District (PWD)
   1. Contractor shall be responsible for coordinating all work in the vicinity of water lines with PWD. Contractor shall bear all costs for PWD inspection requirements, temporary facilities, water main adjustments and other requirements.
D. Maine Turnpike Authority (MTA):
   1. The Contractor shall be responsible for coordinating all work around MTA facilities with MTA and shall bear all costs of inspection requirements,
temporary facilities relocation and other requirements. Reference Appendix A for more information and requirements.

E. Maine Department of Transportation (MDOT):
1. Contractor shall be responsible for coordinating all work in the vicinity of MDOT storm drainage infrastructure.

F. Central Maine Power Company (CMP):
1. The Contractor shall be responsible for coordinating all work around CMP facilities with CMP and shall bear all costs of inspection requirements, temporary facilities relocation and other requirements.

G. Consolidated Communications:
1. The Contractor shall be responsible for coordinating all work around Consolidated Communications facilities with Consolidated Communications and shall bear all costs of inspection requirements, temporary facilities relocation and other requirements.

H. The Contractor shall provide the Resident Project Representative, Wastewater Treatment Facility Superintendent, and Chief Operator a construction schedule indicating the times to perform the work required. The Contractor shall update the schedule when required and give Owner’s Chief Operator/Superintendent one week notice before the start of any work. The Contractor shall provide the Owner’s personnel enough time to obtain materials and perform any work required of them. The Contractor shall daily communicate with the Resident Project Representative, Superintendent and Chief Operator concerning updating the schedule, job progress, delay or early starts that affect pump station operations, facility staffing, etc.

I. Weekly coordination meetings shall be held between the Contractor, Owner’s Chief Operator/Superintendent, the Resident Project Representative, [and a member of the Woodlands Homeowners Association/Woodlands Club for work on Woodlands housing development property]. These meetings shall cover the following:
1. Work to be completed the following week
2. Project Schedule
3. Shop Drawing and O&M issues
4. Outstanding RFIs and Clarifications
5. Change Orders and Field Orders
6. Review of Record Drawing Information
7. Discussion/Resolution of any old issues
8. New issues discussion
9. Contractor’s Safety and Health Plan Updates

J. Snow Removal Coordination: It is anticipated that this project will be completed prior to winter weather. However, if snowfall occurs during construction, the Contractor shall be responsible for all snow removal activities in construction and laydown areas onsite (within the temporary construction easement) and on Pinehurst Drive, Woodlands Drive, Woods Road, Middle Road, and Lunt Road if pavement binder and surface courses are not complete.

END OF SECTION
SECTION 01070

ABBREVIATIONS & SYMBOLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Where any of the following abbreviations are used in these Specifications, they shall have the meaning set forth opposite each.

AASHTO American Association of State Highway and Transportation Officials
AC Alternating Current
ACI American Concrete Institute
ACP Asbestos Cement Pipe
AGA American Gas Association
AIC Ampere Interrupting Capacity
AGMA American Gear Manufacturers Association
AIEE(IEEE) American Institute of Electrical Engineers (Institute of Electrical and Electronics Engineers, Inc.)
AISC American Institute of Steel Construction
amp Ampere 125-16
Amer. Std. American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class I25 (ASA B16 11960)
ANSI American National Standards Institute
API American Petroleum Institute
ASA American Standards Association
ASCE American Society of Civil Engineers
ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials
AWG American or Brown and Sharpe Wire Gage
AWWA American Water Works Association
BOD Biochemical Oxygen Demand
c.f. Cubic Foot
c.f.m. Cubic Foot Per Minute
c.f.s. Cubic Foot Per Second
CI Cast Iron
CIPRA Cast Iron Pipe Research Association
CSI Construction Specifications Institute
c.y. Cubic Yards
DC Direct Current
DEP Department of Environmental Protection
DI Ductile Iron
DOT Department of Transportation
EDR Equivalent Directional Radiation
ABBREVIATIONS & SYMBOLS

EPA  U.S. Environmental Protection Agency
fps  Feet Per Second
ft.  Feet
gal. Gallons
gpd Gallons Per Day
gpm Gallons Per Minute
HP Horsepower
IBR Institute of Boiler and Radiator Manufacturers
in.  Inches
inter. Interlock
ISA Instrument Society of America
kva Kilovolt-ampere
kw Kilowatt
lb.  Pound
max. Maximum
MCB Master Car Builders
MGD Million Gallons Per Day
Min. Minimum
NBS National Bureau of Standards
NEC National Electrical Code, Latest Edition
NEMA National Electrical Manufacturers Association
NEWWA New England Water Works Association
NPT National Pipe Thread
OS&Y Outside Screw and Yoke
PCA Portland Cement Association
ppm Parts Per Million
% Percent
psi Pounds Per Square Inch
psig Pounds Per Square Inch Gage
PVC Polyvinyl Chloride
rpm Revolutions Per Minute
RUS Rural Utility Service
s.f. Square Foot
STL. W.G. U.S. Steel Wire, Washburn and Moen, American Steel and Wire Cos., or Roebling Gage
s.y. Square yard
TDH Total Dynamic Head
USAS Standards of the United States of America Standards Institute (formerly American Standards Association)
USS GAGE United States Standard Gage
VC Vitrified Clay
WSP Working Steam Pressure

END OF SECTION
SECTION 01100

ALTERNATES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Each Bidder shall be held fully responsible for examining the scope of the Alternates generally defined herein and for recognizing any modifications to the Work caused by any Alternate.
B. Alternate:
   1. To enable the Owner to compare total costs where alternate materials and methods might be used, an Alternate has been established as described in this Section of these Specifications.
C. Related Work Specified Elsewhere:
   1. Materials and methods to be used in the Base Bid and in the Alternate have been described on the Drawings and in pertinent Sections of these Specifications.
   2. Method for stating the proposed Contract Sum is described in the Bid Form.
D. Submittals:
   1. All Alternates described in this Section are required to be reflected on the Bid Form as submitted by bidders. However, do not submit alternates other than as described in this Section, except as provided for "substitutions" under the General Conditions.

PART 2 - PRODUCTS

2.1 PRODUCT HANDLING
A. If the Owner elects to proceed on the basis of the described Alternative, make all modifications to the Work required in furnishing and installing the selected Alternative to the approval of the Engineer and at no additional cost to the Owner other than as proposed on the Bid Form.

2.2 ALTERNATE NO. A – [DEDUCT] - TYPE 2 CONCRETE COATING FOR FALMOUTH ROAD PUMP STATION WETWELL
A. The work of this ALTERNATE shall consist of alternatively furnishing and installing a Type 2 concrete coating in place of a Type 1 coating to the Falmouth Road Pump Station wetwell interior as indicated in the Drawings and as specified in Section 03930, complete in all respects.

PART 3 - EXECUTION

3.1 ADVANCE COORDINATION
Immediately after award of the Contract, or as soon thereafter as the Owner has made a decision on whether the Alternate will be selected, thoroughly and clearly advise all necessary personnel
and suppliers as to the nature and extent of Alternates selected by the Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the work caused by the Owner's selection or rejection of the Alternate.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. For lump sum items, payment shall be made to the contractor in accordance with an accepted progress schedule and schedule of values on the basis of actual work completed.

B. For unit-price items, payment shall be based on the actual amount of work accepted and for the actual amount of materials in place, as shown by final measurements.
   1. All units of measurement shall be standard United States convention as applied to the specific items of work by tradition and as interpreted by the Engineer.
   2. At the end of each day's work, the Contractor's Superintendent or other authorized representative of the Contractor shall meet with the Resident Project Representative and determine the quantities of unit price work accomplished and/or completed during the work day.
   3. The Resident Project Representative will then prepare two "Daily Progress Reports" which shall be signed by both the Resident Project Representative and Contractor's Representative.
   4. Once each month the Resident Project Representative will prepare two "Monthly Progress Summation" forms from the month's accumulation of "Daily Progress Reports" which shall also be signed by both the Resident Project Representative and Contractor's Representative.
   5. These completed forms will provide the basis of the Engineer's monthly quantity estimate upon which payment will be made. Items not appearing on both the Daily Progress Reports and Monthly Progress Summation will not be included for payment. Items appearing on forms not properly signed by the Contractor will not be included for payment.
   6. After the work is completed and before final payment is made, the Engineer will make final measurements to determine the quantities of various items of work accepted as the basis for final settlement.

1.2 SCOPE OF PAYMENT

A. Payments to the Contractor will be made for the actual quantities of the Contract items performed and accepted in accordance with the Contract Documents. Upon completion of construction, if these actual quantities show either an increase or decrease from the quantities given in the Proposal Form, the Contract Unit Prices will still prevail.

B. The Contractor shall accept in compensation, as herein provided, in full payment for furnishing all materials, labor, tools, equipment, and incidentals necessary to the completed work and for performing all work contemplated and embraced by the Contract; also for all loss or damage arising from the nature of the Work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the Work and until its final acceptance by the Engineer, and
for all risks of every description connected with the prosecution of the work, except as provided herein, also for all expenses incurred in consequence of the suspension of the Work as herein authorized.

C. The payment of any partial estimate or of any retained percentage except by and under the approved final invoice, in no way shall affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for all damage due to such defects.

1.3 PAYMENT FOR INCREASED OR DECREASED QUANTITIES
A. When alterations in the quantities of work not requiring supplemental agreements, as hereinbefore provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract price for the actual quantities of work done. No allowance will be made for anticipated profits. Increased or decreased work involving supplemental agreements will be paid for as stipulated in such agreements.

1.4 OMITTED ITEMS
A. Should any items contained in the bid form be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract, and such action shall in no way invalidate the Contract, and no allowance will be made for items so eliminated in making final payment to the Contractor.

1.5 PARTIAL PAYMENTS
A. Partial payments shall be made monthly as the work progresses. Partial payments shall be made subject to the provisions of the Supplemental and General Conditions.

1.6 PAYMENT FOR MATERIAL DELIVERED
A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable, non-perishable materials and equipment which are to be incorporated into bid items, have not been used and have been delivered to the construction site, or placed in storage places acceptable to the Owner. Payment shall be subject to the provisions of the General and Supplemental Conditions.

B. No payment shall be made upon fuels, supplies, lumber, false work, or other materials, or on temporary structures of any kind which are not a permanent part of the Contract.

1.7 FINAL PAYMENT
After final measurements are made by the Engineer, the Contractor will prepare a final quantity invoice of the amount of the Work performed and the value of such Work. Owner shall make final payments of the sum found due less retainages subject to provisions of the General and Supplemental Conditions.

1.8 INCIDENTAL WORK
A. Incidental work items for which separate payment will not be made includes, but is not limited to, the following items:
1. Pre-Construction photographs.
2. Project record documents.
3. Signs
4. Clean-up and restoration of property.
5. Restoration of fences and other structures.
6. Cooperation and coordination with other Contractors and utility companies including related inspection costs and other costs (Refer to Section 01050).
7. Utility crossings and relocations, unless otherwise paid for.
8. Temporary utility services to buildings, as required to maintain service during construction.
9. Minor Items--such as relocation or replacement of sign posts, guard rails, rock wall, mail boxes, curbs, traffic loop detectors, pavement markings, etc., damaged as a result of construction activities.
10. Trench boxes, steel and/or wood sheeting as required, including that left in place.
11. Maintenance of all existing sewer flows and repair of existing sewer pipes.
12. Dewatering as necessary.
13. Dust control.
15. Quality assurance testing.
16. Final cleaning of sewers, force mains and storm drains.
17. Clearing, grubbing and stripping.
18. Grading, liming, fertilization, mulching, and watering.
19. Construction schedules, bonds, insurance, shop drawings, warranties, guarantees, certifications and other submittals required by the Contract Documents.
20. Repair and replacement of water lines under 2-inches in size, culverts, underdrains, rock lined drainage trenches in streets and other utilities damaged by construction activities and corresponding proper disposal of removed materials unless otherwise paid for.
21. Temporary construction necessary for construction sequencing and other facilities not permanently incorporated into the work.
22. Weather protection.
23. Permits not otherwise paid for or provided by the Owner.
24. Visits to the project site or elsewhere by personnel or agents of the Contractor, including manufacturer's representatives, as may be required.
25. All excavation except the test pits specifically shown or ordered by the Engineer to establish sewer line and water line locations, earth excavation below grade and rock excavation.
27. Electrical service shutdown during utility connection.

1.9 DESCRIPTION OF PAY ITEMS
A. The following sections describe the measurement of and payment for the work to be done under the respective items listed in the Bid Form.
B. Each unit or lump-sum price stated in the Bid Form shall constitute full compensation, as herein specified, for each item of the work completed.
(1) – Mobilization/Demobilization Method of Measurement: Lump sum. Total of bid item shall not exceed 5% of Total Amount of the Bid.

B. Basis of Payment: Mobilization/demobilization costs are those costs of initiating and ending the contract. Payment for mobilization/demobilization shall be a lump sum at the price as stated in the Bid Form. Fifty percent (50%) of the lump sum will be payable when the Contractor is Operational on the site and the remaining 50% of the lump sum will be payable when the Contractor leaves the site following the completion of all contract work. For purposes of payment on this item, "Operational" shall mean the Contractor has provided all required and properly executed bonds and insurance certificates and the Owner has approved the following: Construction Schedule, Erosion Control Plan, Pre-Blast Survey and Blasting Plan, Traffic Control Plan, Project Sign (as installed), Temporary Facilities, and Pre-Construction photographs/videos. Only one lump sum payment divided into the two partial payments described herein shall be made to cover all mobilization/demobilization costs throughout the entire contract.

(2) – Falmouth Road Pump Station Upgrades

A. Method of Measurement: Upgrades to the Falmouth Road Pump Station shall be paid for at the Contract lump sum price stated in the Bid Schedule.

B. Basis of Payment: Said lump sum price shall constitute full compensation for all items shown on Drawings and Specified herein related to the Pump Station and the surrounding site except where noted below. Lump sum price shall include furnishing all labor, materials, tools and equipment necessary for construction of the pump station, complete, operational and satisfactorily tested, including, but not limited to, site preparation, clearing and grubbing, excavation and backfill (except rock excavation which shall be paid under Item 5), sheeting, shoring, bracing or other acceptable methods of excavation support, dewatering, subsurface and structures including valve pit, electrical controls awning and foundation, all equipment, temporary and permanent electrical work, instrumentation, site work, new force main from the pump station to the connection to the existing force main at the pig launcher manhole on the pump station property, combination air/vacuum release assembly to be installed in the existing force main air release manhole adjacent to the pig launcher manhole, and new air release valve drain piping (as indicated on the Drawings), bypass pumping, pipe restraints, fittings, landscaping and site restoration at the pump station property, paving of the pump station drive (as indicated on the Drawings, except for trench paving as described in 2.C), erosion control, grading, start-up and testing, and all appurtenant work needed for complete and operational systems, as indicated on the Drawings and as specified.

C. Trench paving associated with installation of the pump station’s new electrical duct bank located along the pump station access road shall be paid separately in accordance with the trench paving details, as indicated on the Drawings, and the applicable bituminous pavement Pay Items listed in the Bid Schedule and in this Section. For measurement and payment purposes, the limit of trench paving for the pump station’s underground electrical duct bank shall be to the pump station drive pavement limits, as indicated on the Drawings.
(3) - Replacement of Unsuitable Material Above Pipe Bedding and Initial Backfill

A. Method of Measurement: Quantity to be paid for under this item shall be the number of cubic yards of material removed and replaced with materials from off-site as authorized by the Engineer. The payment limit for this item shall be between vertical planes that are a distance apart equal to a maximum of 6-feet extending from the top of the initial backfill layer to the bottom of the aggregate subbase layer as called out in the contract drawings for the length of the excavation as directed by the Engineer.

B. Basis of Payment:
   1. Excavated unsuitable materials shall be paid for at the unit price per cubic yard stated in the Bid Schedule. Said unit price shall be full compensation for furnishing all labor, equipment, and tools necessary for the excavation of unsuitable material including the disposal of materials; furnishing installing and compacting replacement suitable backfill, and for all other work and expenses incidental thereto for which payment is not provided under other items.
   2. Material excavated that could have, in the opinion of the Engineer, remained in place through the use of adequate dewatering efforts shall be replaced by the Contractor at no additional cost to the Owner.

(4) - Excavation Below Grade and Replacement Backfill

A. Method of Measurement: Quantity to be paid for under this item shall be the number of cubic yards of material removed and replaced below the pipe or structure bedding with materials from off-site as authorized by the Engineer. The payment limit for this item shall be between vertical planes that are a distance apart equal to the sum of 18 inches plus 1-1/3 times the nominal inside diameter of pipe to be installed (minimum 3 feet) extending from the typical excavation depth called out in the contract drawings (bottom of bedding layer) to the depth accepted by the Engineer for the length of the excavation as directed by the Engineer.

B. Basis of Payment:
   1. Excavated unsuitable materials below the bedding elevation shall be paid for at the unit price per cubic yard stated in the Bid Schedule. Said unit price shall be full compensation for furnishing all labor, equipment, and tools necessary for the excavation of unsuitable material including the disposal of materials; and including furnishing installing and compacting replacement suitable backfill, and filter fabric, and for all other work and expenses incidental thereto for which payment is not provided under other items.
   2. Material excavated below pipe bedding grade that could have, in the opinion of the Engineer, remained in place through the use of adequate dewatering efforts shall be replaced by the Contractor at no additional cost to the Owner.

(5) – Ledge Excavation

A. Method of Measurement:
   1. Ledge excavation measured for payment shall be the number of cubic yards of ledge removed during construction. This quantity shall be determined by:
      a. Exposing the ledge profile for measurement. Excavation and backfill of the earth overburden shall be considered incidental, and no separate payment shall be made therefore.
b. Should the Contractor elect to pre-drill and blast ledge without exposing the ledge surface for measurement, ledge depths shall be determined by the Resident Project Representative at the time of drilling or, when direct drilling observation is not conducted, the ledge profile shall be measured after excavation, and 20% of the ledge volume thus measured shall be deducted due to ledge expansion caused by the blasting operation.

2. The payment limit for trench width shall be between vertical planes which are a distance apart equal to the sum of 18 inches plus 1-1/3 times the nominal outside diameter of pipe which is to be installed in the trench (min. of 3 feet) and extending from the top of the ledge surface to a depth of 6 inches below the invert grade of the pipe. Where two pipes are installed in the same trench, trench ledge excavation shall be measured as the actual volume of ledge removed between vertical planes which are a distance apart equal to the sum of 3 feet plus the sum of the pipes nominal outside diameter. Where three pipes are installed in the same trench, trench ledge excavation shall be measured as the actual volume of ledge removed between vertical planes which are a distance apart equal to the sum of 4.5 feet plus the sum of the pipes nominal outside diameter.

3. Ledge excavation for structures (including manholes) shall be measured as 18 inches outside the structure and extending to a depth of 6 inches below the base of the structure indicated on the Drawings.

4. Rocks or boulders greater than two cubic yards volume shall be considered as ledge excavation. Volume of rocks shall be determined from their average length, width, and depth as measured by the Engineer.

B. Basis of Payment:
1. The contract unit price per cubic yard for ledge excavation shall be full compensation for all labor, materials, tools and equipment necessary to complete the excavation including conducting the pre-blast survey, public notifications, drilling, blasting, excavating, loading and disposing the excess or unusable material outside the work limits, suitable replacement backfill, and all else incidental thereto for which payment is not provided under other items.

2. Not all the potential ledge locations are identified on the Drawings and ledge could be encountered anywhere within the limits of work. Such ledge, if encountered, is not considered a Differing Subsurface or Physical Condition. The unit price in the bid form shall apply to all ledge encountered and removed.

(6) – 15-inch Gravity Sewer Pipe

A. Method of Measurement: Sewer pipe measured for payment shall be the number of linear feet installed measured along the center line of the pipe as laid including fittings. Pipes shall be measured between centers of the manholes minus half the inside diameter of each manhole. Pipe installed into the manhole will not be measured for payment.

B. Basis of Payment:
1. The contract unit price per linear foot for sewer pipe shall be full compensation for all labor, materials, and equipment necessary to complete this work including excavation (except ledge excavation), dewatering, bedding,
furnishing and installing pipe and fittings, making connections to new and existing manholes, installation of impervious material dams, backfill including aggregate base and subbase material, compaction, cleaning, testing, maintaining existing flows during construction of new facilities, and all incidental thereto for which separate payment is not provided under other items.

2. Payment for this work on interim requisitions shall be according to the following percentages:
   a. Sewer pipe acceptably set in place and backfilled - 90 percent.
   b. Sewer pipe successfully tested - 10 percent.

(7) – 12-inch Gravity Sewer Pipe
A. Method of Measurement: Sewer pipe measured for payment shall be the number of linear feet installed measured along the center line of the pipe as laid including fittings. Pipes shall be measured between centers of the manholes minus half the inside diameter of each manhole. Pipe installed into the manhole will not be measured for payment.

B. Basis of Payment:
   1. The contract unit price per linear foot for sewer pipe shall be full compensation for all labor, materials, and equipment necessary to complete this work including excavation (except ledge excavation), dewatering, bedding, furnishing and installing pipe and fittings, making connections to new and existing manholes, installation of impervious material dams, backfill including aggregate base and subbase material, compaction, cleaning, testing, maintaining existing flows during construction of new facilities, and all incidental thereto for which separate payment is not provided under other items.
   2. Payment for this work on interim requisitions shall be according to the following percentages:
      a. Sewer pipe acceptably set in place and backfilled - 90 percent.
      b. Sewer pipe successfully tested - 10 percent.

(8) 15-inch Pre-Insulated Ductile Iron Sewer Pipe
A. Method of Measurement: Pre-insulated Ductile Iron Sewer Pipe measured for payment shall be the number of linear feet installed measured along the center line of the pipe as laid including fittings. Pipes shall be measured between centers of the manholes minus half the inside diameter of each manhole. Pipe installed into the manhole will not be measured for payment.

B. Basis of Payment:
   1. The contract unit price per linear foot shall be full compensation for all labor, materials, and equipment necessary to complete this work including excavation (except ledge excavation), dewatering, bedding, demolition and disposal of existing buried and suspended pipes, fittings and pipe supports on the Middle Road Bridge between the existing SMH 249 and new SMH 248, furnishing and installing pre-insulated pipe from the existing SMH 249 on Middle Road across the Middle Road Bridge to the new SMH 248 on Middle Road (as shown on the Drawings), fittings and necessary pipe supports, connecting the new sewer pipes to the existing SMH 249 and new SMH 248, backfill including aggregate
MEASUREMENT AND PAYMENT

base and subbase material, compaction, cleaning, testing, maintaining existing flows during construction of new facilities and all else incidental thereto for which payment is not provided under other items.

2. Payment for this work on interim requisitions shall be according to the following percentages:
   a. Sewer pipe acceptably set in place and backfilled - 90 percent.
   b. Sewer pipe successfully tested - 10 percent.

(9) 8-inch Diameter HDPE Force Main
   A. Method of Measurement: Shall be the number of linear feet installed, measured along the centerline of the pipe as laid including fittings. Pipe shall be measured from the initial connection point to the terminus manhole.
   B. Basis of Payment
      1. The unit price as stated in the Bid Schedule shall constitute full compensation for all labor, materials, and equipment necessary to complete this work including excavation (except ledge excavation), dewatering, bedding, furnishing and installing pipe and fittings, making connections to new and existing force main, backfill including aggregate base and subbase material, compaction, pavement and site restoration, cleaning, testing, maintaining existing flows during construction of new facilities and all else incidental thereto for which payment is not provided under other items.

(10) – Drain Piping (< 6-inch)
   A. Method of Measurement: Drain pipe measured for payment shall be the number of linear feet installed measured along the center line of the pipe as laid including fittings. Pipes shall be measured between centers of the manholes or structures minus half the inside diameter of each manhole or structure. Pipe installed into the manhole will not be measured for payment.
   B. Basis of Payment:
      1. The contract unit price per linear foot for drain pipe shall be full compensation for all labor, materials, and equipment necessary to complete this work including excavation (except ledge excavation), dewatering, bedding, furnishing and installing pipe and fittings, making connections to new and existing manholes, backfill including aggregate base and subbase material, and all else incidental thereto for which separate payment is not provided under other items.

(11) – Sanitary Service Connections (all sizes)
   A. Method of Measurement: This item shall consist of installing private sanitary service leads from the new sanitary sewer mainline to the edge of the mainline trench as shown on the Drawings and/or as determined in the field. Measurement shall be from the top of the tee or wye in the main to the edge of the mainline trench measured along the centerline of the pipe, or as otherwise determined by the Engineer.
   B. Basis of Payment:
      1. The contract unit price per linear foot shall be full compensation for all labor, materials, and equipment necessary to complete this work including furnishing
and installing pipe and fittings, adequately capping service connection and marking location as specified and shown on the Drawings or connection to existing service, cleaning, testing, maintaining existing flows during construction of new facilities and all else incidental thereto for which payment is not provided under other items.

(12) – Sanitary Service Extensions (all sizes)
A. Method of Measurement: This item shall consist of installing private sanitary service leads from the edge of the mainline trench to the point of connection to the existing sanitary sewer services as shown on the Drawings and/or as determined in the field. Measurement shall be from the edge of the mainline trench to the point of connection with the existing sanitary sewer service pipe measured along the centerline of the pipe, or as otherwise determined by the Engineer.
B. Basis of Payment:
1. The contract unit price per linear foot shall be full compensation for all labor, materials, and equipment necessary to complete this work including excavation (except ledge excavation), dewatering, bedding, furnishing and installing pipe and fittings, adequately capping service connection and marking location as specified and shown on the Drawings or connection to existing service, backfilling including aggregate base and subbase material, compaction, cleaning, testing, maintaining existing flows during construction of new facilities and all else incidental thereto for which payment is not provided under other items.

(13) – Middle Road Culvert Replacement
A. Method of Measurement: Lump sum.
B. Basis of Payment: The lump sum payment for the Middle Road Culvert Replacement shall be full compensation for all labor, materials, and equipment necessary to complete this work including excavation, dewatering, temporary bypass pumping, bedding, erosion and sedimentation controls, cofferdams, furnishing and installing pipes and fittings, backfill including aggregate base and subbase material, compaction, grading, riprap and all else incidental thereto for which payment is not provided under other items.

(14) - Relocation of Existing Water Main
A. Method of Measurement: Relocation of existing water mains (sizes 2" and larger and all depths) measured for payment shall be the actual linear feet of relocated water main installed and accepted complete in place as a result of direct conflict with new sewer lines. Relocation of water lines less than 2" is considered incidental. Waterlines repaired or replaced as a result of Contractor error or negligence, or not in direct conflict with new sewers will not be considered for payment.
B. Basis of Payment: The contract unit price per linear foot for replacement of existing water mains shall be full compensation for all labor, materials, tools and equipment necessary to complete this work including excavation (except rock excavation), bedding, pipe, adaptors, fittings, valves, thrust blocks, joint restraints, dewatering, backfill and compaction to the satisfaction of the water company, payment for direct
water company supervision, and all else incidental thereto for which payment is not provided under other items.

(15) - Pipe Trench Insulation
A. Method of Measurement: Pipe trench insulation accepted for payment shall be the actual linear feet of trench insulation installed and accepted complete in place.
B. Basis of Payment: The contract unit price per linear foot for pipe trench insulation shall be full compensation for all labor, materials, tools and equipment necessary to complete this work including excavation, bedding, insulation, backfill, compaction and all else incidental thereto for which payment is not provided under other items.

(16) - Removal and Disposal of Asbestos Cement (AC) Pipe
A. Method of Measurement: Removal and Disposal of Asbestos Cement Pipe accepted for payment shall be the actual number of linear feet as show on the plans or as required by the Engineer of Asbestos Cement Pipe (all diameters) removed and disposed of in accordance with local, State and Federal Regulations.
B. Basis of Payment: The Contract unit price per linear foot for Removal and Disposal of Asbestos Cement Pipe shall be full compensation for all labor, subcontractors, materials, tools and equipment necessary to complete this work including excavation, handling and removing of pipe, bagging of pipe and miscellaneous friable pieces of pipe and contaminated trench materials, transporting to a licensed disposal site, disposal fees, coordination with regulatory agencies and Owner, and all else incidental thereto for which payment is not provided under other items. Note that capping/plugging AC pipe to be abandoned is paid for under a separate Bid item.

(17) – Abandon and Demolish Sewer Pipe and Manholes
A. Method of Measurement: Item measured for payment shall be per lump sum for all work as shown on the Drawings including but not limited to abandonment, removal and disposal of existing sewer pipe/manholes that interfere with the new work (except AC pipe which is paid under a separate Bid item); flowable fill, capping/plugging pipe at extents shown on the Drawings; the excavation and removal of the top section of manholes to be abandoned and subsequent backfill to grade as well as any other abandonment/demolition requirements outlined on the Drawings. Note that there are both PVC and AC gravity sewers in the project area, as shown on the Drawings.
B. Basis of Payment: The lump sum price for this item shall be full compensation for all labor, materials and equipment necessary to complete this work including flowable fill, caps, coordination, cleaning, removal, abatement, transportation of and disposal of demolished materials, and for all other work and expenses incidental thereto for which payment is not provided under other items.

(18) –Sanitary Sewer Manholes (4-ft diameter)
A. Method of Measurement: Sanitary manholes accepted for payment shall be the actual vertical feet of structures installed and accepted complete in place, from the lowest invert to finish grade.
B. Basis of Payment:
1. The contract unit price per vertical foot shall be full compensation for all labor, materials, tools and equipment necessary to complete this work including excavation (except ledge excavation), bedding, furnishing and installing precast concrete sections, frames, covers, frost protective wrap, masonry materials, waterproofing, constructing inverts, backfilling including aggregate base and subbase material, compaction, cleaning, testing, maintaining existing flows during construction, and all else incidental thereto for which payment is not provided under other items.

2. Payment for this item shall be as follows:
   a. 90 percent of the unit price upon installation of manholes.
   b. 10 percent of the unit price upon successful completion of cleaning and final manhole testing.

(19) – Sanitary Sewer Manholes (5-ft diameter)
   C. Method of Measurement: Sanitary manholes accepted for payment shall be the actual vertical feet of structures installed and accepted complete in place, from the lowest invert to finish grade.
   D. Basis of Payment:
      1. The contract unit price per vertical foot shall be full compensation for all labor, materials, tools and equipment necessary to complete this work including excavation (except ledge excavation), bedding, furnishing and installing precast concrete sections, frames, covers, frost protective wrap, masonry materials, waterproofing, constructing inverts, backfilling including aggregate base and subbase material, compaction, cleaning, testing, maintaining existing flows during construction, and all else incidental thereto for which payment is not provided under other items.
      2. Payment for this item shall be as follows:
         a. 90 percent of the unit price upon installation of manholes.
         b. 10 percent of the unit price upon successful completion of cleaning and final manhole testing.

(20) - Manhole Drop Connections
   A. Method of Measurement: Manhole Drop Connections measured for payment shall be the actual vertical feet of pipe furnished and installed measured from the invert of inlet pipe to the lowest manhole invert.
   B. Basis of Payment: The contract unit price per vertical foot shall be full compensation for all labor, materials, tools and equipment necessary to complete this work including furnishing and installing pipe, fittings and pipe supports, constructing inverts and all else incidental thereto for which payment is not provided under other items.

(21) – Force Main Air Release and Drain Manholes
   A. Method of Measurement: Force main air release and drain manholes accepted for payment shall be the actual number of air release and/or drain manholes installed.
   B. Basis of Payment: Said per each price shall constitute full compensation for furnishing all labor, materials, tools and equipment necessary for constructing the air release and/or drain manholes complete, operational and satisfactorily tested,
including but not limited to: site preparation, dewatering, excavation and backfill (except rock excavation), bedding, furnishing and installing the precast structure, frame, cover, piping and combination air/vacuum release valve within the manhole (as applicable), couplings, appurtenances, fittings, pipe supports; cleaning; testing; and all else incidental thereto for which payment is not provided under other items.

(22), (23), (23a), (23b) & (24) – Initial Pavement (Binder Course without Overlay), Final Pavement (Finish Course without Overlay), Final Pavement (Finish Course – with Overlay Woods Road Only), Driveway Aprons-Woods Road Only, and Driveway Aprons (Hand Placed)

A. Method of Measurement:
1. The quantity of bituminous concrete pavement to be paid for under this item includes the number of tons of initial pavement (binder course), final pavement (wearing course), overlay paving (Woods Road Only), driveway apron pavement on Woods Road, driveway apron pavement in all other project areas (not otherwise included under another Bid item), and temporary pavement placed at the direction of the Engineer, calculated as described below, within the pavement limits shown on the Drawings. This pay item is not applicable to pavement at the Falmouth Road Pump Station site. Refer to Bid item 2.
2. Actual widths will be used in computing area wherever the width of pavement removed and replaced is less than the limits indicated on the Drawings.
3. The conversion factor to change volume of bituminous concrete pavement measured in place to tons will be 0.055 tons per square yard per inch of thickness.
4. Trench pavement shall include pavement placed in the roadway, from shoulder to shoulder. Hand placed pavement shall include driveway aprons outside the edge of road pavement.
5. Temporary pavement shall include pavement placed after the date (or temperature) requirements outlined in Specification 02513A cannot be met and as directed by the Engineer.

B. Basis of Payment:
1. Pavement shall be paid for at the Contract unit price per ton stated in the Bid Schedule.
2. Said unit price shall be full compensation for furnishing all materials, labor, equipment and tools necessary for the placement and removal of pavement, preparation of base material, application of tack coat, milling as noted, butt joints as noted, placement and grading of gravel shoulder material to match final pavement grade, and installation of pavement markings. No additional payment will be made to the contractor for repair work done in maintaining bituminous concrete pavement.
3. Overlay milling and butt joints along Wood Road, as noted on Final Trench Paving (with Overlay) detail, shall be paid for under the Driveway Aprons - Woods Road Only Bid item 23b.

(25) - Bituminous Curb

A. Method of Measurement: The quantity of replacement of bituminous curb to be paid for under this item shall be the linear feet of curb removed and replaced within the
payment limits defined in the Documents and directed by the Engineer. Curb removed for the convenience of, or damaged by the Contractor is not covered by this bid item.

B. Basis of Payment: Replacement of bituminous curb shall be paid for at the unit price per linear foot stated in the Bid Schedule. Said unit price shall be full compensation for all labor, materials, equipment and tools required for the removal and placement of bituminous curb including excavation and backfill, disposal of curb that is removed, placement of new curb, repair of loam and seed behind curb, and for all other work and expenses incidental thereto for which payment is not provided under other items.

(26) - Traffic Control

A. Method of Measurement: Traffic regulation and control will be paid for at the Lump Sum price as stated in the Bid Schedule.

B. Basis of Payment: Payment for traffic regulation and control shall constitute full compensation for all traffic regulation and control efforts and including all labor, materials, equipment and supervision required to provide comprehensive and professional traffic regulation and control at all project locations. The traffic control plan, temporary pavement markings for traffic re-routing and pedestrian safety, and temporary operation of the traffic signals at the intersection of Middle Road/Falmouth Road/Bucknam Road in coordination with the local police department are included in this item. Payment under this item will be made for full-time dedicated flaggers only. Part-time flaggers will not be considered adequate. Cost for police detail related to night work is included in this item. The lump sum shall be paid in partial payments over the course of the project, where the percentage paid is equal to the percentage of completion of the entire Contract.

(27) - Test Pit Excavation

A. Method of Measurement: The quantity to be paid for under this item shall be the actual number of test pits performed as authorized by the Engineer.

B. Basis of Payment: Test pit excavations shall be paid for at the unit price per each test pit as stated in the Bid Schedule. Said unit price shall be full compensation for furnishing all labor, tools, and equipment; for sawcut and removal of pavement, excavation (except ledge excavation), dewatering, backfill including aggregate base and subbase, compaction, temporary pavement; providing the test pit result information to the Engineer and for all other work and expenses incidental thereto for which payment is not provided under other items.

(28) - Landscaping

C. Method of Measurement: Landscaping measured for payment shall be the contract lump sum price installed and accepted complete in place for all landscaping unless otherwise included under a separate Pay Item in the Bid Schedule.

D. Basis of Payment: The Contract lump sum price for landscaping shall constitute full compensation for all labor, equipment and materials necessary to complete this work including providing, spreading and raking loam, providing fertilizer, lime, seed, water and mulch, and providing any special plantings, trees, shrubs and miscellaneous site restoration materials requested at the direction of the Owner and Engineer in order to
restore areas to their original condition, and all else incidental thereto for which payment is not provided under other items.

E. Note that landscaping related to the Pump Station Site is not included in this item and shall be paid for as part of Item 2.

(29) - Electrical Service Entrance Allowance – Falmouth Road Pump Station

A. Method of Measurement: Allowance of $20,000 to be included and carried in the Bid Schedule.
B. Basis of Payment:
   1. The allowance shall cover the cost charged to the Contractor by the local power utility for permanent electrical service to include replacement of the transformer, wiring and meter, service disconnection and re-energization. Excluded from this allowance are any costs associated with providing temporary services for Contractors use during construction, cost associated with coordination between Contractor and power utility, cost for duct bank from the transformer to the station, and other costs incurred by the Contractor for permanent electrical service beyond the charges by the local power utility.
   2. Payment for this item shall be on the basis of invoices presented by the local power utility to the Contractor for the work. No markup will be added by the Contractor to the power company invoice.

(30) - Top Flange and Web Painting – Spur Bridge

A. Method of Measurement: Protective Coating shall be measured by the lump sum method, complete and accepted. The limits shall be as described within the MTA Specifications in Appendix A.
B. Basis of Payment:
   1. All work for Protective Coating will be paid for at the lump sum price for the respective item. Payment will be full compensation for all work and materials needed to complete the item; coating and cleaning materials, testing, labor, surface preparation, all containment, environmental protections, cleaning, application, curing and repairs to coating.

(31) - Bottom Flange Painting – Spur Bridge

A. Method of Measurement: Protective Coating shall be measured by the lump sum method, complete and accepted. The limits shall be as described within the MTA Specifications in Appendix A.
B. Basis of Payment:
   1. All work for Protective Coating will be paid for at the lump sum price for the respective item. Payment will be full compensation for all work and materials needed to complete the item; coating and cleaning materials, testing, labor, surface preparation, all containment, environmental protections, cleaning, application, curing and repairs to coating.

END OF SECTION
SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION
   A. Work Included: To enable orderly review during progress of the work, and to provide for systematic discussion of problems, the Engineer will conduct project meetings throughout the construction period.
   B. Related work described elsewhere: The Contractor's relations with his subcontractors and materials suppliers and discussions relative thereto, are the Contractor's responsibility and are not part of project meetings content.
   C. A representative from the Woodlands Homeowners Association and/or Woodlands Club, Maine Turnpike Authority, Local Police Department, or other utility may attend project meetings including pre-bid meeting, pre-construction meeting, construction progress meetings or any special meetings called by the Owner or Engineer during the project.

1.2 QUALITY ASSURANCE
   A. Persons designated by the Contractor to attend and participate in the project meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS
   A. Agenda items: To the maximum extent practicable, advise the Engineer at least 24 hours in advance of project meetings regarding all items to be added to the agenda.
   B. Minutes: The Engineer will compile minutes of each project meeting and will furnish a copy to the Contractor. The Contractor may make and distribute such other copies as he wishes.

PART 2 - PRODUCTS
   (No products are required in this Section.)

PART 3 - EXECUTION

3.1 MEETING SCHEDULE
   A. Except as noted below for Preconstruction Meeting, project meetings will be held monthly. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION
   A. To the maximum extent practicable, meetings will be held at the job site in the Engineer's field office.
3.3 PRECONSTRUCTION MEETING
A. Preconstruction meeting will be scheduled within twenty days after the Effective Date of the Agreement, but before the Contractor starts work at the site. Provide attendance by authorized representatives of the Contractor and all major subcontractors. The Engineer will advise other interested parties and request their attendance.
B. Minimum agenda: Distribute data on, and discuss:
   1. Identification of key project personnel for Owner, Engineer, Contractor, funding/regulatory Agencies.
   2. Responsibilities of Owner, Engineer, Resident Project Representative, Contractor.
   3. Channels and procedures for communications.
   4. Construction schedule, including sequence of critical work.
   5. Easements, permits.
   6. Contract Documents, including distribution of required copies of original documents and revisions.
   7. Processing of Shop Drawings and other data submitted to the Engineer for review.
   8. Processing of field decisions and Change Orders.
   9. Rules and regulations governing performance of the Work, including funding/regulatory Agency requirements.

3.4 PROJECT MEETINGS
A. Attendance: To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work. The Superintendent shall attend. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the Work are involved.
B. Minimum agenda:
   1. Review, revise as necessary, and approved minutes of previous meeting.
   2. Review progress of the Work since last meeting, including status of submittals for approval.
   3. Review schedule of work to be accomplished prior to next meeting.
   4. Discuss monthly partial payment request.
   6. Identify problems which impede planned progress.
   7. Develop corrective measures and procedures to regain planned schedule.
   8. Complete other current business.

END OF SECTION
SECTION 01310

CONSTRUCTION SCHEDULES – SHORT FORM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Within ten (10) days after the effective date of the Agreement between Owner and Contractor submit to the Engineer an estimated progress schedule as specified herein.

B. Form of Schedules:
   1. Narrative: Completely describe the construction methods to be employed.
   2. Network Analysis System:
      a. Provide a separate horizontal schedule line for each trade or operation and show concurrent and preceding activities.
      b. Present in chronological order the beginning of each trade or operation showing duration and float time.
      c. Scale: Identify key dates and allow space for updating and revision.
   3. Mathematical Analysis:
      a. A mathematical analysis shall accompany the network diagram. A computer printout will be acceptable.
      b. Information shall be included on activity numbers, duration, early start, late start, etc. and float times.

C. Content of Schedules:
   1. Provide complete sequence of construction by activity:
      a. Shop Drawings, Project Data and Samples:
         i. Submittal dates.
         ii. Dates reviewed copies will be required.
      b. Decision dates for:
         i. Products specified by allowances.
         ii. Selection of finishes.
      c. Estimated product procurement and delivery dates.
      d. Dates for beginning and completion of each element of construction.
   2. Identify work of separate phases and logically grouped activities.
   3. Show the projected percentage of completion for each item of work as of the first day of each month.
   4. Provide separate sub-schedules, if requested by the Engineer, showing submittals, review times, procurement schedules, and delivery dates.

D. Updating:
   1. Show all changes occurring since previous submission.
   2. Indicate progress of each activity, show completion dates.
   3. Include:
      a. Major changes in scope.
      b. Activities modified since previous updating.
      c. Revised projections due to changes.
      d. Other identifiable changes.
4. Provide narrative report, including:
   a. Discussion of problem areas, including current and anticipated delay factors.
   b. Corrective action taken, or proposed.
   c. Description of revisions that may affect schedules.

1.2 SUBMITTALS
   A. Submit updated schedules with each progress payment request.
   B. Submit 4 copies of initial and updated schedules to the Engineer.

1.3 SCHEDULE LIMITATIONS
   A. In-Stream Work
      1. As required by Maine DEP and the U.S. Army Corps of Engineers, all work to be performed in-stream for culvert replacement on Middle Road must be completed between July 15th and September 30th.

END OF SECTION
SECTION 01320
SAFETY AND HEALTH PLAN

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work, as outlined herein and in the General and Special Conditions of the Contract Documents. Within 10 days after the effective date of the Agreement between Owner and Contractor, submit to the Engineer a Safety and Health Plan as specified herein. Refer to submittals section below.
   2. Contractor shall comply with all applicable Laws and Regulations related to the safety of persons or property, or for the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
   3. Contractor shall designate a qualified and experienced safety representative (OSHA defined "Competent Person") at the site whose duties and responsibilities shall be the prevention of accidents and maintaining and supervising of safety precautions and programs, including a "Job Hazards Analysis".
   4. The Contractor shall be solely responsible to provide all labor, equipment, and utilities sufficient to ensure no construction noise, particulates, or odors, are allowed to accumulate to levels which adversely affect health or work in, or near the construction area.

B. Content of Safety and Health Plan:
   1. Prepare complete safety and health plan in accordance with the requirements of CFR Title 29 Part 1926 - Safety and Health Regulations for Construction.
      a. Provide documentation that Contractor's hazardous communication program is up to date.
      b. Provide documentation that Contractor's safety training is up to date.
      c. Prepare a project specific Safety and Health Plan addressing construction safety issues, including but not limited to excavations, fall protection and egress, COVID-19 infection prevention protocols, as well as provisions for construction in hazardous environmental conditions at the Falmouth Road Pump Station. The hazardous environmental conditions at the Falmouth Road Pump Station include, but are not limited to, confined space entry and electrically classified spaces.
   2. Safety provisions for confined space entry shall follow the requirements of CFR Title 29 Part 1926, Subpart AA – Confined Spaces in Construction and will be incorporated into the Safety and Health Plan.
      a. The Owner has provided Table 1 at the end of this Section listing confined space locations which may be encountered during the execution of this Contract. The Contractor is required to perform a site evaluation to
identify all hazards and potential hazards in work areas whether included in Table 1 or not, prior to control of site.

b. The Contractor shall be responsible for all aspects of construction site safety including development of appropriate confined space entry procedures. The plan shall include, but not necessarily be limited to, the following:

i. Definitions
ii. Confined Space Evaluations
iii. Equipment Selection
iv. Confined Space Entry Training Documentation
v. Permit Required Confined Space Entry Requirements
vi. Testing (Monitoring) and Ventilation
vii. Confined Space Entry Permit Form
viii. Rescue and Emergency Procedures
ix. Emergency Contact Information

c. The Contractor shall inform the Owner and Engineer's representative whenever work will be performed in a confined space and the permit space program that the Contractor will follow.

d. The Contractor shall inform the Owner and Engineer's representative of any hazards confronted or created during entry operations, either through a briefing or during the entry operation.

e. The Contractor will coordinate entry operations with the Owner when both Owner personnel and Contractor personnel will be working in or near permit spaces.

f. The Owner, Engineer, their representatives, independent testing laboratories and government agencies, when inspecting the site, shall be supplied by the Contractor proper safety equipment when entry into a confined space is required.

3. The Owner has provided Table 2 at the end of this Section listing the spaces that are considered “classified” per NFPA 820 (Standard for Fire Protection in Wastewater Treatment and Collection Facilities) where the Contractor may be required to carry out work tasks. The Contractor is required to perform a site evaluation to identify all hazards and potential hazards in work areas whether included in Table 2 or not, prior to control of site. Contractor shall implement appropriate safety precautions and/or construction practices to comply with classification requirements. Contractor shall ensure that all employees and subcontractors working in these areas have received appropriate training and are properly equipped in accordance with Contractor's Safety and Health Plan.

C. Updating:

1. Contractor shall be responsible for updating the Safety and Health Plan as appropriate throughout the course of the construction period.

1.2 SUBMITTALS

A. Submit the Contractor's site-specific Safety and Health Plan to the Engineer, in accordance with Section 01340. Submit hardcopy submittals, if required.

B. Submit updated Safety and Health Plans as necessary during the course of the project.
C. The Safety and Health Plan is provided “for information only” to inform the Owner, Engineer and Resident Project Representative of the project specific safety program requirements; however, if the Safety and Health Plan incomplete (e.g., missing elements relevant to the project work), inadequate (e.g., outdated qualifications) or not project-specific, it will be returned “revise and resubmit”. Delays related to an incomplete Safety and Health Plan are the responsibility of the Contractor.

D. The Contractor will overview the plan with the Owner (and staff), Engineer (and Resident Project Representative) prior to work beginning at the project site, and subsequently when/if the safety plan is updated.

E. Contractor's most current Safety and Health Plan shall be available at the construction site throughout the construction project.

1.3 ON-SITE COORDINATION MEETINGS
A. Contractor shall review key aspects of Safety and Health Plan at the Pre-Construction Meeting, and subsequent on-site safety informational meeting.
B. Contractor shall report to Engineer and Owner at each progress meeting concerning compliance with the Safety and Health Plan for the most recent construction period and new considerations and requirements for the upcoming period.
C. Contractor shall hold weekly on-site coordination meetings with Resident Project Representative and Owner to ensure that Owner's staff is aware of key Safety and Health Plan requirements of the current phase of construction.

1.4 OWNER’S CONFINED SPACE ENTRY PROGRAM INFORMATION
A. A copy of the Owner’s Confined Space Entry Program is available for viewing at the facility and is not included herein.

1.5 SITE-SPECIFIC INFORMATION
A. Refer to Tables 1 and 2 as follows for site specific information.

| TABLE 1 |
| FALMOUTH SEWER SYSTEM |
| CONFINED SPACES LISTING |

<table>
<thead>
<tr>
<th>Confined Space Location</th>
<th>Hazard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falmouth Road Pump Station - Wet Well and Valve Vault</td>
<td>Possible lack of oxygen or presence of explosive or hazardous gases - Hydrogen Sulfide.</td>
</tr>
</tbody>
</table>

Note: This list has been provided by the Owner based upon their knowledge of the site and may not include all site hazards. Its intent is to aid the Contractor in determining the magnitude of effort needed to fulfill the safety and health requirements of this Contract.
**TABLE 2**

**FALMOUTH SEWER SYSTEM**  
**CLASSIFIED SPACES LISTING (NFPA 820)**

<table>
<thead>
<tr>
<th>Location</th>
<th>NFPA 820 Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falmouth Road Pump Station – Wet Well</td>
<td>Class 1, Division 1</td>
</tr>
<tr>
<td>Falmouth Road Pump Station – Valve Vault</td>
<td>Class 1, Division 2</td>
</tr>
</tbody>
</table>

Note: This list has been provided by the Owner based upon their knowledge of the site and may not include all site hazards. Its intent is to aid the Contractor in determining the magnitude of effort needed to fulfill the safety and health requirements of this Contract.

**END OF SECTION**
SECTION 01340

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Submit all shop drawings, operations and maintenance manuals, Manufacturers' certificates, project data, and samples required by the Specifications.
B. Related Work Specified Elsewhere:
   1. Construction Schedules: Section 01310
   2. Project Record Documents: Section 01720
   3. General Conditions: Section 00700.
C. Submittals: This project shall utilize:
   1. Submittals – Electronic via Web-Based Software with Hard Copy for Record
      a. The Contractor shall utilize the web-based software provided by the Engineer for the Project Team. The Contractor shall provide contact information for its members of the Project Team for the web-based software. The Contractor shall conform to the format and work-flow of the web-based software provided for the Project.
      b. The Contractor shall submit to the Engineer an electronic submittal of shop drawings and O&M Manuals in portable document format (PDF) transmitted via the provided web-based software tool. The Engineer shall return an electronic PDF of the submittal review comments to the Contractor through the provided web-based software tool. The electronic submittals shall serve as the electronic record of the project.
      c. In addition, completed shop drawings and completed operations and maintenance (O&M) manuals shall be provided in hard copy (paper) format, for the record, in accordance with the following requirements.
         i. Shop drawings and O&M manuals shall be considered “completed” once an action code of “0” or “1” has been attained, as specified below, unless otherwise directed by the Engineer.
         ii. Once completed, the Contractor shall provide three hard copy sets (for Owner, Engineer and Resident Project Representative, respectively).
         iii. Hard copy submittals shall be updated on a monthly basis, for those submittals completed during the preceding month.

1.2 SHOP DRAWINGS
A. Shop Drawings are required for each and every element of the work.
B. Shop Drawings are generally defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the Contractor, their subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.
C. The Contractor shall provide a completed Contractor Submittal Certification Form (copy provided for Contractor’s use at the end of this Specification Section) which shall be attached to every copy of every shop drawing and signed by the Contractor and Manufacturer (where applicable). Shop Drawings shall show the principal
dimensions, weight, structural and operating features, space required, clearances, type
and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of
the drawing. When it is customary to do so, when the dimensions are of particular
importance, or when so specified, the drawings shall be certified by the manufacturer
or fabricator as correct for the work.
1. Each shop drawing submittal shall include a complete copy of the relevant
specification section markup up to reflect “compliance” or “deviation” on an
item-by-item basis.

D. Shop Drawings shall be submitted as a complete package by specification section,
unless otherwise reviewed and approved by the Engineer. It is the intent that all
information, materials and samples associated with each specification section be
included as a single submittal for the Engineer's review. Any deviation from this
requirement, shall be requested in writing with an anticipated shop drawing
breakdown/schedule prior to any associated submittal. An exception to this
requirement are shop drawings for reinforcing steel, miscellaneous metals and
structural steel, which shall be submitted separately for each structure unless
otherwise permitted by the Engineer.

E. The Contractor shall be responsible for the prompt and timely submittal of all shop
and working drawings so that there shall be no delay to the work due to the absence
of such drawings.

F. No material or equipment shall be purchased or fabricated especially for the Contract
until the required shop and working drawings have been submitted as hereinabove
provided and reviewed for conformance to the Contract requirements. All such
materials and equipment and the work involved in their installation or incorporation
into the Work shall then be as shown in and represented by said drawings.

G. Until the necessary review has been made, the Contractor shall not proceed with any
portion of the work (such as the construction of foundations), the design or details of
which are dependent upon the design or details of work, materials, equipment or other
features for which review is required.

H. All shop and working drawings shall be submitted to the Engineer by and/or through
the Contractor, who shall be responsible for obtaining shop and working drawings
from their subcontractors and returning reviewed drawings to them. Shop drawings
shall be formatted to standard paper sizes to enable the Owner to maintain a
permanent record of the submissions. Approved standard sizes shall be: (a) 24 inches
by 36 inches; (b) 11 inches by 17 inches, and (c) 11 inches by 8-1/2 inches. Provision
shall be made in preparing the shop drawings to provide a binding margin on the left
hand side of the sheet. Shop drawings submitted other than as specified herein may
be returned for resubmittal without being reviewed.

I. Only drawings which have been checked and corrected by the fabricator should be
submitted to the Contractor by their subcontractors and vendors. Prior to submitting
drawings to the Engineer, the Contractor shall check thoroughly all such drawings to
confirm that the subject matter thereof conforms to the Drawings and Specifications
in all respects. All drawings which are correct shall be marked with the date,
checker's name, and indication of the Contractor's approval, and then shall be
submitted to the Engineer.

J. If a shop drawing shows any deviation from the Contract requirements, the Contractor
shall make specific mention of the deviations in the transmittal. Shop Drawings that
contain significant deviations that are not brought to the attention of the Engineer may be subject to rejection.

K. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, Contractor shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications.

L. A maximum of two submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Contractor. Any additional submissions which are ordered by the Engineer to fulfill the stipulations of the Drawings and Specifications, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Drawings and Specifications, or to make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each Shop Drawing, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon Engineer's documentation of time and rates established for additional services in the Owner-Engineer Agreement for this Project, may be deducted from the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely fashion. Resubmittals for the sole purpose of providing written responses to review comments will not be considered a resubmittal counting towards the two submission limit.

M. Shop Drawings that include drawings or other material that is illegible or too small may be returned without review.

N. American Iron & Steel certifications must be submitted with the initial shop drawing.

1.3 SAMPLES
A. The Contractor shall submit samples when requested by the Engineer to establish conformance with the specifications, and as necessary to define color selections available. Submittals of “samples” shall be documented through the electronic submittal process by including a photograph of the item(s) and indicating the date the sample was mailed and/or delivered.

1.4 OPERATION AND MAINTENANCE MANUALS
A. Operation and Maintenance (O&M) Manuals are required for certain elements of the project, as specified herein.
B. The Contractor shall provide a completed Operation and Maintenance Manual Certification Form (copy provided for Contractor's use at the end of this Specification Section) which shall be attached to every copy of every Manual and signed by the Contractor and Manufacturer.
C. Each hard copy of an O&M Manual shall be provided in a stand-alone binder or shall be suitable for insertion into a 3-ring binder. Include the General Contractor's and Manufacturer's representative's contact information on the front cover. O&M manuals must be appropriate for the project and customized for the project. If a Manufacturer's standard O&M manual is included in the submittal, all non-applicable content must be removed or crossed out.
D. O&M Manuals shall contain the following operational information:
   1. Safety Precautions: List personnel hazards, equipment or product safety precautions for all operating conditions.
2. Operator Prestart: Include all procedures required to set up and prepare each system, equipment or component for use.
3. Startup Procedures: Provide a narrative description for all startup operating procedures, include all control sequences.
4. Shutdown Procedures: Provide a narrative description for all shutdown operating procedures, include all control sequences.
5. Post-Shutdown Procedures: Provide a narrative description for all post-shutdown operating procedures, include all control sequences.
6. Normal Operating Procedures: Provide a narrative description of normal operating procedures. Include control diagrams with data to explain operation and control of systems and specific equipment.
7. Emergency Operations: Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.
8. Operator Service Requirements: Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, alignment, spare parts installation and gage reading or recording.
9. Environmental Conditions: Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which the equipment should not be allowed to run.

E. O&M Manuals shall contain the following maintenance information:
1. Lubrication Data: Include a table showing recommended lubricants for specific temperature ranges and applications. Also, include charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, capacities and a lubrication schedule showing service interval frequency
2. Preventative Maintenance Plan: Include the manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation as well as to ensure minimization of corrective maintenance and repair. Provide the manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide the manufacturer's specified frequency and procedures for each separate operation.
3. Troubleshooting Guides: Include recommendations on procedures and instructions for correcting problems and making repairs. Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
4. Wiring and Control Diagrams: Provide Wiring diagrams and control diagrams. All diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction
of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to the actual installation numbering.

5. Maintenance and Repair Procedures: Include instructions and list the tools required to restore products and/or equipment to proper conditions or operating standards.

6. Removal and Replacement Instructions: Include step-by-step procedures, list required tools/supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

7. Spare Parts and Supply Lists: Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration shall be required for facilities at remote locations. List spare parts and supplies that have a long lead times to obtain.

8. Corrective Maintenance Work Hours: Include the manufacturer's projection of corrective maintenance work-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

F. O&M Manuals shall contain the following additional information:

1. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirements to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items.
   a. When illustrations omit a part number and description, both the illustration and a separate listing shall show the index, reference, or key number which shall cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

2. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force. Include warranty information for all primary components included in product systems.

3. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

4. Testing and Special Tools: Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.
5. Contractor Information: Provide a list that includes the name, address, and telephone number of the General Contractor and each subcontractor installing the respective product or equipment. Include local representatives and service organizations most convenient to the project site. Provide the name, address, and telephone number of the product or equipment manufacturers.

6. Written confirmation from the manufacturer that the Contractor has coordinated the equipment One Year Service Call in accordance with specification Section 01800, par. 1.1, A, 2.

1.5 MANUFACTURER’S CERTIFICATES
A. Prior to accepting the installation, the Contractor shall submit manufacturer's certificates for each item specified.

B. Such manufacturer's certificates shall state that the equipment has been installed under either the continuous or periodic supervision of the manufacturer's authorized representative, that it has been adjusted and initially operated in the presence of the manufacturer's authorized representative, and that it is operating in accordance with the specified requirements, to the manufacturer's satisfaction. All costs for meeting this requirement shall be included in the Contractor's bid price.

1.6 SUBMISSION REQUIREMENTS
A. Accompany submittals with a transmittal cover sheet, containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. The sequential shop drawing number for each shop drawing, project data and sample submitted shall be:
      a. Specification Section number followed by a dash and then a sequential number beginning with 01 (e.g., 16000-01).
      b. Under limited situations when additional different pieces of equipment are submitted under the same specification section, those submittals shall be numbered sequentially (e.g. 05500-01, 05500-02, 05500-03, etc.).
      c. Resubmittals shall include an alphabetic suffix after the corresponding sequential number (e.g., 16000-01A).
      d. O&M submittals shall be numbered with the Specification Section number followed by a dash, the letters “OM”, another dash, and then a sequential number beginning with 01 (e.g. 16000-OM-01). Resubmittals of O&Ms shall include an alphabetic suffix after the corresponding sequential number (e.g. 16000-OM-01A).

B. A completed Contractor Submittal Certification Form shall be attached to each hardcopy and electronic PDF of each shop drawing and must include:
   1. Project name
   2. Specification Section and sequential number with alphabet suffix for resubmittal
   3. Description
5. Contractor's stamp, initialed or signed, certifying review of the submittal, verification of field measurements and compliance with Contract Documents.
6. Where specified or when requested by the Engineer, manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements.
7. Where specified, manufacturer's guarantee.

C. Additional Requirements for Electronic Submittals:
1. Each individual shop drawing or O&M submittal shall be contained in one PDF.
2. The first page of the PDF shall be the Contractor Submittal Certification Form as described above.
3. The electronic PDF shall be exactly as submitted in the hardcopy.
4. The electronic PDF shall include an electronic table of contents that is bookmarked for each section of the submittal.
5. The electronic PDF shall be configured such that is fully searchable.
6. PDF versions of 24x36 drawings shall be converted to 24 x 36 PDFs so as not to lose the clarity of the original drawing.
7. Electronic PDF submittals that are not submitted in accordance with the requirements stated above will not be reviewed by the Engineer.
8. Electronic submittals shall be transmitted via the protocol established in Part 1 above.

1.7 RESUBMISSION REQUIREMENTS
A. Revise initial submittals as required and resubmit as specified for initial submittal.
B. Indicate on submittals any changes which have been made other than those required by Engineer. All renumbering of shop drawings, relabeling of individual pieces or assemblies or relocating of pieces or assemblies to other Drawings within the submittal shall be clearly brought to the attention of the Engineer. If relabeling of individual pieces or assemblies has taken place, the labels from the previous submittal shall be indicated to assist in comparing the original and resubmitted shop drawing.
C. All resubmittals shall include a summary of the previous submittal review comments with the vendors’ written response as to how the previous comments were addressed.

1.8 ENGINEER'S REVIEW
A. The review of shop and working drawings hereunder will be general only, and nothing contained in this specification shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.
B. The Engineer's review comments will be summarized on a Submittal Review Form, which includes an action code. A description of each action code is provided below.
1. No Exceptions Taken (Status 0 on shop drawing log). The shop drawing complies with the Contract Document requirements. No changes or further information are required. Where appropriate, the submittal review form will be used to alert the Contractor, Owner and Field personnel of remaining items within that specification section that still needs to be submitted.
2. Make Corrections Indicated (Status 1 on shop drawing log). The shop drawing complies with the Contract Document requirements except for minor changes,
as indicated. Engineer requires that all comments will be addressed by the Contractor, unless otherwise notified in writing prior to execution of the relevant work.

3. Conditional to Remarks (Status 2 on shop drawing log). The shop drawing potentially complies with the Contract Document requirements, contingent upon satisfactory resolution of review comments. Remarks will explicitly list what information needs to be resubmitted. Resubmittal from the Contractor should include a cover letter or summary which indicates how each review comment has been addressed. **This action code will not be used, or will be sparingly used, for electronic submittals.**

4. Revise and Resubmit (Status 3 on shop drawing log). The shop drawing does not comply with the Contract Document requirement as submitted, but may with changes indicated and/or submission of additional information. The entire package must be resubmitted with the necessary information and a cover letter which indicates how each review comment has been addressed and where to find the information in the resubmittal.

5. Rejected (Status 4 on shop drawing log). The shop drawing does not comply with the Contract Document requirements, for the reasons indicated in the remarks, and is unacceptable.

6. For Information Only (Status 5 on shop drawing log). The shop drawing review was for information only.

7. In Review (Status 6 on shop drawing log). The shop drawing is currently under review.
CONTRACTOR SUBMITTAL CERTIFICATION FORM

PROJECT: ______________________  CONTRACTOR'S PROJ. NO: ________________

CONTRACTOR: ___________________  ENGINEER'S PROJ. NO: _________________

ENGINEER: ______________________

SHOP DRAWING NUMBER: ______________________

SPECIFICATION SECTION OR DRAWING NO: ______________________

SEQUENTIAL NUMBER (& ALPHA SUFFIX FOR RESUBMITTAL)

MANUFACTURER: ______________________

The above referenced submittal has been reviewed by the undersigned and I/we certify that the material and/or equipment meets or exceeds the project specification requirements with

☐ NO DEVIATIONS

or

☐ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS a:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

By: ____________________________  By: ____________________________

Contractor b

Manufacturer c

Date: __________________________  Date: __________________________

a Any deviations not brought to the attention of the Engineer for review and concurrence shall be the responsibility of the Contractor to correct, if so directed.
b Required on all submittals
c When required by specifications

General Contractor's Stamp

Page ___ of ___
OPERATIONS AND MAINTENANCE MANUAL CERTIFICATION FORM

PROJECT: ______________________  CONTRACTOR'S PROJ. NO: ______________

CONTRACTOR: __________________  ENGINEER'S PROJ. NO: ______________

ENGINEER: ______________________

O&M NUMBER: _______________  SPECIFICATION SECTION OR DRAWING NO: _______________

SEQUENTIAL NUMBER & ALPHA SUFFIX FOR RESUBMITTAL

DESCRIPTION: ______________________

MANUFACTURER: ______________________

The above referenced operations and maintenance manual has been reviewed by the undersigned and I/we certify that the manual is customized as needed for this project, is suitable for mounting in a 3-ring binder, and contains the following items:

- Table of Contents
- Contractor and Manufacturer Contact Information
- Preventative Maintenance Schedule and Summary
- Removal and Replacement Instructions
- Lubrication Schedule
- Troubleshooting Information
- Warranty Information
- Rebuild Information for All Components
- Startup, Operation and Shutdown Procedures
- Normal and Emergency Operations
- Safety Procedures and Precautions
- Shop Drawings corrected to As-Built Conditions
- Personnel Training Requirements
- Project-Related Design Data
- Serial Numbers
- Maintenance and Repair Procedures
- Wiring and Control Diagrams
- Equipment Drawings & Schematics
- Equipment Performance Curves
- Parts and Service Contact Information
- Manufacturer's Contact Information
- Emergency Operations Plan
- List of All Component Part Numbers
- List of Spare Parts Supplied
- Testing Equipment & Special Tools
- Other System Specific Information

By: ___________________________  By: ___________________________
Contractor a  Manufacturer b

Date: ___________________________  Date: ___________________________

a Contact information shall include name, address and telephone number.
b Required on all Operation and Maintenance Manuals.
c When required by Specifications.
PROCESS EQUIPMENT MANUFACTURER SUBMITTAL CERTIFICATION
(Divisions 11 and 14)

Owner: ___________________________ Date: ___________________________

Project: ______________________________________________________________________________________

Contractor: ______________________________________________________________________________________

Equipment Manufacturer: __________________________________________________________________________

Equipment: ______________________________________________________________________________________

As an authorized representative of the equipment manufacturer, the undersigned certifies that the
equipment listed above conforms to the requirements of Section 11000, Part 1.3.K. The
undersigned authorized representative of the manufacturer further certifies that the equipment
manufacturer or supplier has: reviewed the Construction Documents, the intended installation by
the Contractor, and the intended functional and operational conditions; determined all conditions
to be acceptable; and found no conditions which would cause the warranty to be void; or the
equipment to function improperly, or not meet the performance requirements.

______________________________________________________________________________________________

(Authorized Representative of the Manufacturer) (Date)

END OF SECTION
SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Extent of Work:
   1. Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the Work for the Falmouth Road Pump Station Upgrades and Middle Road Culvert Replacement pay items, as specified herein and in other provisions of the Contract Documents. The breakdown for these lump sum items shall divide the Work into its appropriate component parts together with a quantity and a unit price for each part such that the sum of the products of quantities and unit prices will equal the contract price for the items.
   2. The required testing for gravity sewers (all sizes), force main (all sizes), and sanitary sewer manholes, as specified, shall be broken out separately from the installation-related components of the Work on the schedule of values.
   3. Coordinate with the Engineer regarding the level of detailed warranted for the project.
B. Related Work Specified Elsewhere:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections of these Specifications.
   2. Schedule of values is required under the General Conditions.
   3. Schedule of values is required to be compatible with applications for progress payment.

1.2 QUALITY ASSURANCE
A. Use required means to assure arithmetical accuracy of the sums described.
B. When so required by the Engineer, provide copies of the subcontracts or other data acceptable to the Engineer substantiating the sums described.

1.3 SUBMITTALS
A. Prior to first application for payment, submit a proposed schedule of values to the Engineer.
   1. Secure the Engineer's approval of the schedule of values prior to submitting first application for payment.

END OF SECTION
SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Pre-Construction Record: Contractor shall take digital photographs and video to obtain a visual record of the project area prior to beginning any work at the project site.

1.2 QUALITY
A. Pre-Construction Record: Quality shall be such that the condition of existing pavement, curbing, driveway entrances, sidewalks, walls, doors, equipment, piping, etc. can be readily determined.

1.3 SUBMITTAL OF PRINTS
A. Pre-Construction Record:
   1. Submit pre-construction photographs/videos in accordance with Section 01340 prior to initiating any work on-site.
B. The quality of the photos and video are subject to approval by the Engineer.
C. Photographs and videos taken for the project and submitted are released to the Owner and Engineer for reproduction and use for records retention, governmental and commercial purposes.

END OF SECTION
SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED
A. General Quality Control.
B. Workmanship.
C. Manufacturer's Instructions.
D. Manufacturer's Certificates.
E. Manufacturer's Field Services.
F. Testing Laboratory Services.

1.2 RELATED REQUIREMENTS
A. Section 00700 - General Conditions: Inspection and testing required by governing authorities.
B. Section 01340 - Submittals: Submittal of Manufacturer's Instructions
C. Section 02200 - Earthwork
D. Section 02513 – Bituminous Concrete Paving
E. Section 03300 - Cast-in-Place Concrete
F. Section 03305 - Concrete Testing
G. Section 03930 – Concrete Coatings
H. Section 05120 - Structural Steel

1.3 QUALITY CONTROL
A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.4 WORKMANSHIP
A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
B. Perform work by persons qualified to produce workmanship of specified quality.
C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 MANUFACTURERS' INSTRUCTIONS
A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

1.6 MANUFACTURERS' CERTIFICATES
A. When required by individual Specifications Section, submit manufacturer's certificate that products meet or exceed specified requirements.

1.7 MANUFACTURERS' FIELD SERVICES
A. When specified in respective Specification Sections, require supplier and/or
manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to make appropriate recommendations.

B. Representative shall submit written report to Engineer listing observations and recommendations.

1.8 TESTING LABORATORY SERVICES

A. Owner will employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services wherever an Independent Testing Laboratory is required by individual specification sections listed in paragraph 1.2 above, unless otherwise indicated.

B. Services will be performed in accordance with requirements of governing authorities and with specified standards.

C. Reports will present observations and test results and indicate compliance or non-compliance with specified standards and with Contract Documents. Independent Testing Laboratory will submit one copy of each report directly to each of the following: Engineer, Resident Project Representative, Contractor. Reports will be submitted within 5 days of obtaining test results. If test results indicate deficiencies, Independent Testing Laboratory shall telephone or email results to Engineer, Resident Project Representative and Contractor within 24 hours.

D. Contractor shall cooperate with Independent Testing Laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.

E. Contractor shall notify Engineer at least one full working day prior to needing testing laboratory services. Engineer will notify Independent Testing Laboratory. If scheduled tests or sampling cannot be performed because the work is not ready as scheduled, testing costs associated with the delay will be determined by Engineer and invoiced by Owner to Contractor. If unpaid after 60 days, the invoice amount will be deducted from the Contract Price. If adequate notice is not provided, Contractor shall suspend work on that portion of the Project until testing can be performed. Such suspension will not be grounds for a claim against the Owner for delay, nor will it be an acceptable basis for an extension of time.

F. Payment for Independent Testing Laboratory services shall be as follows:
   1. General: Where testing is the Owner's responsibility, payment will be made as stated below unless other requirements are given in Specification Sections. Testing which is the responsibility of the Contractor will be considered an incidental item unless otherwise indicated in Section 01150, Measurement and Payment.
   2. Initial Testing: Owner will pay for initial tests.
   3. Retesting: Costs of retesting due to non-compliance will be paid by Owner. The cost of retesting will be determined by Engineer and Owner will invoice Contractor for this cost. If unpaid after 60 days, the invoice amount will be deducted from the Contract Price.
   4. Contractor's Convenience Testing: Inspections and tests performed for Contractor's convenience will be paid for by Contractor.
PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION
SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
1. This specification is intended for use if the Contractor’s construction sequencing will require the use of temporary electric utility power at the pump station(s) to maintain pumping capabilities and to facilitate construction activities.
2. Provide and pay for all temporary utilities required to properly perform the Work at no additional cost to the Owner including the placement and removal of the utilities.
3. Completely remove all temporary equipment and materials upon completion of the Work and repair all damage caused by the installation of temporary utilities.
4. Make all necessary applications and arrangements for light and electric power with the local electric power company. Notify the local electric power company if unusually heavy loads, such as welders, will be connected.
5. Provide temporary protection of existing concrete tanks and other unheated concrete structures taken out of service for the General Contractor to complete the Work as indicated on the Contract Documents in that area.
6. Contractor shall provide temporary ventilation during construction as required to ensure a safe working environment. The temporary ventilation systems shall address the following conditions, including but is not limited to: removal of hazardous fumes from explosion-proof rated spaces (Class 1, Division 1 rated spaces), removal of paint fumes and other potentially toxic conditions associated with the contractor's activities and ventilation of confined spaces, in compliance with all OSHA and State safety requirements.

1.2 QUALITY ASSURANCE
A. Requirements of Regulatory Agencies:
1. Obtain permits as required by local governmental authorities.
2. Obtain easements, when required, across private property other than that of the Owner for temporary power service.
3. Comply with the latest National Electrical Code.
4. Comply with all local, State and Federal codes, laws, and regulations.
B. All temporary utilities are subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Electrical:
1. The General Contractor shall make necessary arrangements with the local power company for connection to the existing power supply and shall provide
and pay for all temporary light and power requirements except as otherwise specified hereunder. In general, the temporary electrical service shall include all necessary switches, poles, wiring, cables, conduit, raceways, panelboards, fixtures, lamps and receptacles to supply construction power of adequate capacity for the project. Temporary transformers and meters shall be furnished and installed by the appropriate power authority, but paid for by the General Contractor, who shall be responsible for making all arrangements for their installation prior to using any existing power for temporary purposes.

2. Use new or used materials adequate in capacity for the purposes intended.

3. Materials must not create unsafe conditions or violate the requirements of applicable codes.

4. Conductors:

5. Wire, cable or busses of appropriate type, sized in accordance with the latest National Electrical Code for the applied loads.

6. Use only UL approved wire.

7. Conduit:


9. Electrical metallic tubing: ANSI C80.3.

10. Other material approved by NEC.

11. Equipment: Provide appropriate enclosures for the environment in which used in compliance with NEMA Standards.

12. Temporary power shall be based upon the following minimum requirements:

13. Lighting - 300 watt per 1,000 square feet of floor area.

14. Receptacles - One 15 ampere duplex for 1,000 square feet of floor space.

15. Special Construction Equipment - Provide one 30-amp, 2-pole fused switch for equipment connection. The cost for cables and connection from switch to the special equipment will be borne by the Sub-Contractor requiring same.

16. The General Contractor will pay for the cost of energy consumed by all trades, including cost of lamp replacement. The General Contractor and Subcontractors of all trades shall furnish their own extension cords and such additional lamps as may be required for their work, shall pay for the cost of temporary wiring of a special nature for light and power required, other than that above mentioned.

17. All temporary work shall be furnished and installed in conformity with the National Electrical Code and in accordance with local ordinances and requirements of the municipal power authority. All temporary wiring and accessories shall be removed after it has served its purpose.

B. Heating and Ventilation:

1. The General Contractor shall furnish, install, and maintain a complete temporary heating and ventilation systems, including fuel therefore, which will provide heat and ventilation as required by the trades and for the protection of personnel in the work spaces, and stored and installed materials from injury as can be caused by dampness and cold. The General Contractor shall employ, within the terms of the General Contract, a competent watchman who will maintain and operate the systems, as required. The General Contractor shall bear all costs incurred from the temporary heating and ventilation from the time
the systems are first required until the date of Substantial Completion of the
General Contract, as defined in the General Conditions and Supplementary
Conditions.
2. Temporary heating equipment must be smokeless and fumeless type,
Underwriters Laboratories, Factory Mutual, Fire Marshal and Engineer
approved, and will fulfill the heating requirements specified hereunder.

C. Water and Sanitary:
1. All lines, temporary or permanent, shall be protected and maintained by the
General Contractor. Temporary lines shall be removed by the General
Contractor when the temporary service is no longer required.
2. The General Contractor shall provide an adequate drinking water supply,
satisfactorily cooled, for his employees.
3. The General Contractor shall furnish, install, maintain and pay for adequate
temporary chemical type toilet accommodations, for all persons employed on
the work and located where approved by the Engineer. The accommodations
shall be in proper enclosures and in accordance with Municipal Ordinances and
shall be maintained in proper, safe and sanitary conditions and suitably heated
when requested.
4. Relocate temporary toilet facilities as required to facilitate the construction.
5. Remove all temporary facilities at completion of work when directed by the
Engineer.

D. Protection of Existing Concrete Tanks and other Unheated Concrete Structures taken
out of Service:
1. The General Contractor shall provide protection as required to maintain the
surface temperatures of the existing concrete above 40 degrees F during the
months of November through March and other periods during which the
ambient air temperature is below 32 degrees F. The General Contractor shall
be responsible for all means and methods to maintain the specified temperature
at no additional cost to the Owner.
2. The General Contractor shall furnish and monitor surface thermometers on the
concrete surfaces.
3. The above listed requirement is a minimum required to prevent the structure
from freezing. If the nature of the work within the structure requires a greater
air temperature to perform the work (such as application of coatings), the
requirements of Part D.1.B shall apply.
4. If, in the opinion of the Engineer, the work required in the unheated structure is
of a short duration or the anticipated ambient air temperatures will not drop
below 40 degrees F, additional protection as required in Part D.1 may not be
required. The General Contractor shall still be responsible for monitoring the
temperature of the concrete surfaces and providing protection if they drop
below 40 degrees F.

PART 3 - EXECUTION

3.1 PERFORMANCE
A. Electrical:
1. Provide electrical energy to:
   a. All necessary points on the construction site so that power can be obtained at any desired point with extension cords no longer than 100 feet.
   b. Construction site offices, as applicable.
   c. Lighting as required for safe working conditions at any location on the construction site.
   d. When applicable, Owner's present facilities during the changeover of electrical equipment.

2. Maintain electrical energy throughout the entire construction period.

3. Capacity:
   a. Provide and maintain adequate electrical service for construction use by all trades during the construction period at the locations necessary, as specified herein.

4. Installation:
   a. Install all work with a neat and orderly appearance.
   b. All installations shall be performed by a qualified electrician.
   c. Modify service as job progress requires.
   d. Locate all installations to avoid interference with cranes and materials handling equipment, storage areas, traffic areas and other work.

B. Heating and Ventilation:
   1. Maintain a heated and ventilated environment for the work at the temperature and for the length of time specified or as directed by the Engineer, and as needed to protect all individuals on the construction site.
   2. Precaution:
      a. Operate temporary heating apparatus in such a manner that finished work will not be damaged.
      b. Repair all damage, caused by temporary heating operations, to the complete satisfaction of the Engineer.

C. Water:
   1. Provide and maintain water for drinking and construction purposes as required for the proper execution of the Work.

D. Sanitary Accommodations:
   a. Provide and maintain sanitary accommodations for the use of the employees of the General Contractor, subcontractors, and Engineer.
   b. Sanitary accommodations shall meet the requirements of all local, State and Federal health codes, laws and regulations.

E. Protection of Existing Tanks and other Unheated Structures taken out of Service:
   1. The General Contractor shall provide protection and/or heat as required to maintain the specified temperature of the existing structure.
   2. The General Contractor shall document the condition of the structures immediately after they are taken out of service with either still photos or video.
   3. Precaution:
      a. If additional heat is required, operate temporary heating apparatus in such a manner that the existing structure will not be damaged.
      b. Repair all damage, caused by temporary heating operations, to the complete satisfaction of the Engineer.
4. The General Contractor shall repair any concrete damaged as a result of the surface temperatures of the concrete dropping below 40 degrees F.

END OF SECTION
SECTION 01515

TEMPORARY BYPASS PUMPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION
A. The Contractor shall design, furnish, install, test, operate, maintain and remove temporary bypass pumping system(s) in order to divert sewage flow around the work area. Temporary bypass pumping system(s) shall be fully automated and able to reliably convey the full range of wastewater flows, as scheduled herein.
B. The Contractor shall furnish the necessary labor and 24-hour supervision to set up and operate the specified pumping and bypass system(s).
C. Additional Requirements Specified Elsewhere:
   1. Summary of Work: Section 01010
   2. Submittals: Section 01340
   3. Site Piping, Sewer Line Cleaning, Television Inspection of Sewers, Final Sewer Testing and Sewer Flow Control: Division 2

1.2 QUALITY ASSURANCE
A. All system components specified herein shall be furnished by a Supplier who regularly engages in temporary bypass pumping systems. Supplier shall have a minimum of 15 years of experience with temporary bypass pumping systems. Supplier shall provide at least 5 references of project of a similar size and complexity as this project that have been performed within the past 5 years within New England.
B. Supplier shall have sufficient equipment and spare parts inventory to perform normal rentals, including this project, and maintain at least 100% reserve equipment for this project for immediate delivery. Supplier shall have sufficient service personnel to provide service calls within 4 hours, 24 hours per day, 7 days per week.
C. Temporary bypass pumping systems shall be:
   1. Godwin Pumps, Manchester, New Hampshire;
   2. Baker Corp, Oxford, Massachusetts;
   3. or equal.
D. A qualified representative of the Supplier shall inspect the installation and supervise the startup and testing of the temporary bypass pumping system.
E. The temporary bypass pumping system shall meet all applicable local, state and federal requirements.

1.3 SUBMITTALS
A. In accordance with the requirements of Section 01340.
   1. Qualifications information
   2. Proposed schedule, sequence of construction, duration of activities and description of sewer control methods to be utilized for each element of the project.
3. Coordination Drawings showing detailed layout of equipment, pumps, suction piping, discharge piping, fittings, valves, supports, materials, temporary enclosure and temporary odor control provided under this section.

4. List of duty equipment, pumps, piping, fittings, valves, and materials to be utilized by the Contactor for the temporary bypass pumping system.

5. List of standby equipment and spare parts available on-site and off-site in order to ensure uninterrupted operation of the bypass pumping system in the event of a utility power failure.

6. Fuel consumption rate at full speed duty and standby pumping.

7. Fuel storage tank and secondary containment provision, including Spill Prevention Control and Countermeasure (SPCC) Plan, if applicable.

8. Catalog cut sheets/ technical data for equipment and appurtenances.

9. Performance curves for wastewater bypass pumps and suction lift, static head, headloss, and total dynamic head (TDH) calculations.

10. Description of maintenance procedures to be utilized.

11. Description of controls and alarm equipment to be utilized. Sample alarm log.

12. Names of individuals responsible for on-call response, 24 hours per day, 7 days per week. Call list for alarm response.

B. No construction related activities requiring the need for bypass pumping operations shall begin until the related project submittals are reviewed and all provisions of the work have been fully coordinated with the Owner, Agency, Engineer and any other parties having jurisdiction for the proposed work activities.

PART 2 - PRODUCTS

2.1 WASTEWATER BYPASS PUMPING SYSTEM

A. Pumping Equipment:

1. Temporary bypass pumping system(s) shall be designed to convey the full range of flows and head conditions as scheduled herein.

<table>
<thead>
<tr>
<th>FALMOUTH ROAD PUMP STATION</th>
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<tbody>
<tr>
<td>Duty</td>
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<tr>
<td>Duty Pumps</td>
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<tr>
<td>Standby Pumps</td>
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<tr>
<td>Variable Speed Required for Duty Pumps</td>
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<tr>
<td>Existing Peak Inst. Flow (for bypassing via existing 6-inch force main) <em>see note below.</em></td>
</tr>
<tr>
<td>Future Peak Inst. Flow (for bypassing via extended force main including new 8-inch force main extension)</td>
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<tr>
<td>Force Main</td>
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* Note: The peak inst. flow rate for bypassing via the existing 6-inch force main shall not be exceeded to avoid overwhelming the Pinehurst Drive Pump Station’s hydraulic capacity.
2. Each pump shall be a skid-mounted unit. The pump system may utilize available on-site manholes, junction/splitter structures, and/or tankage for suction and discharge, as appropriate.

3. The pumps shall be centrifugal trash pumps suitable for handling raw, unscreened sewage with solids up to 3 inches in diameter, and capable of running completely dry for extended periods of time without damage. Pumps shall be capable of static suction lifts to 28 vertical feet, at sea level.

4. The pump priming system shall be fully automatic, needing no form of adjustment or manual addition of water. The priming system shall be capable of priming the pump from a completely dry casing.

5. All pumps shall be critically silenced to less than 68 decibels at 25 feet.

6. Contractor shall provide appropriately sized portable spill guard containment dikes to contain leaks resulting from the pumping system, from the fuel storage tanks(s) and/or from the pumps and process piping within 5 feet of the system.

B. Piping

1. Suction piping and discharge piping shall be constructed of one of the following:
   a. Rigid galvanized steel pipe with ball and socket joints, Bauer HK Quick Coupling Piping or equal.
   b. Fused HDPE piping
   c. Connection to existing piping shall be made with equivalent materials.

2. Aluminum "irrigation" type piping or glued PVC pipe shall not be allowed.

C. Controls and Alarms

1. The pump set shall be furnished with a weather-proof automatic control system consisting of floats and/or transducer level controls.

2. The controller shall start/stop the pumps based on signals from high- and low-level floats or a transducer. The controller shall be capable of automatically varying the pump speed to match varying flow conditions and maintain a constant suction level, if scheduled herein.

3. The controller shall annunciate and log all alarm conditions including but not limited to high upstream water level, duty pump failure, utility power loss and standby pump failure. The alarm log shall include the type of alarm, time of alarm, time alarm acknowledged, and time alarm condition cleared. Annunciation shall be via teledialer, two-way radio, cellular telephone, or equivalent.

PART 3 - EXECUTION

3.1 COORDINATION OF WORK

A. Provide all labor and equipment necessary to coordinate work of this section and maintain communications.

B. Notify all personnel, including but not limited to Owner, Engineer and applicable Utility Companies, seven days in advance of any temporary bypass pumping work. The Owner will identify personnel to be notified in addition to those identified by the Contractor.

C. Contractor shall coordinate temporary bypass pumping operations with the Owner and Engineer on a daily basis.
3.2 PERFORMANCE:

A. General
1. The Contractor shall install and test all sewer flow control methods to the satisfaction of the Owner and Engineer prior to proceeding with the Work.
2. The Contractor shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.
3. Any temporary pumps, piping, fuel storage, or other appurtenances associated with the temporary pumping system shall be either located above the 100-year flood elevation or protected against flotation or other damage which would be caused by a flood event.

B. The temporary bypass pumping system shall be furnished, installed, tested, operated, maintained and removed as follows:
1. The Contractor shall furnish, install, and test temporary bypass pumping system and discharge pipelines.
2. The Contractor shall test and debug all systems and verify that all necessary equipment, materials, spare parts, and labor are available on-site prior to operation of the system and prior to the demolition of any part of the existing pumping station facilities.
3. The Contractor shall operate and maintain the system until the new Work is completed, demonstration tested and accepted by the Owner and Engineer.
4. Contractor shall be responsible for making all regulatory reporting notifications for any release of wastewater or fuel to the environment including but not limited to, calling the Maine DEP oil spill response program at 1-866-DEP-SPIL (1-866-337-7745). Contractor shall provide copies of notifications to the Owner and Engineer.
5. The Contractor shall anticipate that the Owner will require 2 calendar days of operation on the new, permanent Work following satisfactory completion of demonstration testing prior to beginning disassembly of the temporary bypass pumping system.
6. Upon receipt of approval by the Owner and Engineer, the Contractor shall disassemble and remove the temporary bypass pumping system, including all appurtenant piping. Contractor shall restore the area impacted by the temporary bypass pumping system to a like-new condition.

C. Contractor shall be responsible for cleanup, repairs, restoration and fines required to address spills or overflows from a failed bypass pumping system.

END OF SECTION
SECTION 01546

USE OF EXPLOSIVES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Drilling, blasting, and removal of all ledge within the limits of excavation as indicated on the Contract Drawings.
   2. Pre-blast and post-blast surveys of existing structures and utilities.
   3. Seismic monitoring and documentation of all blasting.

1.2 REFERENCES
B. US Department of Interior Bureau of Mines – Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting (RI 8507)
C. Occupational Safety and Health Administration (OSHA) 29 CFR 1910.109 Explosives and Blasting Agents
D. State Blasting Regulations
E. Local Blasting Regulations

1.3 QUALITY ASSURANCE
A. Perform all blasting operations, including, but not limited to transportation, storage, handling, use and disposal, in accordance with all applicable Local, State and Federal laws, ordinances and code requirements, including NFPA 495 and 29 CFR 1910.109, unless otherwise specified herein.
B. All blasting operations shall be performed by a single firm.
C. Qualifications:
   1. Blasting Subcontractor:
      a. Shall possess a current blasting license issued by the appropriate regulatory authority within the project state.
      b. Shall have a minimum 5-years’ experience on similar blasting projects.
   2. Seismic Monitoring Subcontractor:
      a. Shall be experienced in the use of seismographs and interpreting the information recorded.
      b. Shall have a minimum 5 years’ experience on similar blasting projects.
      c. shall be selected and employed by the General Contractor.
      d. may be the Blasting Subcontractor, upon approval of the Engineer.
   3. Pre-Blast and Post-Blast Survey Subcontractor:
      a. Shall be experienced in conducting pre-blast and post-blast surveys and documenting existing conditions of structures, buildings, utilities and monuments.
      b. Shall have a minimum 5 years’ experience on similar projects.
      c. Shall be selected and employed by the General Contractor.
D. The Blasting Subcontractor shall secure and pay for all necessary blasting permits,
and furnish proof of permitting by all Local and State departments having jurisdiction.

E. A Pre-Blast Meeting shall be conducted, at the discretion of the Owner and Engineer, by the Blasting Subcontractor to discuss blasting procedures prior to the commencement of blasting operations. The meeting shall be attended by the Engineer, Owner, Blasting Subcontractor, Seismic Monitoring Subcontractor, pre-blast and post-blast Survey Subcontractor, and local utility companies.

**SUBMITTALS**

A. Submit qualifications of the Blasting Subcontractor, Seismic Monitoring Subcontractor and Pre-Blast/Post-Blast Subcontractor, including the names and qualifications of the individuals who will be directly responsible for the work.

B. Blasting Subcontractor – proof of liability insurance and permitting shall be submitted prior to mobilization of blasting materials.

C. Submit pre-blast survey documentation/report.

D. Submit blasting plan prior to the commencement of the blasting operations. The blasting plan shall include the following:
   1. All equipment that will be used in the blasting operations.
   2. Methods of matting or covering the blast area in open excavations to prevent flyrock and excessive air overpressure (airblast), and dust and fume mitigation.
   3. Estimates of ground vibration at adjacent structures and/or monitoring locations based on the proposed blasting plan and distances to adjacent structures and/or monitoring locations.

E. Submit a monitoring plan prepared by the Seismic Monitoring Subcontractor with the coordination of the Blasting Subcontractor. The monitoring plan shall include the following:
   1. Specifications of proposed instruments used to monitor ground vibrations and air overpressure. Submit calibration documents from within the past year.
   2. Plan indicating Blasting and Seismic Monitoring locations relative to existing buildings and/or other structures.

F. Submit post-blast survey documentation/report.

**PART 2 - PRODUCTS**

2.1 **MATERIALS**

A. Explosive charges and detonation devices shall be of a type suitable for the intended use. The use of blasting materials shall meet the manufacturer’s specifications and safety requirements.

**PART 3 - EXECUTION**

3.1 **PRE-BLAST SURVEY**

A. Prior to commencing blasting operations and prior to installing excavation support systems, the Contractor shall perform a pre-blast survey. The pre-blast survey may be attended by the General Contractor, Blasting Subcontractor, Owner and Engineer. General Contractor and/or Blasting Subcontractor shall give Owner and Engineer 24-hr notice prior to scheduling surveys to allow Owner and Engineer to witness the survey if desired.
B. The structures to be surveyed shall be within 500 feet in all directions from the edge of each blasting locale as shown on the seismic monitoring plan. Structures to be surveyed, and their distance from the blast site may be influenced by the blast design, predicted vibration level and site specific public relations requirements.

C. The pre-blast survey shall include color photographs and/or high definition videos of all structures, buildings (including items such as bridges, dams, etc.) and water supply wells within the pre-blast survey zone. The photos and videos shall include both the exterior of each building and structure and all accessible interior rooms of each building, at the discretion of the property owner. All photos shall have the date permanently imprinted on the image.

D. Prior to blasting, all wells shall be documented and tested as follows:
   1. Flow test to measure the yield.
   2. Water quality tests by a State certified laboratory for bacteria and turbidity.

E. The Owner will coordinate access for survey work on adjacent properties.

F. The Pre-Blast Survey Subcontractor shall submit a final report, which shall include the following:
   1. Dated photographs with written identification of each, and/or high definition video of all buildings and other structures surveyed.
   2. A written report shall be submitted a minimum of one week prior to commencement of blasting operations or excavation support system installation. The report will be made available to property owners on an as needed basis, with the cost borne by the Owner. The report shall include the following for each building, other structure, and wells:
      a. Location and description.
      b. Description of the overall condition.
      c. Noted physical deficiencies, cracks, pertinent elevations and other physical conditions that could be potentially affected by blasting operations.
      d. Yield and water quality test results of each water supply well.

3.2 PERFORMANCE - GENERAL

A. Drilling and blasting materials and methods shall be those necessary to accomplish ledge excavation required for completion of the work indicated on the Contract Drawings.

B. Blasting shall not commence until the pre-blast survey has been completed, submitted and accepted by the Engineer.

C. All explosives shall be stored and handled in a secure manner, in compliance with all Local, State and Federal laws, ordinances, and code requirements. Storage locations shall be legibly marked (vehicles placarded), and daily-use quantities limited to such quantities as may be needed for the current workday, including those necessary for changing site conditions. Explosives shall not be stored on site during non-working hours.

D. All blasting shall be performed in accordance with all Local, State and Federal laws, ordinances and code requirements.

E. All blasting areas shall be properly identified with appropriate signs or identification markers as required by law. Blasting signs notifying those approaching the blast site shall be placed at each entrance to the site or blasting area. Blasting notification signs
shall be left in place while the above conditions prevail. Immediately remove signs after blasting operations have been completed.

F. All blasting shall be conducted within the hours of 7 a.m. – 5 p.m. from Monday through Friday. Any and all blasting outside of these time limits shall be subject to approval from the Owner, and shall be in compliance with all Local, State and Federal laws, ordinances and code requirements.

G. All safety precautions shall be taken to protect individuals in the direct vicinity of the blasting operations. Blasting mats or other means to prevent flying rock shall be utilized.

H. Conduct blasting operations such that damage is prevented to adjacent buildings, other structures, water supply wells, public domain, natural resources and habitat. Acceptable peak particle velocity limits and peak air overpressure limits shall not be exceeded.

I. General Contractor shall notify each property owner and public utility company with buildings or other structures within a minimum 500-foot radius of the site work at least 10 days prior to initiating pre-blast surveys to enable the owners to take such steps as they may deem necessary to protect their property. The actual blasting program to be implemented may require notification beyond the 500-foot radius. Notice shall be published in a local paper no more than 30 days and no less than 10 days prior to the initiation of the blasting.

J. General Contractor shall notify the Engineer at least 72 hours prior to commencing blasting operations.

K. An audible warning system shall be employed to warn all persons on site of blasting operations. Do not perform blasting work until the area is cleared and secure. Take appropriate precautions to prevent individuals from entering the blasting area. Provide sufficient flagmen outside the danger zone to stop all approaching traffic and pedestrians. The audible system shall include a warning that blasting is to commence, and notification that blasting is complete. Signs explaining the audible warning system shall be posted prior to blasting.

L. When blasting in areas where rock removal is required adjacent to and below existing structures, care shall be taken at the excavation limits to minimize over-blasting (back break or side break) and fracturing of remaining rock. Hydraulic hammer line drilling, presplit, or other means may be required to minimize the impact to the remaining rock relative to the site-specific conditions and geologic structure.

M. Perform at least one small controlled test blast prior to commencement of production blasting in order to substantiate, or if necessary adjust, the proposed blast design to ensure vibration and overpressure limits are not exceeded. Coordinate scheduling of test blast/s with Engineer.

3.3 VIBRATION CONTROL
A. All blasting operations shall be conducted to limit ground vibrations to acceptable limits to help ensure that adjacent structures and buildings are not damaged.

B. Acceptable ground vibration limits shall be:
   1. The following vibration limits (Peak Particle Velocity in inch/sec) shall be adhered to based upon the USBM Alternative Blasting Level Criteria (adopted from RI 8507, 1980) relative to vibration frequency of blasts:
      a. Greater than 40 Hz - Maximum PPV = 2.0 in/s
b. Greater than 30 Hz but not more than 40 Hz - Maximum PPV = 1.5 in/s

c. Greater than 20 Hz but not more than 30 Hz - Maximum PPV = 1.0 in/s

d. Not more than 20 Hz - Maximum PPV = 0.5 in/s

C. The peak air overpressures measured at the nearest above grade occupied structure shall not exceed 133 dB (0.014 psi).

D. Blasting shall not be permitted less than 72 hours after completion of any and all concrete placements within 250 feet. Blasting shall not be permitted less within 100 feet of freshly placed concrete until such concrete has cured for a minimum of 72 hours and has attained 33% of its 28-day design strength.

E. Adherence to the above listed limits shall not relieve the Contractor of the responsibility to protect existing structures.

3.4 BLASTING DOCUMENTATION (BLAST LOGS)

A. The Blasting Subcontractor shall prepare and maintain copies of all blasting logs which shall include, but not be limited to, the following information:

1. Date, time and location of blast.
2. Diagram of blast pattern showing the number, diameter, depth, subdrill, distribution, and powder factor for the explosives used per hole and per blast.
3. Sequence and schedule of blasting rounds and delay pattern.
4. Blast evaluations.
5. Weather and temperature conditions.

B. For each blast at all blast sites, the Seismic Monitoring Subcontractor shall monitor the blasting vibrations and overpressures at a minimum of two buildings or other structures within 500 feet of each blast. This may be adjusted dependent upon the blast design and site-specific conditions as deemed necessary. One monitoring location shall be the nearest structure. Monitoring locations shall preferably be in different directions from the blast. The buildings or other structures to be monitored shall be mutually agreed upon by the Engineer, General Contractor, and Blasting Subcontractor. Blast monitoring shall commence just before the blasts are set off. Record vibration and overpressure measurements, which shall include, but not be limited to:

1. Identification of monitoring instrument, and serial number.
2. Calibration certificate dated within the past year.
3. Name of instrument operator.
4. Building or other structure at which the monitoring instrument is located, and distance from such structure.
5. Distance and direction of monitoring instrument from blast site.
6. Date and time of reading.
7. Type of ground at recording station.
8. Peak particle velocity and frequency for all components (vertical, radial and perpendicular).
9. Values of air overpressure.
10. Printed copies of measurement readings.
11. Blast vibration and air overpressure measurement records shall be made available to Owner and Engineer on a weekly basis as deemed necessary, or as requested.
C. **Crack Monitors:**

1. Where required, crack monitors shall be installed by the Seismic Monitoring Subcontractor. They may be required on structures that are within the zone of displacement or heave of the blast (within 20 feet), and/or at cracks in concrete and/or masonry that are greater than 1/16 inches (1.6 mm) wide and within 250 feet of the blast area. Crack monitor locations shall be as determined by the Engineer, Contractor, Blasting Subcontractor, or Seismic Monitoring Subcontractor. All crack monitors shall be documented on plans of the buildings or structures with reference numbers for each monitor.

2. All cracks shall be measured and documented prior to commencement of blasting. Crack widths shall be measured to the nearest 0.10 millimeters.

### 3.5 POST-BLAST SURVEY

A. After conclusion of all blasting work, perform a post-blast survey shall be conducted at all building, structures and water supply wells that were part of the pre-blast survey. The survey may be attended by the General Contractor, Blasting Subcontractor, Engineer, and Owner. A report comparing the pre and post-blast conditions shall be provided.

### 3.6 DAMAGE TO STRUCTURES AND BUILDINGS

A. The General Contractor shall be responsible for all damages caused by blasting operations regardless of the adherence to specified vibration limits.

B. Such damage shall be repaired by the General Contractor at no additional cost to the Owner. The General Contractor shall submit proposed repairs, which shall be reviewed by the Engineer with no exceptions taken. Damages shall be defined as:

   1. Physical damage to the structure or building.
   2. Newly formed cracks in concrete or masonry.
   3. Substantial increase in width and/or length of existing cracks in concrete or masonry.
   4. Structure or building movement.
   5. Reduction in water supply well yield or water quality.

C. The extent of damages caused by blasting operations shall be determined by the Engineer. The Engineer will notify the General Contractor in writing of all damages caused by blasting operations. Disputes shall be resolved based on review of the pre-blast and post-blast surveys, seismic readings, etc.

END OF SECTION
SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.1 DESCRIPTIONS
   A. Work Included:
      1. Furnish and apply water or calcium chloride on the road surfaces within the
         construction site, when required to control dust and when directed by the
         Engineer.
      2. When dust control is not included as a separate item in the Contract, the work
         shall be considered incidental to the appropriate items of the Contract.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Water for Sprinkling:
   B. Clean, free of salt, oil, and other injurious matter.
   C. Calcium Chloride:
      1. Meet the requirements of AASHTO M144.

PART 3 - EXECUTION

3.1 APPLICATION
   A. Water:
      1. Apply water by methods approved by the Engineer.
      2. Use approved equipment including a tank with gauge equipped pump and spray
         bar.
   B. Calcium Chloride:
      1. Apply at a rate sufficient to maintain a damp surface but low enough to assure
         non-contamination of water courses.
      2. Apply water prior to calcium chloride addition.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Provide all materials and perform all work necessary to completely regulate traffic in the area of Work.
   2. Perform all work in such a manner as to provide safe passage at all times for the public and with a minimum of obstruction to traffic.
   3. Do not close roads or streets to passage of the public without the permission of the proper authorities.
B. The local police department and Maine Turnpike Authority (where applicable) will decide if safe passage is being maintained and shall have the authority to require the Contractor to take any additional steps necessary to maintain safe passage. If the Authority furnishes an inspector on the job as a result of poor traffic control by the Contractor, the Contractor shall be responsible for all costs assessed by the Authority.
C. Minimize the length of delays or traffic stoppage to the extent practicable. Maximum traffic stoppage time shall be 10 minutes.
D. Traffic control shall be maintained at all times while construction vehicles and equipment are in operation along traveled ways.

1.2 SUBMITTALS
A. Develop a project specific traffic control plan that meets the requirements of Manual of Uniform Traffic Control Devices (MUTCD) and any local and state requirements.
B. Contractor shall submit Traffic Control Plan to Owner, Engineer, Local Police Department and Maine Turnpike Authority for review prior to commencement of construction activities. The Traffic Control Plan shall include, but is not limited to, the following elements:
   1. Portions of the Traffic Control Plan on Maine Turnpike Authority property will be prepared in accordance with latest version of Maine Turnpike Authority standards:
   2. Traffic Control Plan submittal will be provided to Maine Turnpike Authority for approval prior to commencement of construction activities.
   3. Traffic Control Plan shall indicate signs and traffic control methods to be used and locations to be used.
   4. Traffic Control Plan submittal will be provided to the Engineer and Owner for general information only.
C. The Contractor’s designated traffic control representative shall respond to all traffic safety complaints and be available to direct traffic control subcontractors the entire time work is occurring on site. If the designated representative is not on site for a
period of time, another on site representative shall be designated by the Contractor for that period.

1.3 SCHEDULING WORK
A. During the Project Pre-Construction Meeting one Contractor representative will be designated as the coordinator between the Police Department, Maine Turnpike Authority and subcontracted traffic control.
B. Variable Message Signs notifying the public of pending road closure and/or construction must be in place at least seven days prior to road closure or as required by local Police Department and Maine Turnpike Authority.
C. Schedule all work so that two adjacent parallel streets are not closed to passage by the public at any one time, if at all possible.
D. Revise the plan of work if it will create a traffic hazard or an unreasonably long detour.
E. Do not start work in any new location without the permission of the Engineer.
F. Notify all police and fire departments of all scheduled detours and when streets are reopened.
G. Refer to Appendix A for Maine Turnpike Authority work scheduling restrictions on Maine Turnpike Authority property.

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND BARRICADES
A. Traffic control (plans, methods and devices) shall be as outlined in Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) as published by U. S. Department of Transportation, and any local and state requirements.
B. Provide adequate warning signs, barricades, signal lights, flaggers/uniformed police officers, and take other necessary precautions for the safety of the public.
C. Provide and illuminate suitable warning signs to show where construction, barricades or detours exist.
D. Provide digital message boards at appropriate locations as determined by the local police department and/or the Maine Department of Transportation to maintain safe passage of traffic and work zone.
E. Provide barricades of substantial construction and painted with a finish that increases visibility at night, as outlined in the MUTCD.
F. Keep signal lights illuminated at all barricades and obstructions from sunset to sunrise.
G. Maintain all necessary signs, barricades, lights, watchmen and other safety precautions during authorized suspension of the Work, weekends, holidays or other times when the Work is not in progress.
H. Contractor shall make periodic inspection throughout the day of the traffic control patterns, methods, signs and other devices to ensure that they are properly placed.

2.2 UNIFORMED POLICE OFFICER
A. A uniformed police officer is a police officer (local, county or state) on regular or special duty dressed in uniform with the necessary high visibility vest and apparel needed for traffic control.
B. Arrange the police detail with the local Chief of Police, County Sheriff, or State Police Captain depending on jurisdiction.
C. Note that local police department will require a police detail for night work with a lane closure.

2.3 FLAG PERSON
A. A flag person is a trained and certified individual assigned specifically to the task of directing traffic and is outfitted in the necessary high visibility vest and apparel needed for traffic control.
B. Flag persons shall be provided by the Contractor.

PART 3 - EXECUTION

3.1 DETOURS
A. Provide, identify and maintain suitable detours when the project, or any part thereof, is closed to public travel.
B. When the closed part of the project is reopened, restore the detour area and any other disturbed areas to the original condition.

3.2 INCONVENIENCE TO RESIDENTS OF VICINITY
A. Whenever a traveled way is closed, perform the Work in such a manner that local travel, residents and businesses in the vicinity of the Work will be inconvenienced as little as possible.
B. Allow access to residents and abutting land owners along the project to driveways and other normal outlets from their property.

3.3 TRAFFIC CONTROL OFFICERS
A. Where required by the local, county or state police departments and/or when specified, traffic control officer shall be Uniformed Police Officers.
B. Where the local, county or state police departments do not wish to or are unable to furnish traffic control officers and/or when specified, the traffic control officers shall be flag person.

END OF SECTION
SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Provide and erect sign(s) at the project site to identify the project and to indicate the applicable Federal and State Government Agencies that are participating in the development of the project.
   B. Do not place, or allow the placement of, other advertising sign boards at the project site or along rights-of-way furnished for the project work.

PART 2 - PRODUCTS

2.1 MATERIAL AND DESIGN

A. Construct a sign of 3/4-inch exterior grade, high density overlaid plywood or other material, approved by the Engineer, suitable for signs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Erect the sign in a prominent location as approved by the Engineer.
B. Construct the sign in accordance with the sample drawing provided in the Specifications.
C. Remove the sign when the Work has been completed at no additional cost to the Owner.
SECTION 01600
DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.1 DESCRIPTION
A. This Section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the work. An updated delivery and storage log is required with the monthly payment requisition prior to approval. An example log is included in this section.
B. Related Items:
   2. Section 11000: Equipment - General.

1.2 TRANSPORTATION AND DELIVERY
A. Transport and handle items in accordance with manufacturer’s instructions.
B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than 120 days prior to installation without written authorization from the Engineer.
C. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for the protection of components.
D. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended, including cross reference of the applicable contract specification section.
E. Deliver spare parts at the same time as pertaining equipment. Deliver spare parts to the Owner after completion of work.
F. Deliver products to the site in manufacturer’s original sealed containers or other packing system, complete with instructions for handling, storing, unpacking, protecting and installing.
G. Instructions for handling, storing, unpacking, protecting and installing equipment shall be included in the Equipment O&M Manuals, which shall be submitted prior to the equipment being shipped to the site. This information shall be filed in a dedicated three ring binder(s) on-site, in the Contractor trailers, accessible to the Owner and Engineer. The binder(s) shall be clearly labeled, and include dividers for each specification section. The manufacturer-provided instructions for each equipment item shall be labeled with the specification number, equipment name, and equipment number. The instructions shall also be submitted to the Engineer.
H. Assume responsibility for equipment material and spare parts just before unloading from carrier at site.
I. All items delivered to site shall be unloaded and placed in a manner which will not hamper the Contractors normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
J. Provide equipment and personnel to unload all items delivered to the site.
K. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify the Engineer in writing of any problems.

L. Pay all demurrage charges if failed to promptly unload items.

1.3 STORAGE AND PROTECTION

A. Store and protect products and equipment in accordance with the manufacturer’s instructions, with seals and labels intact and legible. Storage instructions shall be studied by the Contractor and reviewed with the Engineer by them. Instructions shall be carefully followed and a written record of this kept by the Contractor for each product and pieces of equipment.

B. Arrange storage of products and equipment to permit access for inspection. Periodically, inspect to make sure products and equipment are undamaged and are maintained under specified conditions.

C. Provide protective maintenance during storage consisting of manually exercising equipment, inspecting mechanical surfaces for signs of corrosion or other damage, lubricating, applying any coatings as recommended by the equipment manufacturer necessary for its protection and all other precautions to assure proper protection of all equipment stored and for compliance with manufactures requirements related to warranties.

D. Store loose granular materials on a solid flat surface in a well-drained area. Prevent mixing with foreign matter.

E. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking and spalling to a minimum.

F. All mechanical and electrical equipment and instruments shall be covered with canvas and stored in a weather tight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it shall be satisfactory to the Engineer.

1. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by manufacturer.

2. Moving parts shall be rotated at a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal “welding”. Log all rotation maintenance for each piece of equipment in the written record noted above.

3. Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use. Log all startup for each piece of equipment in the written record noted above.

4. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
5. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor’s expense.

G. The weather tight building shall be provided with adequate heating/cooling and ventilation as required by the manufacturer to prevent condensation. Maintain temperature and humidity within range required by manufacturer and to prevent condensation on the equipment being stored.

H. Temporary heating and cooling is acceptable. Equipment shall be protected from environmental effects as required by the manufacturer and dependent on the season. Equipment that arrives on site without coating shall be protected from environmental impacts through coating or protection at the Contractor’s expense. Any equipment that displays defects or corrosion from environmental impacts will not be accepted for installation.

I. The location of all stored material and equipment shall be reviewed with the Owner and Engineer. The Owner and Engineer may request that equipment and material be moved to an alternate location to accommodate plant maintenance and operation, or if the location is deemed unacceptable or unsuitable.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING MONTHLY LOG
A. An updated storage and delivery log is required with the monthly payment requisition prior to approval.

B. The monthly log shall include the specification section, equipment description, equipment tagging, submittal approval date, date of equipment delivery, date of O&M submittal, contractor start-up sign-off, certified equipment testing date, operator training date, spare parts turnover date, required maintenance (activity and date), and equipment turnover (Owner’s witness and date).

3.2 STORAGE AND PROTECTION
A. Equipment requires acceptance and verification of the storage from the Owner, Engineer, Manufacturer and Contractor at the Engineer’s discretion.

B. Following delivery, the equipment warranty from the Manufacturer is the responsibility of the Contractor.

C. All storage and maintenance will be the responsibility of the Contractor, conducted at the Contractor’s expenses and verified by the Engineer.

D. It is the Contractor’s responsibility to coordinate all storage requirements on site as required by the Manufacturer to achieve acceptance.
## Section 01600 Delivery, Storage and Handling

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Equipment Description</th>
<th>Equipment Tags</th>
<th>Submittal Approved</th>
<th>Date of Equipment Delivery¹</th>
<th>Date of O&amp;M Submittal</th>
<th>Equipment Start-Up²</th>
<th>Certified Equipment Testing</th>
<th>Operator Training</th>
<th>Spare Parts Turnover</th>
<th>Required Maintenance by Contractor (activity &amp; date)</th>
<th>Equipment Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date</td>
<td>Witness</td>
<td>Date</td>
<td>Date</td>
<td>Owner's Witness Date Date</td>
<td>Date</td>
</tr>
</tbody>
</table>

1. If equipment is delivered and placed in storage, all steps for Stored Equipment shall be followed and tracked separately
2. Log weekly start-ups of installed equipment, performed by Contractor, until Equipment Turnover

END OF SECTION
SECTION 01710
PROJECT CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
   2. At completion of work, remove waste materials, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces. Leave project clean and ready for use.

1.2 QUALITY ASSURANCE
A. Requirements of Regulatory Agencies: Conduct cleaning and disposal operations in accordance with all applicable local and state laws, ordinances, and code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.
B. Use cleaning materials only on surfaces recommended by cleaning material manufacturers.

PART 3 - EXECUTION

3.1 PERFORMANCE
A. Cleaning During Construction:
   1. Execute cleaning operations to ensure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
   2. Entirely remove and dispose of material or debris during the progress of the work that has washed into or has been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations.
   3. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
   4. At reasonable intervals during the progress of work, clean the site and dispose of waste materials, debris, and rubbish.
   5. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw material from heights.
   6. When applicable, schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.
B. Control of Hazards:
   1. Store volatile wastes in covered metal containers, and remove from premises daily.
   2. Prevent accumulation of wastes which may create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.
C. Disposal:
   1. Do not burn or bury rubbish and waste materials on project site.
   2. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.
D. Final Cleaning:
   1. Employ experienced workmen, or professional cleaners, for final cleaning.
   2. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from all sight-exposed interior and exterior finished surfaces.
   3. Repair, patch and touch up marred surfaces to specified finishes.
   5. Rake clean non-paved surfaces of the project site.
   6. Restore to their original condition those portions of the site not designated for alterations by the Contract Documents.

END OF SECTION
SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Keep accurate record documents for all additions, demolition, changes of material or equipment (from that shown on the Drawings), variations in work, and any other additions or revisions to the Contract (via Change Order, Work Change Directive, Field Order or Clarification).
B. Related Work Specified Elsewhere:
   1. Shop Drawings, Project Data, and Samples are specified in "General Conditions" and Section 01340, Submittals.
   2. Electrical System Record Drawing requirements are outlined in Section 16000.

1.2 MAINTENANCE OF DOCUMENTS
A. Maintain at job site, one copy of:
   1. Contract Drawings
   2. Specifications
   3. Addenda
   4. Reviewed Shop Drawings
   5. Change Orders
   6. Any other modifications to the Contract
   7. Field Test Reports
B. Store documents in files and racks specifically identified for Record Drawing use, that are apart from documents used for construction.
C. File documents in a logical manner indexed for easy reference.
D. Maintain documents in clean, dry, legible condition.
E. Do not use record documents for construction purposes.
F. Make documents available at all times for inspection by the Engineer and Owner, and by the end of the project, transmit these documents to the Engineer.
G. Failure to maintain current records, as specified herein, shall be grounds for withholding additional retainage from monthly partial payment requests.

1.3 RECORDING
A. Label each document "PROJECT RECORD" in large high printed letters.
B. Keep record documents current and do not permanently conceal any work until required information has been recorded.
C. General Field Recording Issues:
   1. All swing ties shall be taken from existing, permanent features such as utility poles, corners of buildings and hydrants. Porches, sheds or other house additions shall be avoided as they could be torn down. A minimum of two swing ties shall be taken. Survey grade GPS coordinates are also acceptable.
   2. Stations shall be recorded to the nearest foot.
3. Inverts shall be recorded to the nearest hundredth of a foot.
4. Elevations shall be recorded to the nearest hundredth of a foot.
5. Building dimensions shall be recorded to the nearest 1/4".
6. Equipment and Piping shall be recorded to the nearest tenth of a foot, and the overall dimensions and layout of the equipment shall be adjusted to reflect the equipment provided.

D. Project Record Drawings - Legibly mark Contract Drawings to record existing utilities and actual construction of all work, including but not limited to the following (where applicable):

1. Existing Utilities
   a. Water mains and services, water main gate valves, sewer mains and services, storm drains, culverts, steam lines, gas lines, tanks and other existing utilities encountered during construction must be accurately located and shown on the Drawings. In congested areas supplemental drawings or enlargements may be required.
   b. Show any existing utilities encountered in plan and profile and properly labeled showing size, material and type of utility. Ties shall be shown on plan. Utility shall be drawn to scale in section (horizontally and vertically) and an elevation shall be called out to the nearest hundredth of a foot.
   c. When existing utility lines are broken and repaired, ties shall be taken to these locations.
   d. If existing water lines are replaced or relocated, document the area involved and pipe materials, size, etc. in a note, and with ties.

2. Manholes, Catch Basins, Valve Pits and other structures.
   a. Renumber structure stationing to reflect changes.
   b. Show ties to center of structure covers or hatches.
   c. In general, show inverts at center of structures. However, for manholes with drop structures, or steep channels (greater than 0.2' change on slope), show inverts at face of manhole.
   d. Show inverts for other structures at the face of the structure.
   e. Draw any new structures that are added on plan and profile.
   f. Show any field or office redesigns.
   g. Redraw plan if the structure's location is moved more than 5 feet in any direction. Note: It is important to show existing utilities, as outlined in Paragraph 1 above, especially if they were one reason for relocating the sewer, manholes and other structures.
   h. Redraw profile if inverts changed by more than 6 inches.

3. Gravity Sewer Line
   a. Change sewer line slopes indicated on Drawings if inverts are changed.
   b. Draw any new gravity lines that are added on plan and profile.
   c. Show any field or office redesigns.
   d. Redraw the sewer line profile if manhole inverts are redrawn.
   e. Redraw the sewer line on plan corresponding to relocated manholes.

4. Sewer Force Mains
   a. Show ties to the location of all valves, bends (horizontal and vertical), tees and other fittings. The use of thrust blocks shall be recorded.
   b. Revise elevations indicated on the Drawings to reflect actual construction.
5. Ledge
   a. Ledge profiles shall be shown. Note whether the plotted ledge profile reflects undisturbed or expanded conditions.

6. Yard Piping and Buried Electrical Conduit
   a. Site piping and utilities shall be drawn to reflect the installed locations, with ties and elevation of all bends (horizontal and vertical).
   b. Show routing for electrical conduits and pull boxes, especially in close proximity to buildings and when the conduits change direction or cross process piping.

7. Roads
   a. Show centerline road profile and level spot elevations.
   b. Show pavement widths.
   c. On road cross sections, show the pavement cross slope.
   d. Show any deviations from the design plans.

8. Buildings
   a. In general, small changes to structures shall not be redrawn. If any dimensional changes were made in the field, the numerical change shall be made on the Drawing and be properly labeled. Update dimensions and elevations on Drawings.
   b. Show finished concrete elevations (top of slab, top of wall, top of footing, etc.). Redraw any foundation, frost wall, etc. that was modified, deepened, or altered during construction.
   c. Adjust finished concrete horizontal dimensions that are shown on the Drawings.
   d. Any additions or major changes shall be shown in both plan and elevation (i.e. relocated doors, opposite door swings, change in wall location, relocation of floor drains).
   e. Show approximate location and routing of electrical conduits in walls, slabs and ceilings. Most conduits are run in groups, therefore, use range of measurements to define location for entire section of conduits.
   f. Special circuits for alarms and instrumentation shall be shown.
   g. Show any changes in location and elevation of ductwork and devices, fuel piping and equipment, and heat piping and equipment.
   h. If wall mounted electrical switches, control boxes, thermostats, etc. have been relocated significantly, (other side of door, or to a wall other than indicated diagrammatically on electrical plans) make the revision accordingly.

9. Utilities
   a. When encountered, additional utilities (e.g., gas, cable, telephone, fiber optic, etc.) shall be indicated on the Record Drawings.

10. Equipment Systems and Piping
    a. Show any changes to equipment systems, whether interior or exterior, for process, instrumentation or electrical. If any dimensional changes were made in the field, the numerical change shall be made on the Drawing and be properly labeled. Update dimensions and elevations on Drawings.
Record Drawings must reflect any equipment configuration and layout
changes differing from that shown on the Drawings.

b. Show any changes to piping systems, whether interior or exterior, for
process, and instrumentation. If any dimensional changes were made in
the field, the numerical change shall be made on the Drawing and be
properly labeled. Update dimensions and elevations on Drawings.

E. Specifications and Addenda - Legibly mark up each section to record:
1. Manufacturer, trade name, catalog number, and supplier of each product and
item of equipment actually installed.
2. Changes made by Change Order, Field Order, or other method.

1.4 SUBMITTALS
A. At the completion of the project, and prior to the release of retainage, deliver record
documents to the Engineer.
1. Record drawings shall be provided as a bound paper set of computer-generated
drawings, an electronic file (pdf format) of the bound paper set, and electronic
files in AutoCAD format. Ownership of the drawings and files shall pass to the
Owner at the time of submittal.
B. Accompany submittal with transmittal letter, in duplicate, containing:
1. Date, project title and number.
2. Contractor's name and address.
3. Title and number of each record document with certification that each document
is completed and accurate.
4. Signature of Contractor, or his authorized representative.
C. Failure to supply all information on the Project Record Drawings as specified in Part
1.3 may result in withholding final completion and in non-approval of final payments
of the Contract. If Contract Time has elapsed, this shall be grounds for imposing
liquidated damages.

1.5 QUALITY ASSURANCE
A. All horizontal and vertical dimensions, swing-ties, and elevations shall be accurate to
within one-tenth of a foot, unless greater accuracy is specified elsewhere in the
Specifications (e.g., concrete elevations, weir elevations, etc.).

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 MAINTAINING AND PROVIDING RECORDS
A. Records shall be kept current as the work progresses.
B. Records shall be made available for review by the Owner, Engineer, Resident Project
Representative and/or Funding Agency(s) upon request.
C. Records shall be kept current as the work progresses. Failure to maintain current
records shall be grounds for withholding additional retainage from monthly partial
payment requests. Failure to provide records shall also be grounds for withholding of
final payment and, if beyond contract time, shall be grounds for imposing liquidated
damages.
3.2 **AS-BUILT SURVEY PERFORMANCE**
A. From established survey control, and construction baseline as shown on the drawings, conduct surveys of the project area during construction as needed to obtain information of buried and above ground items. Surveys shall include information outlined in Section 1.3.
B. Actual road alignments; walls; fence and guardrail; existing, new and relocated utility poles; traffic and warning sign locations; crosswalks, parking space and stop bar locations; retaining walls and foundations drains; all underground and overhead utility poles and lines within the project limits, including those installed on private property; all other new features and appurtenances and those existing features and appurtenances changed as a result of this project shall be included in the survey.

3.3 **FORMAT FOR ELECTRONIC DELIVERABLES**
A. AutoCAD digital survey data for the as-built survey shall include:
   1. Copy of field notes and sketches of the survey.
   3. Paper copy of base map.
   4. Provide digital information on compact disk with paper copy printout; information shall be provided in .DWG format (AutoCAD 2011 or earlier). Data shall be provided in 3D format (northing, easting, elevation, or Y, X, Z).
   5. Drawing scale: Minimum one inch = twenty feet.
   6. Layering:
      a. Repetitive symbols made into blocks and defined on layer 0.
      b. All entities shall be drawn “by layer” as opposed to individual properties.
      c. Use one linetype and one color per layer as opposed to numerous colors/linetypes on a single layer.
      d. Preface each layer with the initials of the Survey company or Contractor (example, Survey Company: SC “layername”).
      e. Database text annotation will be coordinated so the text will be right-reading.
      f. Place text on separate layers.
B. ESRI GIS digital survey data for the as-built survey shall include:
   1. All lines and points shall be accompanied by the attributes listed in Table 1 at the end of this Section with consistent formatting and punctuation (e.g. 6, 8, 12, not 6”, 8, 10”, 12), and shall be provided in an ESRI geodatabase that may be easily imported by the Owner into their GIS System.
# SANITARY SEWER SERVICE LOCATION

<table>
<thead>
<tr>
<th>Project:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Installed:</td>
<td>Town, City of:</td>
</tr>
<tr>
<td>Type, Size of Service Pipe</td>
<td>Street</td>
</tr>
<tr>
<td>Connection at Sewer Main</td>
<td>Dwelling No.</td>
</tr>
<tr>
<td>Depth, End of Service</td>
<td>Occupant</td>
</tr>
<tr>
<td>Length of Service Pipe</td>
<td>Owner</td>
</tr>
<tr>
<td>Laid</td>
<td></td>
</tr>
<tr>
<td>Measured, Located By</td>
<td>House No.</td>
</tr>
<tr>
<td>Project Contractor</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>Incomplete</td>
</tr>
</tbody>
</table>

N.T.S.

Comments:

---

Observed By:

<table>
<thead>
<tr>
<th>Contractor</th>
<th>(Date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wright-Pierce</td>
<td>(Date)</td>
</tr>
</tbody>
</table>
### Table 1
Sewer - GIS Attribute Table

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Casing</strong></td>
<td></td>
</tr>
<tr>
<td>INSTALLDATE</td>
<td>The date the asset was installed</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>The diameter of the asset</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>Material the casing is manufactured with</td>
</tr>
<tr>
<td>RECORDLENG</td>
<td>Recorded length of the casing</td>
</tr>
<tr>
<td>CASEINVUP</td>
<td>Invert elevation of the casing (upstream)</td>
</tr>
<tr>
<td>CASEINVDOWN</td>
<td>Invert elevation of the casing (downstream)</td>
</tr>
<tr>
<td><strong>Clean - Out</strong></td>
<td></td>
</tr>
<tr>
<td>FACILITYID</td>
<td>Locally assigned Facility Identifier = &quot;CO&quot;</td>
</tr>
<tr>
<td>ACCESSMAT</td>
<td>Access material for lid or cover</td>
</tr>
<tr>
<td>CORIM</td>
<td>Rim elevation of the clean out</td>
</tr>
<tr>
<td>COINV</td>
<td>Invert elevation of the clean out</td>
</tr>
<tr>
<td>INTDEPTH</td>
<td>Interior Depth</td>
</tr>
<tr>
<td>INSTALLDATE</td>
<td>The date the asset was installed</td>
</tr>
<tr>
<td>DEVICETYPE</td>
<td>The type of cleanout</td>
</tr>
<tr>
<td>ACCESSDIAM</td>
<td>Access diameter for the clean out</td>
</tr>
<tr>
<td><strong>Gravity Main</strong></td>
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</tr>
<tr>
<td>FACILITYID</td>
<td>Locally assigned Facility Identifier - US/DS</td>
</tr>
<tr>
<td>INSTALLDATE</td>
<td>The date the asset was installed</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>Material the asset is manufactured with</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>The diameter of the asset</td>
</tr>
<tr>
<td>MAINSHAPE</td>
<td>The shape of the gravity main</td>
</tr>
<tr>
<td>FROMMH</td>
<td>From Manhole</td>
</tr>
<tr>
<td>TOMH</td>
<td>The downstream manhole</td>
</tr>
<tr>
<td>WATERTYPE</td>
<td>Indicates the type of water in the pipe = &quot;Sewer&quot;</td>
</tr>
<tr>
<td>DOWNELEV</td>
<td>The downstream pipe elevation</td>
</tr>
<tr>
<td>UPELEV</td>
<td>The upstream pipe elevation</td>
</tr>
<tr>
<td>SLOPE</td>
<td>The slope of the pipe from outside face of structure</td>
</tr>
<tr>
<td>CALCPipeLength</td>
<td>The pipe length used to calculate slope</td>
</tr>
<tr>
<td><strong>Lateral Lines (separated &amp; combined)</strong></td>
<td></td>
</tr>
<tr>
<td>INSTALLDATE</td>
<td>The date the asset was installed</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>Material the asset is manufactured with</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>The diameter of the asset</td>
</tr>
<tr>
<td>WATERTYPE</td>
<td>Indicates the type of water in the pipe = &quot;Sewer&quot;</td>
</tr>
</tbody>
</table>
Table 1  
Sewer - GIS Attribute Table

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Lateral Line Points</strong></td>
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</tr>
<tr>
<td>INSTALLDATE</td>
<td>The date the asset was installed</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>Material the asset is manufactured with</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>The diameter of the asset</td>
</tr>
<tr>
<td>WATERTYPE</td>
<td>Indicates the type of water in the pipe = &quot;Sewer&quot;</td>
</tr>
<tr>
<td>ELEV</td>
<td>Elevation at the top of the asset</td>
</tr>
<tr>
<td><strong>Sewer Manholes</strong></td>
<td></td>
</tr>
<tr>
<td>FACILITYID</td>
<td>Locally assigned Facility Identifier</td>
</tr>
<tr>
<td>INSTALLDATE</td>
<td>The date the asset was installed</td>
</tr>
<tr>
<td>HIGHELEV</td>
<td>High pipe elevation inside manhole - for drop</td>
</tr>
<tr>
<td>DEPTH</td>
<td>The depth of the manhole</td>
</tr>
<tr>
<td>INVERTELEV1</td>
<td>Invert elevation 1</td>
</tr>
<tr>
<td>INVERTELEV2</td>
<td>Invert elevation 2</td>
</tr>
<tr>
<td>INVERTELEV3</td>
<td>Invert elevation 3</td>
</tr>
<tr>
<td>RIMELEV</td>
<td>The elevation of the manhole rim</td>
</tr>
<tr>
<td>CVTYPE</td>
<td>The type of sewer manhole cover</td>
</tr>
<tr>
<td>WALLMAT</td>
<td>The manhole wall material = Brick, Block, or Concrete</td>
</tr>
<tr>
<td>MHTYPE</td>
<td>The type of manhole - Size and Shape</td>
</tr>
<tr>
<td>CONDITION</td>
<td>The condition of the asset = Excellent</td>
</tr>
<tr>
<td>GPSDATE</td>
<td>Date the feature was located with GPS</td>
</tr>
<tr>
<td>WATERTYPE</td>
<td>Indicates the type of water in the pipe = &quot;Sewer&quot;</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 01800
EQUIPMENT STARTUP, CERTIFICATION AND OPERATOR TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. General: The work included in this Section includes startup of equipment, Certified Equipment Testing and Manufacturer provided Operator Training of the facility personnel in the proper operations and maintenance of the furnished equipment. This shall include all equipment provided for the project, regardless of specification Division, unless specifically noted otherwise. Clean, test and adjust each piece of equipment and/or system to the complete satisfaction of the Engineer.
   2. One Year Service Call: In addition to the Manufacturer's installation and startup/testing services, the Contractor shall arrange for the Manufacturer to provide one additional service call of one 8 hour working day on site upon demand of the Owner for each type of equipment within the first year of operation (commencing upon date of Substantial Completion) at no additional cost to the Owner.

   a. Equipment Systems requiring one year of service call are as follows:

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Equipment System</th>
</tr>
</thead>
<tbody>
<tr>
<td>11319</td>
<td>Submersible Non-Clog Centrifugal Pumps</td>
</tr>
<tr>
<td>13440</td>
<td>Instrumentation</td>
</tr>
</tbody>
</table>

General Definitions:
1. Equipment Startup shall be generally defined as the initial placing into operation of the equipment by representatives of the Contractor, any subcontractors directly responsible for the equipment provided, and the equipment Manufacturer.
2. Certified Equipment Testing shall generally be defined as the formal and scheduled demonstration of operations in accordance with the requirements of the Contract Documents. This formal demonstration shall be performed in the presence of the Engineer by representatives of the General Contractor, any Subcontractors directly responsible for the equipment provided, and the equipment Manufacturer.
3. Operator Training shall generally be defined as the formal and scheduled instruction of Owner’s personnel in the proper operations of provided equipment, and in the techniques, methods, schedules, etc. associated with maintenance. This formal training shall be performed in the presence of the Engineer, by representatives of the Contractor, any subcontractors directly responsible for the equipment provided, and the equipment Manufacturer. Operator Training shall also include assistance to Owner’s personnel by Manufacturer representatives during the initial operations of the equipment.
C. Related Work Specified Elsewhere:
   1. Process equipment/systems are specified in Division 11.
   2. Instrumentation systems are specified in Division 13.
D. Submittals:
   1. Submit the name(s) and resume(s) of the duly authorized representatives of the Manufacturer proposed for the project at least 30 days prior to the need for such services. The qualifications of duly authorized representatives of the Manufacturer are identified in Paragraph 1.2 below.
E. Schedules:
   1. Contractor shall provide Engineer with at least 72-hours’ notice of his desire to perform equipment start-up and Certified Equipment Testing and/or training to allow necessary coordination with Owner representatives. Contractor shall be responsible for any and all coordination necessary with the daily operations of the facility to accommodate his testing schedule. Actual date and time for testing and/or training will be the first mutually acceptable date and time available to all parties subsequent to receipt of the request.
   2. Operator Training may be conducted concurrently with the Certified Equipment Testing with prior approval of the Engineer. However, under no circumstances will conditions of the testing interfere with the ability of Owner's representatives to observe necessary features, to hear and understand instructions, or to ask questions. Under such conditions, and as deemed necessary by the Engineer, Operator Training will be conducted separately from, and subsequent to, the Certified Equipment Testing.

1.2 QUALITY ASSURANCE
A. Duly authorized representative of the Manufacturer shall meet the following criteria:
   1. A direct employee of the Manufacturer;
   2. Fluent in the English language;
   3. Has a minimum of 5 years of experience in the proper installation, adjustment, operation, testing, and startup of the specified model, including, but not limited to, equipment calibration, and other mechanical or electrical components of the equipment.
   4. Sales personnel, marketing personnel or local representatives will not be accepted as a duly authorized representative of the Manufacturer unless the Manufacturer has certified them accordingly.

PART 2 - PRODUCTS
(NOT USED)

PART 3 - EXECUTION

3.1 EQUIPMENT STARTUP
A. Equipment startup shall be performed by the authorized representative(s) of the Manufacturer as identified in the Submittals. Refer to Paragraph 1.1.D above.
B. The Equipment Startup shall be performed prior to Certified Equipment Testing and prior to Operator Training.
C. No form of energy shall be applied to any part of the system prior to receipt by the Engineer of a certified statement of approval of the installation from the Contractor. This certification shall contain a statement by an authorized representative of the equipment Manufacturer that the equipment is ready for testing, as outlined below.

D. As part of the equipment startup, the Contractor shall:
   1. Verify that the equipment is installed properly and in accordance with Manufacturer's requirements and instructions, and as such, it is appropriate to apply power to the units in question.
   2. Verify that all manual, automatic and safety control features of the equipment functions properly, including all alarm, activation and deactivation sequences.
   3. Verify that the equipment can operate without excessive noise, vibration, overheating, overloading, jamming, etc. during normal operating conditions.
   4. Check amperage draws on all power feeds with equipment running under normal operating conditions.

E. Each piece of equipment shall be tested sufficiently to ensure that all features required to be demonstrated and/or verified during the equipment certification testing are within acceptable limits. The startup shall not be considered complete until the unit is fully capable of passing the equipment certification testing.

F. Where multiple units are provided, each unit shall undergo startup procedures.

G. The duly authorized representative of the Manufacturer shall provide all specialty tools, specialty testing equipment and labor necessary for the start-up of the equipment.

H. The Contractor shall provide all power, chemical, tools, lubricants, equipment, labor, water and fuel as required for startup.
   1. The Contractor shall be responsible for all contacts and arrangements as necessary with the proper municipal departments and/or public utility companies to arrange for temporary and/or separate billing so that bills associated with testing and startup procedures can be easily identified.
   2. Contacts and arrangements with the local power company shall include, but not be limited to, all arrangements as necessary so that peak power demands incurred during testing and startup procedures will not become a part of the permanent record for determining future power demand charges for the Owner.
   3. All waste materials shall be disposed of by the Contractor in an environmentally acceptable manner at no additional cost to the Owner.

I. In the event of an unsuccessful equipment start-up, Manufacturer and Contractor shall make necessary alternations, adjustments, repairs and replacements and the equipment start-up shall be repeated at no additional cost to the Owner.

J. The Manufacturer Representative’s shall fill out the Equipment Start-Up Certification form included at the end of this Section. Start-up will not be considered complete until this form has been provided to the Engineer along with the Manufacturer Representative’s field report.

3.2 CERTIFIED EQUIPMENT TESTING
   A. Certified Equipment Testing shall be performed after the equipment start-up testing is completed and it has been verified that equipment functions in accordance with the requirements of the Contract Documents in all aspects. Certified Equipment Testing shall be performed by the authorized representative(s) of the Manufacturer as
identified in the Submittals. Refer to Paragraph 1.1.D above.

B. Certified Equipment Testing shall not be scheduled concurrently with the equipment start-up without the prior approval of the Engineer. In all cases, if the Engineer has arrived on-site for the scheduled Certified Equipment Testing and the equipment is not capable of demonstrating complete compliance with the Contract Documents, or if the Manufacturer's representative is not present, the Contractor shall be responsible for all costs to the Engineer associated with failed testing, including travel expenses. The importance of prior and proper equipment start-up demonstrations to verify the requirements of the Certified Equipment Testing is stressed.

C. At a minimum during the Certified Equipment Testing, the Contractor shall demonstrate to the complete satisfaction of the Engineer the following:

1. That the equipment is installed properly and in accordance with Manufacturer's requirements and instructions, and as such, it is appropriate to apply power to the units in question.
2. That all manual, automatic and safety control features of the equipment functions properly, including all alarm, activation and deactivation sequences.
3. That the equipment can operate without excessive noise, vibration, overheating, overloading, jamming, etc. during normal operating conditions.
4. Amperage draws on all power feeds with equipment running under normal operating conditions.
5. The noise level of equipment, drives and motors, unless otherwise noted, shall not exceed 90 dBA, as measured 3 feet from the unit under free field conditions.
   i. Each unit shall be monitored for compliance independently with other area equipment deactivated.
   ii. For monitoring, the equipment will be run under normal operation conditions.
   iii. Contractor shall provide certified proof of calibration for instrument utilized to measure noise level.

1. Other specific requirements as outlined within the individual specifications sections.

D. Each piece of equipment shall be tested sufficiently to ensure that all features required to be demonstrated and/or verified are within acceptable limits.

E. Where multiple units are provided, each unit shall undergo equipment certification testing procedures individually and then with multiple units on-line to verify the total systems output capacity and performance.

F. The duly authorized representative of the Manufacturer shall provide all specialty tools, specialty testing equipment and labor necessary for the start-up and testing of the equipment.

G. The Contractor shall provide all power, chemical, lubricants, equipment, labor, water and fuel as required for start-up and testing.

H. All equipment provided on the project shall be demonstrated to function properly. Demonstration as a component of an overall system shall not relieve the Contractor of his responsibilities to demonstrate proper operation or verify specific requirements for each individual component.
I. Minimum Certified Equipment Testing Requirements for Pumps:
1. If sufficient sewage or water is not available for tests, Contractor will provide water at his expense for testing, if so directed.
2. During tests, observe and record head, output, rpm and motor input. Sufficient test points shall be obtained to develop accurate pump system curve. If multiple operational points are specified, compliance with all points must be sufficiently demonstrated.
3. Fully demonstrate ability to operate at specified conditions without motor overload.
4. For mechanical seals, after a run-in period of 30 minutes, the seal area shall be wiped dry. The pump shall be operated for a 10-minute period. No measurable leakage shall be detected from the mechanical seal.
5. Refer to Section 11000, 11310, as applicable, for additional details.

J. Minimum Certified Equipment Testing Requirements for Instrumentation/Control Systems:
1. All instruments shall be calibrated in the presence of the Engineer.
2. All transmitters or direct-operated receivers shall be calibrated to impose input values representing zero percent, ten percent, and eighty percent of full scale.
3. The inputs and outputs of devices, as appropriate, shall be connected to manometers for differential pressure devices, or compared to measured levels, rates or quantities, during calibration. The receiving devices shall be adjusted to read the calibrated output of the initial calibration.
4. After placing each measuring system in service, an actual comparison of the measured variable versus readout shall be made. For each differential pressure-based measuring system, a manometer shall be connected to the connections provided in the piping or other appropriate device. Each system shall meet the manufacturer's standard accuracy.
5. Secondary functions, such as sequencing, timing features, alarm actuation and pacing shall be adjusted during initial calibration and demonstrated after the system is placed in service.
6. Linkage or range adjustments shall be sealed by colored lacquer in the presence of the Engineer immediately following calibration.
7. Process calibration, such as volumetric drawdown tests on flows and level measurements, shall be conducted on all measuring systems as requested by the Engineer. Once established as being within acceptable accuracy limits, future tests which require use of the measuring device to demonstrate system operations can utilize generation of mA signals to simulate level, flow or similar variable variations.
8. Refer to Division 13 for additional details.

1. Refer to Division 16.

L. In the event of an unsuccessful Certified Equipment Test, Manufacturer and Contractor shall make necessary alternations, adjustments, repairs and replacements and the equipment testing shall be repeated.
M. The Manufacturer Representative’s shall fill out the Equipment/System Testing Certification form included at the end of this Section. Certification Testing will not be considered complete until this form has been provided to the Engineer along with the Manufacturer representative field report.

3.3 OPERATOR TRAINING
A. Operator Training shall be performed by the authorized representative(s) of the Manufacturer as identified in the Submittals. Refer to Paragraph 1.1.D above.
B. Unless otherwise noted within the specific specification sections, provide minimum of one day (8-hour days, not including travel time) of combined training and operational assistance for plant operators for each piece of equipment in the proper operations of provided equipment, and in the techniques, methods, schedules, etc. associated with maintenance.
C. The level of the training and operational assistance provided shall be as required to ensure proper understanding of the equipment’s operations, maintenance and warranty conditions. Should manufacturer require time in addition to the minimums indicated herein, or within the individual specification sections, to sufficiently detail the proper operations and maintenance of the equipment, it will be provided at no additional cost to Owner. Under absolutely no circumstances shall warranties become void due to Owner's failure to follow operational and maintenance procedures which were not fully detailed and described to Owner's representatives during these sessions.
D. Refer to individual equipment specification sections for further requirements.
E. The manufacturer representative shall fill out the Equipment Training Certification form included within this Section. Training will not be considered complete until this form has been provided to the Engineer.
EQUIPMENT START-UP CERTIFICATION

Owner: _______________________________ Date: __________________________

Project:
________________________________________________________________________
________________________________________________________________________

Contractor: _______________________________

Equipment Manufacturer: _______________________________

Equipment: _______________________________

Specification Number: _______________________________

As an authorized representative of the equipment manufacturer, the undersigned certifies that the equipment listed above conforms to the requirements of the Contract Documents. The undersigned authorized representative of the manufacturer further certifies that the equipment has been installed in accordance with the manufacturer's written instructions, that it is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

__________________________________________________________ (Date)

(Authorized Representative of the Manufacturer) (Date)

__________________________________________________________

(Contractor) (Date)

__________________________________________________________

(Engineer) (Date)

** Attach Manufacturer Representative’s Field Report **
EQUIPMENT TRAINING CERTIFICATION

Owner: _______________________________ Date: __________________

Project: __________________________________________________________________________
________________________________________________________________________

Contractor: _________________________________________________________________________

Equipment Manufacturer: _________________________________________________________________________

Equipment: __________________________________________________________________________

Specification Number: _________________________________________________________________________

1. I have trained the Owner's personnel in the proper operation and maintenance of the above equipment.

   (Authorized Representative of the Manufacturer) (Date)

2. The personnel listed below attended the training session.

   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

   (Owner's Representative) (Date)

3. Witnessed by: _______________________________ (Engineer) (Date)
CERTIFIED EQUIPMENT/SYSTEM TESTING FORM

Owner: ___________________________________  Date: __________________________

Project: ______________________________________________________________________
____________________________________________________________________________

Contractor: ____________________________________________________________________

Equipment Manufacturer: _________________________________________________________
                                                                                   _______________________________________

Equipment: _____________________________________________________________________

Specification Number: ___________________________________________________________

This certifies that the entire equipment/system has met the requirements of Section 01800, 16950 and all other applicable requirements of the contract documents.

________________________________________  _________________________
(Authorized Representative of the Manufacturer)         (Date)

________________________________________  _________________________
(Contractor)        (Date)

________________________________________  _________________________
(Engineer)                 (Date)

** Attach Manufacturer Representative’s Field Report **

END OF SECTION
SECTION 02050A

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. The Contractor shall furnish all labor, materials, tools, equipment and apparatus necessary and shall do all work required to complete the demolition, removal, and alterations of existing facilities as indicated on the Drawings, as herein specified, and/or as directed by the Engineer.

2. All equipment, piping, and other materials that are not to be relocated or to be returned to the Owner shall become the property of the Contractor and shall be disposed of by him, away from the site of the work and at his own expense.

3. All demolition or removal of existing structures, utilities, equipment, and appurtenances shall be accomplished without damaging the integrity of existing structures, equipment, and appurtenances to remain, to be salvaged for relocation or stored for future use.

4. Such items that are damaged shall be either repaired or replaced at the Contractor's expense to a condition at least equal to that which existed prior to the start of his work.

5. Unless otherwise indicated, all items labeled to be "removed", "demolished" or "remove/demolish" shall be removed and disposed of offsite in accordance with all Local, State and Federal Regulations.

6. The Contractor shall not collect any samples of either Building Materials, Wastes, Soils, or any other site/project related materials, nor have the samples analyzed for any reason without prior written approval from the Owner or Engineer. Furthermore, the Contractor shall not hire or contract with another party or Consultant to conduct sampling of either Building Materials, Wastes, Soils, or any other site/project related materials or to conduct analytical analysis.

a. All sampling requests are to be directed in written format to the Owner and Engineer.

b. By collecting unauthorized samples, the Contractor shall assume any and all financial burden of the required corrective action.

c. If a sample is collected and analyzed without prior written approval from the Owner or Engineer, the Contractor shall be responsible for any and all remediation required by any applicable regulatory authority arising from or related to the samples collected and analyzed, as the validity of the materials sampled, sample locations and sampling protocols utilized cannot be confirmed by the Owner's or Engineer's independent Consultant.

B. Related Work Specified Elsewhere: (When Applicable)

1. Earthwork is specified in Section 02200.

2. Use of Explosives is specified in Section 01546.
3. See Summary of Work, Section 01010.

1.2 JOB CONDITIONS
   A. Condition of Structures:
      1. The Owner assumes no responsibility for the actual condition of structures to be demolished.
      2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner as far as practicable. However, variations within the structures may occur due to Owner's removal and salvage operations prior to the start of demolition work (where applicable).

1.3 UTILITIES
   A. Utility Locations:
      1. Utility locations shown on the plans are approximate only, based on information supplied by the utility companies.
   B. Coordination with Utilities:
      1. The Contractor shall make all necessary arrangements and perform any necessary work to the satisfaction of affected utility companies and governmental divisions involved with the discontinuance or interruption of affected public utilities and services.

1.4 SUBMITTALS
   A. Schedule - Demolition:
      1. Submit two (2) copies of proposed methods and operations of demolition to the Engineer for review prior to the start of work. Include in the schedule the coordination for shut-off, capping and continuation of utility services as required.
      2. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations.

1.5 PROTECTIONS
   A. Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities and persons. Erect temporary, covered passageways as required by authorities having jurisdiction.
   B. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

1.6 DAMAGES
   A. The Contractor shall promptly repair damages caused by demolition operations to adjacent facilities at no cost to the Owner.

PART 2 - PRODUCTS – Not Applicable

PART 3 - PERFORMANCE
   A. Remove and dispose of non-salvageable material in accordance with all applicable local and state laws, ordinances and code requirements.
   B. Dispose of material daily as it accumulates.
C. Carefully remove, store and protect from damage all materials to be salvaged.

D. Buildings and Adjacent Property:
   1. Protect all buildings and property adjacent to equipment to be removed from damage by erecting suitable barriers or by other suitable means.
   2. Leave such buildings in a permanently safe and satisfactory condition.

E. Maintaining Traffic:
   1. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.
   2. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.

F. Architectural, structural, mechanical, process and electrical demolition, removal and alteration are indicated on the Drawings.

G. Mechanical/Process Demolition:
   1. Mechanical/Process demolition in general shall consist of the dismantling and removal of existing piping, tanks, pumps, motors, equipment and other appurtenances as specified, and indicated on the Drawings.
   2. It shall also include, where necessary, the cutting of existing piping for the purpose of making connections thereto.
   3. Piping not indicated to be removed but which may interfere with construction shall be removed to the nearest solid support, capped and left in place. Where piping that is to be removed passes through the wall of existing structures, it shall be cut off and properly capped on each side of the wall.
   4. When piping is to be altered or removed underground, the remaining piping shall be properly capped or plugged.
   5. Abandoned underground piping shall be left in place unless it interferes with new structures or unless otherwise noted on the Drawings.

H. Salvage:
   1. Salvaged items shall be stored on site for the Owner in an acceptable location and manner.

I. Falmouth Road Pump Station Wetwell Cleaning:
   1. Contractor shall give Owner 7 days minimum notice prior to beginning work in wetwell requiring draining and cleaning; which are to be renovated as part of this project. The Owner will be responsible for removal and disposal of the liquid contents of the wetwell as part of normal pump station operations.
   2. When the existing wetwell is empty of liquid (drained by the Owner), any solids and/or debris remaining that are not easily drained by the Owner as part of normal facility operations shall be the responsibility of the Contractor. Contractor shall remove and dispose of all remaining liquid, solids and/or debris within the tanks at no additional cost to the Owner. The Contractor shall then clean the wetwell walls, floor and ceiling using a high-pressure steam cleaning device.
   3. If the demolition work does not commence within the Contractor's approved project schedule, the wetwell may be placed back in operation by the Owner. It will then be the Contractor's responsibility to provide at least 2 working days (excluding weekends) advance notice to the Owner prior to beginning work in wetwell requiring draining and cleaning, and coordinate the draining of the
wetwell (by Owner) prior to the Contractor removing the remaining liquid, solids and debris and cleaning the wetwell as specified herein.

J. Demolition Sequence:
   1. The demolition sequence is to conform to the reviewed and approved project schedule, and restrictions outlined in Section 01310, Construction Schedules.

K. Pest Control:
   1. Provide pest control when needed or when directed by the Engineer.
   2. Exterminate and prevent migration of rodents to adjoining buildings in accordance with the requirements of the state or local health department.

END OF SECTION
SECTION 02076

ASBESTOS-CEMENT (TRANSITE) PIPE REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 DESCRIPTION
   A. Work Included: Remove and dispose of Asbestos-Cement (AC) sewer main and sewer service laterals according to all applicable Federal, State, and local laws, regulations, and ordinances.

1.2 SCHEDULING
   A. Prior to initiating AC pipe removal, the Contractor shall prepare an abatement plan and provide a copy for record purposes to the Engineer. Refer to Paragraph 1.5 SUBMITTALS for more information.
   B. The Contractor shall update the abatement schedule as requested by the Engineer.

1.3 CODES, REGULATIONS, AND STANDARDS
   A. General Applicability
      1. Contractor shall perform all work in accordance with these specifications: U.S. Environmental Protection Agency (U.S. EPA) and Occupational Safety & Health Administration (OSHA) regulations, NIOSH recommendations, Maine Department of Environmental Protection (Maine DEP) rules and regulations, and any other applicable Federal, State and local government regulations and guidelines.
      2. The most recent edition of any relevant regulation, standard, document, code or policy statement shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
   B. Contractor Responsibility
      1. The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State and local regulations related to all aspects of the abatement project. The Contractor is responsible for providing and maintaining training, accreditation, medical exams, medical records, and personal protective equipment as required by applicable Federal, State and local regulations. The Contractor shall hold the Owner and Owner's Representative harmless for any failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of the Contractor, Contractor's employees, or subcontractors of the Contractor.
   C. The publications listed below form a part of this specification to the extent referenced. The publications listed below are not intended to be a comprehensive list of all regulations, applicable to this work.
      1. Environmental Protection Agency (EPA):
2. Occupational Safety and Health Administration (OSHA):
   d. Construction Industry Standards, 29 CFR 1926

3. U.S. Department of Transportation
   a. 49 CFR 100 - 185, Transportation

4. National Institute for Occupational Safety and Health (NIOSH):

5. American National Standards Institute (ANSI):
   a. Z86.1-1973 - Commodity Specification for Air
   b. Z9.2 - HEPA Filter Specifications
   c. Z88.2-1980-Respiratory Protective Equipment

6. Maine Department of Environmental Protection (Maine DEP):
   a. Chapter 425 - Asbestos Management Regulations
   b. Chapter 401 - Landfill Siting, Design, and Operation
   c. Chapter 411 - Non-Hazardous Waste Transporter Licenses

1.4 PERSONNEL QUALIFICATIONS
   A. All personnel of the Contractor or any approved subcontractors involved with asbestos abatement work shall meet the following minimum qualifications:
      1. Medical examination within the past year in accordance with OSHA 1926.134 with a physician’s written opinion that the worker has no condition that would preclude him/her from working with asbestos or wearing a respirator.
   B. The Contractor shall employ a competent person to oversee all aspects of AC pipe removal.
   C. There shall be a sufficient number of trained and qualified workers, foremen and superintendents to accomplish the work within the required schedule. No untrained or unqualified person shall be employed to speed up completion of the abatement work.

1.5 SUBMITTALS
   A. Submittals shall be in accordance with Specification Section 01300 - Submittals.
   B. At a minimum, the following submittals shall be submitted to the Engineer.
      1. Certification of compliance with OSHA requirements including but not limited to medical surveillance, record keeping and personnel exposure monitoring.
      2. Respiratory Protection Program. Include site specific exposure assessment for respirator selection.
      3. A written project schedule. The schedule shall be date specific and include all phases of the project.
      5. Copies of training certificates for all personnel involved in the removing of asbestos cement pipe.
      6. Copy of current license of the asbestos abatement contractor if utilized.
      7. Proposed waste disposal site and waste transporter. Include name, address, telephone number and operating permits, etc.
8. Material safety data sheets (MSDS) for all materials and products to be used by the Contractor on this project.
9. A work plan outlining the methods to be used during the removal of AC pipe. The work plan shall include the use of the Best Management Practices pertaining to the qualifications of field personnel and methods for dust control, packaging, transportation, and decontamination of equipment.

C. During Abatement
1. Results of personnel exposure monitoring.
2. Project schedule.

D. Post Abatement Submittals
1. Disposal receipts (within timeframes regulated by EPA) signed by the landfill operator demonstrating that the AC pipe removed from the project has been packaged, transported and disposed of properly.
2. Provide the Engineer with copies of on-site job logs, notifications, permits, accident reports, personnel exposure air monitoring results, waivers of lien.
3. Copies of any notices of non-compliance issued by governmental authorities.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Polyethylene sheeting: shall be at least 6-mil thickness. Sheeting, labels and tape shall comply with OSHA standard 29 CFR 1926.
B. Disposable bags and/or drums: shall be of 6-mil polyethylene, on which labels are directly printed, as required by EPA, OSHA and DOT regulations.
C. Surfactant (wetting agent): shall be a 50/50 mixture of polyoxyethylene ether and polyoxyethylene ester, or equivalent, mixed in a proportion of 1 fluid ounce to 5 gallons of water or as specified by manufacturer.

2.2 PERSONNEL PROTECTION
A. The Contractor is responsible to determine what personnel protection equipment is needed.
B. The Contractor is required to provide all required personnel protective equipment.

PART 3 - EXECUTION

3.1 TOOLS AND EQUIPMENT
A. Transportation Equipment: Transportation equipment, as required, shall be suitable for loading, temporary storage, transport, and unloading of contaminated waste without exposure to persons or property. The equipment shall be secured at all times and access limited to authorized personnel only.
B. The Contractor shall provide approved respirators and protective clothing to all Contractor personnel. The Contractor shall also provide approved protective clothing to representatives of the Owner, and to representatives of the State or other governmental entity who may inspect the job site.
C. Protective clothing requirements must include, but may not be limited to:
   1. One-time use, disposable, full-body coveralls made of Tyvek® fabric or approved equal.
   2. Hard Hats
   3. Eye protection
   4. Gloves
   5. Respiratory protective equipment as required by State law
   6. Other as appropriate for site conditions

D. The Contractor shall have sufficient equipment to mix and spray wetting agents.

E. The Contractor shall have a sufficient quantity of, ladders, hand tools and materials to conduct the abatement project in an efficient and workmanlike manner.

3.2 INSPECTION AND PREPARATION
A. Before any work commences, post danger signs in and around the work area to comply with Federal, State, and local law.

3.3 WORK AREA PREPARATION:
A. Regulated area access is to be restricted to authorized trained/accredited and protected personnel. The Contractor shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel.
B. Prior to any asbestos related work in an area, restrict access to all persons other than trained personnel and authorized visitors. The Contractor shall erect signs around the perimeter in accordance with EPA, OSHA and this specification. Maintain a log of all people entering and exiting the workplace during abatement work.
C. The Contractor shall be responsible for taking whatever steps are necessary to prevent a release to the environment and additional contamination of the areas beneath the AC pipe.

3.4 AC PIPE CONNECTION AND REMOVAL PROCEDURES
A. Cutting of existing AC pipe shall be minimized. Cutting of AC pipe shall be performed in accordance with all applicable OSHA standards and shall minimize release of AC fibers.
B. AC pipe shall be secured, wrapped, and disposed of in a timely manner. Stockpiling of removed pipe in an unsecured area shall not be allowed.
C. AC pipe shall be transported to a licensed facility for proper disposal.
D. Crushing of pipe in-place shall not be allowed.

3.5 GENERAL PROCEDURES
A. Install polyethylene sheeting beneath the AC pipe to minimize contamination of adjacent soil.
B. All surfaces shall be wetted during removal activities.
C. If AC pipe is found to be friable or will be rendered friable, abatement shall be conducted in containment.
D. AC pipe shall be removed from the trench in an “intact” condition in sizes such that the piping may be handled without breakage.
E. If AC pipe sections can be separated without cutting, the removal may be conducted without containment.
F. Separated non-friable AC pipe sections may be removed without containment.
G. If AC pipe sections require breaking/cutting to separate, all breaking/cutting activities shall be conducted within a glove bag or negative pressure regulated work area (containment).
H. In the event of breakage of AC pipe during removal which results in pieces contacting soil, then the Contractor shall remove all debris and soil located adjacent to and beneath the debris as well as six inches of soil from beneath and surrounding the debris. All resultant debris and soils shall be properly handled, packaged and disposed of as friable, regulated asbestos waste.
I. The Engineer and Owner shall be notified immediately in the event of breakage.
J. AC pipe shall be double wrapped in 6-mil polyethylene sheeting and labeled prior to transport as required.

3.6 DISPOSAL ACTIVITIES
A. It is the responsibility of the Contractor to determine current waste handling, transportation, and disposal regulations and or requirements for AC pipe and for each waste disposal facility. The Contractor must comply fully with these regulations and all U. S. Department of Transportation and EPA requirements.
B. The Contractor will document actual disposal of the waste at the designated landfill by completing a Waste Shipment Record and forwarding a copy of it along with a copy of the Bill of Lading to the Engineer.
C. All waste load-out and disposal activities shall be the responsibility of the Contractor.
D. Contractor shall insure that transport vehicles do not leak water or other material while being loaded, transported or while on site partially loaded. At minimum, transport vehicles shall be lined with two layers of 6-mil thick polyethylene sheeting installed to form a watertight barrier within the vehicle. If water is observed leaking from any transport or storage container, contractor shall immediately stop work, unload the container (including dumpsters and semi-trailers) find and correct the source of the leak, and place waste material back into the container. This process will be repeated each time any water is observed leaking from a storage or transport vehicle that contains asbestos waste. Contractor shall also take all steps necessary, to decontaminate the ground or other surfaces that became wet due to water leaking from a container that holds asbestos waste.

3.7 CLEANING AND FINAL DECONTAMINATION
A. After the removal of the AC pipe has been completed and before removal of barriers (as applicable), the entire area shall be thoroughly cleaned. All plastic barriers, tapes and disposable contaminated equipment shall also be disposed of as asbestos waste. All reusable contaminated equipment such as masks, hard hats, etc., shall be thoroughly decontaminated through wet cleaning or sealed within 6-mil polyethylene bags before removal from the work area.

END OF SECTION
SECTION 02110
CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Clearing and grubbing includes, but is not limited to, removal of trees, brush, stumps, wooded growth, grass, shrubs, poles, posts, signs, fences, culverts and other vegetation and minor structures; the protection of designated wooded growth; the storage and protection of minor structures and materials which are to be replaced; and the disposal of non-salvageable structures and materials, and necessary preliminary grading.
B. Limits of Work:
   1. Perform clearing and grubbing work within the areas required for construction, or as shown on the Drawings, to a depth of 12 inches below the existing grade.
   2. Perform additional clearing and grubbing work within areas and to depths which, in the opinion of the Engineer, interfere with excavation and/or construction, or are otherwise objectionable.
C. Work Not Included:
   1. Clearing and grubbing work performed for the convenience of the Contractor will not be considered for payment.

1.2 QUALITY ASSURANCE
A. Requirements of Regulatory Agencies:
   1. Dispose of combustible material by burning only when permitted by and in accordance with all applicable local and state laws, ordinances and code requirements.
B. Remove and dispose of non-salvageable structures and material in accordance with all applicable local and state laws, ordinances and code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Provide all materials required to complete the work.
B. All timber and wood shall become the property of the Contractor unless other agreements are made between the Owner and the Contractor.
C. Repair any damage to structures to the complete satisfaction of the Owner and Engineer.
PART 3 - EXECUTION

3.1 PREPARATION
A. Carefully preserve and protect from injury all trees and/or shrubs not to be removed.
B. Right-of-way:
   1. Where excavation is required on public or private rights-of-way containing trees, shrubs, other growth, or any structure or construction, obtain the Engineer's direction concerning the extent to which such obstacles can be cleared or stripped prior to performing the Work.
   2. In all rights-of-way, remove only those particular growths or structures which are, in the opinion of the Engineer, essential for construction operations.
   3. All other removals or damage shall be replaced or restored at the Contractor's expense.

3.2 PERFORMANCE
A. Clearing:
   1. Remove and dispose of all trees, brush, slash, stubs, bushes, shrubs, plants, debris and obstructions within the area to be cleared, except any areas that may be designated as "Selective Clearing", and except as otherwise shown on the Drawings or as directed by the Engineer.
   2. Remove all stumps unless otherwise directed by the Engineer.
   3. Dispose of material to be removed daily as it accumulates.
   4. Take special care to completely dispose of all elm trees and branches immediately after cutting either by burial in approved locations or, when permitted, by burning in areas well removed from standing elm growth.
B. Protection of Wooded Growth:
   1. Fell trees toward the center of the area being cleared to protect trees and shrubs to be left standing.
   2. Cut up, remove and dispose of trees unavoidably falling outside the area to be cleared.
   3. Employ skilled workmen or tree surgeons to trim and repair all trees that are damaged but are to be left standing.
C. Selective Clearing:
   1. When shown on the Drawings and when directed by the Engineer, perform selective clearing work to preserve natural tree cover.
   2. Perform selective clearing work only under the direction and supervision of the Engineer.
   3. Remove all dead and uprooted trees, brush, roots and other material which, in the opinion of the Engineer, are objectionable.
   4. Cut flush with the ground and remove only those trees indicated by the Engineer.
   5. Employ skilled workmen or tree surgeons to carefully trim all branches requiring cutting on trees to be left standing. Wood exposed as the result of removal of branches is to be left exposed to air and sunlight.
   6. Bituminous paint shall not be used on wood exposed as a result of branch removal, excavation around roots, or damage to tree bark.
D. Grubbing:
1. Perform grubbing work beneath new roads, driveways, walks, seeded areas and other areas and as directed by the Engineer.
2. Grub out all sod, vegetation and other objectionable material to a minimum depth of 12 inches below the existing grade.
3. Completely remove all stumps, including major root systems.

E. Disposal:
1. Remove from the site and dispose of material not being burned.
2. Provide an approved disposal area unless otherwise specified.

F. Burning:
1. Dispose of combustible materials by burning, only if approved by local and state officials.
2. Employ competent workmen to perform burning work in such a manner and at such locations that adjacent properties, trees and growth to remain, overhead cables, wires and utilities will not be jeopardized.
3. Do not leave fires unguarded.
4. Do not burn poison oak, poison ivy or other plants of similar nature.
5. Do not use tires or other combustible waste material to augment burning.
6. Burn combustible materials daily as the work progresses.
7. The Contractor shall be responsible for all damage caused by burning and shall be responsible for obtaining all necessary permits for burning.

3.3 REPLACEMENT OF MATERIALS

A. Paving, Curbing and Miscellaneous Material:
1. Remove all paving, subpaving, curbing, gutters, brick, paving block, granite curbing, flagging and minor structures that are over the area to be filled or excavated.
2. Remove and replace bituminous asphaltic and portland cement concrete in accordance with the appropriate sections of these Specifications.
3. Properly store and preserve all material to be replaced in a location approved by the Engineer.

B. Shrubs and Bushes:
1. Remove, store, and replace ornamental shrubs and bushes to be preserved in accordance with accepted horticultural practices.

C. Topsoil:
1. When applicable, carefully remove, store, and protect topsoil in accordance with the appropriate section of this Division.

D. Responsibility:
1. Replace, at no additional cost to the Owner, materials lost or damaged because of careless removal or neglectful or wasteful storage, disposal or use of these materials.
SECTION 02115

STRIPPING AND STOCKPILING TOPSOIL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Segregate topsoil approved by the Engineer prior to excavation, trenching and grading operations and stockpile it for use in the work.
B. Related Work Specified Elsewhere (When Applicable):
   1. Demolition, clearing, grading, embankment, excavation and landscaping are specified in the appropriate sections in this division.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Topsoil shall consist of friable loam of at least two percent decayed organic matter (humus), free of subsoil, and reasonably free of clay lumps, brush, roots, weeds, and other objectionable vegetation, stones and similar objects larger than one (1) inch in any dimension, litter and other materials unsuitable or harmful to plant growth. It shall contain no toxic materials.
B. The quality of the topsoil material to be used shall be approved by the Engineer.

PART 3 - EXECUTION

3.1 PERFORMANCE
A. Remove topsoil from areas that are likely to be disturbed as a result of construction operations to a depth based on the soil profile and approved by Engineer.
B. Remove topsoil from all designated areas prior to normal excavation.

3.2 STORAGE
A. Transport topsoil and deposit in storage piles convenient to the areas which are subsequently to receive the application of topsoil.
B. Stockpile topsoil separate from other materials in an area approved by Engineer.
C. Take all necessary precautions to prevent other excavated material and objectionable material from becoming intermixed with the topsoil before, during and after stripping and stockpiling operations.
D. Neatly trim and grade stockpiles to provide drainage from surfaces and to prevent depressions where water may become impounded.
E. Construct temporary erosion control devices for all stockpiled material, subject to the Engineer's approval.
F. All loam stripped and stockpiled shall be immediately seeded with 70% Domestic/30% Perennial Rye Grass.

END OF SECTION
SECTION 02140
TEMPORARY CONSTRUCTION DEWATERING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Design, furnish, operate, maintain, and remove temporary dewatering system to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry; collect and dispose of ground and surface water where necessary to complete the work.
   2. Design, furnish, operate, maintain, and remove temporary treatment system for temporary dewatering system effluent prior to discharge. Conduct compliance testing, in accordance with the requirements of the permitting authority.
   3. Design, furnish, operate, maintain and remove stream by-pass system for the Middle Road Culvert Replacement.

B. Related Work Specified Elsewhere: (Where Applicable)
   1. Section 01546 Use of Explosives
   2. Section 02156 Temporary Excavation Support System
   3. Section 02200 Earthwork
   4. Geotechnical Data Report is provided in Appendix B.

1.2 DESIGN REQUIREMENTS

A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least one foot below the lowest foundation subgrade or bottom of pipe trench to allow material to be excavated in a dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where temporary excavation support systems are not required. Operate dewatering system continuously until backfill work has been completed.

B. Control of surface and subsurface water is part of dewatering system requirements. Maintain adequate control so that:
   1. The stability of excavated and constructed slopes is not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.
   2. Erosion is controlled.
   3. Flooding of excavations or damage to structures does not occur.
   4. Surface water drains away from excavations.
   5. Excavations are protected from becoming wet from surface water, or ensure excavations are dry before additional work is undertaken
   6. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
7. Maintain stability of sides and bottom of excavation. Construction operations are performed in the dry.
8. Any existing dewatering wells that can affect dewatering and excavation shall be sealed below the excavation subgrade.

D. Design shall include an assessment of how the dewatering operations will affect the stability of all adjacent structures
E. Contractor is responsible to perform whatever additional geotechnical investigations are needed to design the dewatering system to allow for proper construction of new facilities while protecting adjacent structures from damage due to settlement, and in accordance with this specification.

1.3 SUBMITTALS
   A. Provide submittals in accordance with Specification Section 01340.
   B. Review of submittals shall not relieve the Contractor of sole responsibility for the dewatering system as necessary to prevent damage and settlement to adjacent structures, utilities, streets adjacent to excavations and for the safety of persons working within the excavated areas. Submittal shall identify:
      1. Location, depth and size of wellpoints, headers, sumps, ditches; size and location of discharge lines; capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
      2. Estimated average, minimum and maximum pumping rates (total)
      3. Method to minimize or eliminate pumping of fines.
      4. Standby pumping equipment
      5. Standby power equipment
      6. Treatment tankage and discharge locations
      7. Sample monitoring log (flow, TSS, etc.).
      8. System removal requirements.
   C. Submittals under this Section shall be provided concurrently with and coordinated with the submittals under Section 02156 (Temporary Excavation Support Systems).
   D. Submit monitoring results at the frequency required by the permitting authority.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 PERFORMANCE
   A. General:
      1. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.
2. Keep work areas dewatered until the structures, pipes, and appurtenances to be built there have been completed to such an extent that they will not be damaged by water.
3. Thoroughly brace or otherwise protect against flotation all pipelines and structures which are not stable.
4. Maintain standby backup equipment and power supply throughout the duration of the dewatering operation.
5. Prevent soil particles from entering the discharge points.
6. Ground water level shall be maintained at least one foot below the bottom of the excavation.

B. Disposal of Water:
1. Dispose of water pumped or drained from the construction site in a suitable manner to avoid siltation of adjacent drainage structures and piping, wetlands or water bodies, injury to public health, damage to public and private property, and damage to the work completed or in progress.
2. Provide suitable temporary channels for water that may flow along or across the construction site.
3. Provide treatment as necessary to prevent discharge of contaminated ground water caused by Contractor's operations, or any contaminated ground water that may pass through the excavation support system selected by the Contractor.
4. Contractor must obtain all necessary regulatory approvals for the disposal of dewatering flows. These may include, among others, approval by the USEPA under the National Pollutant Discharge Elimination System (NPDES) program for construction activities.

C. Damage:
1. Avoid damage to and settlement of adjacent buildings, roads, structures, utilities and other facilities.
2. Any damage to or settlement of structures resulting from the dewatering operations, or the failure of the Contractor to maintain the work in a suitably dry condition shall be repaired by the Contractor at no additional cost to the Owner.

D. Temporary Underdrains:
1. When necessary, temporary underdrains may be placed in excavations.
2. Underdrain pipe shall be perforated corrugated metal, polyethylene or P.V.C. pipe.
3. Entirely surround the underdrain and fill the space between the underdrain and the pipe or structure with free draining material.

E. Excavation Sump Pumping:
1. When necessary and where appropriate to the geotechnical conditions encountered, excavations may be over excavated 6 to 12 inches and filled with screened stone to allow sump pumping of groundwater.
2. The system shall be installed with suitable screens and filters so that pumping of fines does not occur.
F. Well and Wellpoint System:
   1. If necessary, dewater the excavations and trenches with an efficient well or wellpoint system to drain the soil and prevent saturated soil from flowing into the excavated wells and area.
   2. Wellpoint and well system shall be of the type designed for dewatering work and shall be installed with suitable screens and filters so that pumping of fines does not occur.
   3. Pumping units shall be capable of maintaining sufficient suction to handle large volumes of air and water at the same time.

3.2 PRE-TREATMENT
   A. Contractor shall provide a settling tank (or tanks) to provide pre-treatment of groundwater prior to discharge unless otherwise indicated on the Drawings. Tanks shall be sized to provide 60-minute hydraulic retention time at the anticipated maximum sustained pumping rate. Tanks shall have an underflow baffle to collect any floatables and shall have final overflow weir to allow for flow measurement and sample collection. The effluent weir shall be sized to allow for accurate flow measurement based on the anticipated pumping rates.
   B. Routine inspection of the settling tanks shall be carried out daily, with records maintained.
   C. Settling tanks shall be cleaned frequently to prevent excess deposition of solids which could overflow from the tank.

3.3 MONITORING
   A. General:
      1. Contractor shall monitor the performance of the dewatering system and the groundwater level achieved throughout construction.
      2. Contractor shall monitor the effluent quality from the treatment system as required by the permitting authority.
   B. Corrective Action:
      1. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), the Contractor shall stop work and submit a revised temporary dewatering system design submittal. The revised plan shall indicate why the system revisions are needed and indicated what change will be made to address the issues. Contractor shall perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Owner.

END OF SECTION
SECTION 02141

COFFERDAMS

PART 1 - GENERAL

1.1 DESCRIPTION
A. This work shall consist of the complete design, construction, maintenance and removal of cofferdams and other related work, including dewatering and inspection required to protect the area of the work and adjacent roadways, embankments, or other structural units, as applicable.

1.2 RELATED SECTIONS
A. Section 01515 – Temporary Bypass Pumping Systems
B. Section 01340 – Submittals
C. Section 02140 – Temporary Excavation Dewatering System
D. Section 02200 – Earthwork
E. Section 02270 – Temporary Erosion Control

1.3 PERFORMANCE REQUIREMENTS
A. Cofferdams shall be constructed to protect the Work against damage from the sudden rising of the water body, to prevent damage by erosion and to prevent damage to adjacent Roadways, embankments or other structural units.
B. Cofferdams shall be constructed and maintained in accordance with all applicable federal, state and local requirements.
C. In-stream work window shall be limited to the period between July 1st and September 30th.

1.4 SUBMITTALS
A. The Contractor shall submit shop drawings of the cofferdam in accordance with Section 01340, including the materials to be used and the proposed method of construction of cofferdams to the Engineer.
B. The Contractor shall not start on cofferdams assembly until submittals have been provided to, and reviewed by the Engineer.
C. Any review of, or comment on, or any lack of review of or comment on, the cofferdam shop drawings by the Engineer shall not relieve the Contractor of the responsibility for the satisfactory functioning of the cofferdam.

PART 2 - PRODUCTS
A. Not Applicable.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Cofferdams shall, in general, be carried below the elevation of the work to adequate depths to ensure stability and adequate heights to seal off water from overtopping the cofferdam.
B. Cofferdams shall be constructed to withstand expected pressures without buckling, secured in place to prevent tipping or movement, and be as watertight as necessary for the safe and proper construction of the work. The Contractor shall be responsible for the righting and resetting of cofferdams that have tilted, shifted or moved laterally, as required for construction.

3.2 REMOVAL
A. Cofferdams shall be removed after the completion of the in-water work and final inspection by the Engineer and Owner.
B. Cofferdams shall be removed in a manner that prevents disturbance or injury to the finished work.

END OF SECTION
SECTION 02156
TEMPORARY EXCAVATION SUPPORT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Design, furnish, install, maintain, and remove temporary excavation support system as required to comply with all applicable State and Federal regulations including the Occupational Safety and Health Act. Excavation support system shall consist of steel sheeting, pile and lagging bracing or other systems designed by the Contractor, as applicable. Related Work Specified Elsewhere (When Applicable):
   1. Section 01546 Use of Explosives
   2. Section 02140 Temporary Construction Dewatering System
   3. Section 02200 Earthwork
   4. Geotechnical Data Report is provided in Appendix B.

1.2 DESIGN REQUIREMENTS
A. The Contractor shall be responsible for the design and construction of the excavation support structures. The excavation support structures (sheeting systems or other special excavation techniques) shall be properly designed by a Professional Engineer registered in the State in which the project is located, who practices in a discipline applicable to excavation work and has more than 5 years of experience in the design of excavation support systems. The excavation support system shall be designed to accommodate an additional 2 feet of excavation below the bottom of excavation shown on the Contract Drawings.
B. The excavation support system shall be designed and installed to limit the upward hydraulic gradient into the bottom of the excavation and to sustain all existing and expected loads and utilities, to prevent migration of fine-grained materials into the excavation, to prevent all movement to earth which could in any way cause injury to workmen, delay the work or endanger adjacent structures. If detrimental effects result from construction activities, the Contractor shall modify the design, revise construction procedures and/or take measures to mitigate and abate further movement at no cost to the Owner.
C. The excavation support systems shall be installed to prevent impact to the nearby existing structures and utilities.
D. The internal lateral bracing shall be located so that the braces shall not pass through walls and/or slabs of existing or proposed structures.
E. The support system shall provide adequate room to properly perform the installation and to allow for inspection of the installation.
F. The use of existing structures to support the sheeting bracing or structural framing shall be prohibited.

1.3 SUBMITTALS
A. Provide submittals in accordance with Specification Section 01340.
B. Submit qualifications of temporary excavation support system design engineer.
C. Submit attached certificate of design and complete scaled and dimensioned layout drawings of the proposed excavation system, stamped and sealed by a Professional Engineer registered in the State in which the project is located.
D. The Contractor shall have sole responsibility for design, construction, monitoring and removal of the excavation support system as necessary to prevent damage to adjacent structures, utilities, streets adjacent to excavations and for safety of persons working within the excavated areas. The submittals will be reviewed for consistency with the design intent.
E. Submittals under this Section shall be provided concurrently with and coordinated with the submittals under Section 02410 (Temporary Dewatering System).

PART 2 - PRODUCTS

2.1 MATERIAL
   A. All materials shall conform to all applicable State and Federal regulations including the Occupational Safety and Health Act.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS
   A. Perform preparatory work to discover, protect, maintain and restore utilities, foundations or other facilities located in close proximity of the proposed excavation lateral support system.

3.2 INSTALLATION
   A. Install excavation support system in accordance with all applicable State and Federal regulations including the Occupational Safety and Health Act. The excavation support system design engineer shall visit the site during excavation support system installation.

3.3 INTERNAL LATERAL WALL BRACING (RAKERS, WALES AND STRUTS)
   A. Rakers are only allowed for the temporary lateral brace that is installed within 5 ft. of the ground surface.
   B. Use wales, struts, corner braces to provide support of the excavation lateral support walls as required. Include web stiffeners, plates, brackets, or angles as required to prevent rotation, crippling or buckling of connections and points of bearing between structural steel members. Allow for eccentricities due to fabrication and assembly. Consider effects of temperature changes.
   C. Install and maintain all support members in continuous tight contact with each other and with the wall being supported.
   D. Preload all bracing members (including rakers, corner braces, and struts) in accordance with methods, procedures and sequence as described on the reviewed shop drawings. Coordinate excavation work with installation of bracing and preloading. Use steel shims and steel wedges, welded or bolted in place, to maintain the preloading force in the bracing after release of the jacking equipment pressure. Wood shims or wedges shall not be used. Braces shall be preloaded to 50 percent of
the maximum design load. Provide means to control the fluctuation of loading due to temperature variations.

E. Accomplish preloading by jacking struts, rakers, etc. in place against the excavation lateral support system walls, or by other methods acceptable to the Owner or Owner's Representative.

3.4 REMOVAL OF SHEETING

A. Remove all sheeting and bracing unless the removal may cause injury to adjacent structures and/or property.

B. The General Contractor shall be responsible for repairing all damage to existing structures caused by the removal of sheeting. The excavation support system design engineer shall visit the site during excavation support system removal.

C. All backfill disturbed by the removal of the sheeting shall be re-compacted to its in-situ density.

D. Proceed with backfilling as specified in these Specifications. When the level of compacted backfill reaches the location of bracing and wales, remove these items from the trench or other excavation. When the level of the backfill reaches a point three feet below the existing ground grade, remove the sheeting by approved methods and equipment.

E. After removing the sheeting, complete backfilling in the usual manner.

F. If the Contractor elects to leave the sheeting or any component of the temporary support system in place, the Contractor shall cut the sheeting or such component at least 4 feet below the ground surface, or as directed by the Engineer.
CERTIFICATE OF DESIGN

RE: Contract between
OWNER: ________________________________  (Name)

and
CONTRACTOR: ________________________________  (Name)

on
CONTRACT: ________________________________  (Title)

(Number)  (Date)

The undersigned hereby certify that the engineer listed below:

1. Is licensed or registered to perform professional engineering work in the state of ________________________________ (location of Project);

2. Is qualified by education and training to design the ________________________________

__________________________________________ specified in Section ________________________________ of subject contract;

3. Has previously designed comparable excavation support systems;

4. Has prepared the design in full compliance with the requirements of subject contract, including all applicable laws, regulations, rules, and codes – including review and coordination with the Dewatering System design; and

5. Will inspect and supervise installation of the excavation support system, will monitor the in-place system to confirm that the system is installed and functions in accordance with the design and will inspect and supervise the removal of the excavation support system.

CONTRACTOR

By: ________________________________  (Signature)

__________________________________________  (Name)

__________________________________________  (Title)

__________________________________________  (Date)

ENGINEER

By: ________________________________  (Signature)

__________________________________________  (Name)

__________________________________________  (Engineering Discipline)

__________________________________________  (Date)

END OF SECTION
SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Work described by this Section consists of all earthwork encountered and necessary for construction of the project as indicated in the Contract Documents, and includes but is not limited to the following:
   1. Excavation
   2. Backfilling and Filling
   3. Compaction
   4. Grading
   5. Providing soil material as necessary
   6. Disposal of unsuitable materials
   7. Disposal of excess suitable material

B. Related Work Specified Elsewhere: (When Applicable)
   1. Use of Explosives, Traffic Regulation and Quality Control is specified in Division 1.
   2. Clearing and Grubbing, Temporary Construction Dewatering System, Temporary Excavation Support System, Filter Fabric, Temporary Erosion Control, Stripping and Stockpiling of Topsoil, Temporary Excavation Support Landscaping, and Paving are specified in the appropriate sections of this Division.
   3. Pipe, fittings and valves are specified in Division 2 or 15.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. All work shall be performed and completed in accordance with all local, state and federal regulations.
   2. The General Contractor shall secure all other necessary permits unless otherwise indicated from, and furnish proof of acceptance by, the municipal and state departments having jurisdiction and shall pay for all such permits, except as specifically stated elsewhere in the Contract Documents.

B. Line and Grade:
   1. The Contractor shall establish the lines and grades in conformity with the Drawings and maintain same to properly perform the work.

C. Testing Methods:
   1. Gradation Analysis: Where a gradation is specified the testing shall be in accordance with ASTM C117 and ASTM C136 (or latest revision).
   2. Compaction Control:
      a. Unless otherwise indicated, wherever a percentage of compaction for backfill is indicated or specified, it shall be the in-place density divided by the maximum density and multiplied by 100. The maximum density
shall be the density at optimum moisture as determined by ASTM Standard Methods of Test for Moisture-Density Relations of Soil Using 10-lb. Hammer and 18-in. Drop, Designation D1557 (Modified Proctor), or latest revision, unless otherwise indicated.

b. The in-place density shall be determined in accordance with ASTM Standard Method of Test for Density of Soil in Place by the Sand Cone method, Designation D1556, (or latest revision) or Nuclear method Designation D6938.

c. Wherever specifically indicated, maximum density at optimum moisture may be determined by ASTM Standard Methods of Test for Moisture Density Relations of Soils, ASTM D6938 (Standard Proctor).

d. An Independent Testing Laboratory will be retained by the Owner to conduct all laboratory and field soil sampling and testing, and to observe earth work and foundation construction activities. Laboratory testing will consist of sieve analyses, natural water content determinations, and compaction tests. Field testing will consist of in-place field density tests and determination of water contents.

1.3 SUBMITTALS
A. Collection of samples and testing of all materials for submittals shall be performed by the Independent Testing Laboratory and paid for by the Contractor until the materials are approved by the Owner or Engineer.

B. Submit test results in accordance with the procedure specified in the General and Supplementary Conditions.

C. Submit test results (including gradation analysis) and source location for all borrow material to be used at least 10 working days prior to its use on the site. Contractor shall identify and provide access to borrow sites.

D. Submit moisture density curve for each type of soil (on site or borrow material) to be used for embankment construction or fill beneath structures or pavement.

1.4 TESTS
The Independent Testing Laboratory shall conform to the following procedures and standards:

A. Submit test results in accordance with the procedure specified in the General and Supplementary Conditions.

B. All testing shall be performed by a qualified Independent Testing Laboratory acceptable to the Engineer and Contractor at the Owner's expense unless otherwise indicated (see Section 01400 - Quality Control).

C. Field density tests on embankment materials shall be as follows:

D. Tests shall be taken on every 200 cubic yards of embankment material.

E. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests.

F. Trenches: Field density test in trenches shall be taken at 75 linear foot intervals on every third lift.
G. Foundation Wall Backfill: Take at least one (1) field density tests per lift per wall at locations and elevations as designated by the Engineer.

H. In addition to the above tests the Independent Testing Laboratory will perform additional density tests at locations and times requested by the Engineer.

I. Additional density testing will be required by the Engineer if the Engineer is not satisfied with the apparent results of the Contractor's compaction operation.

1. If the test results fail to meet the requirements of these specifications, the Contractor shall undertake whatever action is necessary, at no additional cost to the Owner, to obtain the required compaction. The cost of retesting will be paid by Owner. The cost of retesting will be determined by Engineer and Owner will invoice Contractor for this cost. If unpaid after 60 days, the invoice amount for retesting will be deducted from the Contract Price. No allowance will be considered for delays in the performance of the work.

2. If the test results pass and meet the requirements of these Specifications, the cost of the testing service will be borne by the Owner, but no allowance will be considered for delays in the performance of the work.

1.5 JOB CONDITIONS

A. Site Information:

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner and Engineer will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data are made available for the convenience of Contractor.

2. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to Owner.

B. Existing Utilities and Structures:

1. The locations of utilities and structures shown on the Drawings are approximate as determined from physical evidence on or above the surface of the ground and from information supplied by the utilities. The Engineer in no way warranties that these locations are correct. It shall be the responsibility of the Contractor to determine the actual locations of any utilities or structures within the project area.

PART 2 - PRODUCTS

2.1 SOIL MATERIAL

A. Aggregate Base: Shall be screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. Type B Aggregate for base shall not contain particles of rock greater than or equal to a 4-inch square mesh sieve. The gradation of the part that passes a 3-inch sieve shall meet the following grading requirements:
### Sieve Designation

#### Percent by Weight

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Passing Square Mesh Sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch</td>
<td>35-75</td>
</tr>
<tr>
<td>1/4 inch</td>
<td>25-60</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-25</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-5</td>
</tr>
</tbody>
</table>

#### Common Borrow
- Shall consist of approved material required for the construction of the work where designated. Common borrow shall be free from frozen material, perishable rubbish, peat, organic, and other unsuitable material.

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percentage by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-5</td>
</tr>
</tbody>
</table>

Common borrow may be used for embankments unless otherwise indicated and provided that the material is at a moisture content suitable for compaction to the specified density. No rocks shall exceed 3/4 of the depth of the specified lift thickness.

#### Crushed Stone
- Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 inch</td>
<td>100</td>
</tr>
<tr>
<td>1 inch</td>
<td>95-100</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>25-60</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-10</td>
</tr>
</tbody>
</table>

#### Screened Stone
- Shall be a well graded stone consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, meeting the following gradation requirements:
Select Fill (Structural Fill): Shall consist of well graded granular material free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material and having no rocks with a maximum dimension of over 4 inches and meeting the following gradation requirements, except where it is used for pipe bedding in which case the maximum size shall be 2 inches.

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent by Weight Passing Square Mesh Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>90-100</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>20-55</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-10</td>
</tr>
<tr>
<td>No. 8</td>
<td>0-5</td>
</tr>
</tbody>
</table>

Sand: Shall be well graded durable material free of organic matter and conform to the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent by Weight Passing Square Mesh Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>95-100</td>
</tr>
<tr>
<td>No. 16</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 50</td>
<td>10-30</td>
</tr>
<tr>
<td>No.100</td>
<td>2-10</td>
</tr>
<tr>
<td>No.200</td>
<td>0-5</td>
</tr>
</tbody>
</table>

Sand conforming to the requirement for fine aggregate in ASTM Standard Specifications for Concrete Aggregate, Designation C-33, will meet the above requirement.
2.2 CONCRETE  
A. If concrete is required for excess excavation, provide 3,000 psi concrete complying with requirements of Section 03300.

2.3 FILTER FABRIC  
A. If filter fabric is required, refer to Section 02260.

PART 3 - EXECUTION

3.1 INSPECTION  
A. Examine the areas and conditions under which excavating, backfilling, filling, compaction and grading are to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 EXCAVATION  
A. General:  
1. Excavation consists of removal and disposal of all material encountered when establishing line and grade elevations required for execution of the work.  
2. The Contractor shall make excavations in such manner and to such widths as will give suitable room for building the structures or laying and jointing the piping; shall furnish and place all sheeting, bracing, and supports; shall do all cofferdamming, pumping, and draining; and shall render the bottom of the excavations firm, dry and acceptable in all respects.  
3. All excavation shall be classified as either earth or ledge. 
   a. Earth Excavation shall consist of the removal, hauling and disposal of all earth materials encountered during excavation including but not limited to native soil or fill, pavement (bituminous or concrete), existing sewers and manholes, ashes, loam, clay, swamp muck, debris, soft or disintegrated rock or hard pan which can be removed with a backhoe, or a combination of such materials, and boulders that do not meet the definition of "Ledge" below. 
   b. Ledge Excavation: Shall consist of the removal, hauling, and disposal of all ledge or rock encountered during excavation. "Ledge" and "rock" shall be defined as any natural compound, natural mixture that in the opinion of the Engineer can be removed from its existing position and state only by drilling and blasting, wedging, sledger, boring or breaking up with power operated tools. No boulder, ledge, slab, or other single piece of excavated material less than two cubic yards in total volume shall be considered to be rock unless, in the opinion of the Engineer it must be removed from its existing position by one of the methods mentioned above.
4. The Contractor shall not have any right of property in any materials taken from any excavation. Do not remove any such materials from the construction site without the approval of the Engineer. This provision shall in no way relieve the Contractor of his obligations to remove and dispose of any material determined by the Engineer to be unsuitable for backfilling. The Contractor
shall dispose of unsuitable and excess material in accordance with the applicable sections of the Contract Documents.

B. Additional Excavation: When excavation has reached required subgrade elevations, notify the Engineer and Resident Project Representative who will observe the conditions.

1. If material unsuitable for the structure or paved area or pipeline (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, screened stone, crushed stone, or concrete as directed by the Engineer.

2. All excavated materials designated by the Engineer as unsuitable shall become the property of the Contractor and disposed of at locations in accordance with all State and local laws and the provisions of the Contract Documents.

C. Unauthorized Excavation: Shall consist of removal of materials beyond indicated subgrade elevations or dimensions without specific authorization of Engineer. Unauthorized excavation, as well as remedial work required by the Engineer shall be at the Contractor's expense. Remedial work required is as follows:

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation with select fill or screened stone compacted to 95% of maximum dry density in accordance with Compaction section of this Specification. Provide 12" minimum select fill or screened stone directly under footings. Concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

2. If the bottom of a trench is excavated beyond the limits indicated, backfill the resulting void with thoroughly compacted screened stone, unless otherwise indicated.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

D. Structural Excavation:

1. Shall consist of the removal, hauling, disposal, of all material encountered in the excavation to permit proper installation of structures.

2. Excavations for structures shall be carried to the lines and subgrades specified or shown on the Drawings.

3. Excavate areas large enough to provide suitable room for building the structures.

4. The extent of open excavation shall be controlled by prevailing conditions subject to any limits designated by the Engineer.

5. Provide, install, and maintain sheeting and bracing as necessary to support the sides of the excavation in accordance with Section 02156 and to prevent any movement of earth which could diminish the width of the excavation or otherwise injure the work, adjacent structures, or persons and property in accordance with all state and OSHA safety standards.

6. Erect suitable fences around structure excavation and other dangerous locations created by the work, at no additional cost to the Owner.
7. Exposed subgrade surfaces shall remain undisturbed, protected, and maintained as uniform, plane areas and shape to receive the foundation components of the structure.
   a. Conform to elevations and dimensions shown on the Drawings within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
   b. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade and trim bottoms to required lines and grades to leave solid base to receive the structure.
   c. If a structure is to be constructed within the embankment, the fill shall first be brought to a minimum of 3 feet above the base of the footing. A suitable excavation shall then be made as though the fill were undisturbed earth.

E. Trench Excavation: Shall consist of removal, hauling and disposal of all material encountered in the excavation to the widths and depths shown on the Drawings to permit proper installation of underground utilities.
1. Excavate trenches to the uniform width shown on the Drawings sufficiently wide to provide sufficient space for installation, backfilling, and compaction. Every effort should be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.
2. Trenches shall be excavated with approximately vertical sides between the elevation of the center of the pipe and an elevation one foot above the top of the pipe.
3. Grade bottoms of trenches as indicated for pipe and bedding to establish the indicated slopes and invert elevations, notching under pipe joints to provide solid bearing for the entire body of the pipe, where applicable.
4. If pipe is to be laid in embankments or other recently filled material, the material shall first be placed to the top of the fill or to a height of at least two feet above the top of the pipe, whichever is the lesser. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall be excavated as though in undisturbed material.
5. Unless otherwise specifically directed or permitted by the Engineer, begin excavation at the low end of sewer and storm lines and proceed upgrade.
6. Perform excavation for force mains and water mains in a logical sequence.
7. The extent of open excavation shall be controlled by prevailing conditions subject to any limits prescribed by the Engineer.
8. As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the state and OSHA safety standards, as outlined in the appropriate section of these Specifications.

F. Protection of Persons, Property and Utilities:
1. Barricade open excavations occurring as part of this work and post with warning lights in compliance with local and State regulations.
2. The work site will be secured after each day’s work is finished. No open trenches shall be left overnight.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Exercise extreme caution and utilize sheeting, bracing, and whatever other precautionary measures that may be required.

4. Rules and regulations governing the respective utilities shall be observed in execution of all work. Active utilities and structures shall be adequately protected from damage, and removed or relocated only as indicated or specified. Inactive and abandoned utilities encountered in excavation and grading operations shall be removed, plugged or capped only with written authorization of the utility owner. Report in writing to the Engineer, the locations of such abandoned utilities. Extreme care shall be taken when performing work in the vicinity of existing utility lines, utilizing hand excavation in such areas, as far as practicable.

5. Repair, or have repaired, all damage to existing utilities, structures, lawns, other public and private property which results from construction operations, at no additional expense to the Owner, to the complete satisfaction of the Engineer, the utility, the property owner, and the Owner.

G. Use of Explosives:
1. Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.
2. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.

H. Stability of Excavations:
1. Slope sides of excavations to comply with all codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

I. Shoring and Bracing:
1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
2. Provide trench shoring and bracing to comply with local codes and authorities having jurisdiction. Refer to Specification Section 02156.
3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Install shoring and bracing as excavation progresses.

J. Material Storage:
1. Stockpile excavated materials which are satisfactory for use on the work until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and protect with temporary seeding or other acceptable methods to control erosion.
2. Locate and retain soil materials away from edge of excavations.
3. Dispose of excess soil material and waste materials as herein specified.
K. Dewatering:
   1. To ensure proper conditions at all times during construction, the Contractor shall provide and maintain ample means and devices (including spare units kept ready for immediate use in case of breakdowns) with which to intercept and/or remove promptly and dispose properly of all water entering trenches and other excavations (including surface and subsurface waters).
   2. Excavations shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be floated or otherwise damaged. Refer to Specification Section 02410.

L. Cold Weather Protection:
   1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.
   2. No frozen material shall be used as backfill or fill and no backfill shall be placed on frozen material.

M. Separation of Surface Material:
   1. The Contractor shall remove only as much of any existing pavement as is necessary for the prosecution of the work.
   2. Prior to excavation, existing pavement shall be cut where in the opinion of the Engineer it is necessary to prevent damage to the remaining road surface.
   3. Where pavement is removed in large pieces, it shall be disposed of before proceeding with the excavation.
   4. From areas within which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate surface materials, he shall furnish, as directed, loam and topsoil at least equal in quantity and quality to that excavated.

N. Dust Control:
   1. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. Refer to Specification Section 01562.
   2. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.

3.3 BACKFILL AND FILL
   A. General:
      1. Backfilling shall consist of replacing material removed to permit installation of structures or utilities, as indicated in the Contract Documents.
      2. Filling shall consist of placing material in areas to bring them up to grades indicated on the Drawings.
      3. The Contractor shall provide and place all necessary backfill and fill material, in layers to the required grade elevations.
      4. Backfill excavations as promptly as work permits, but not until completion of the following:
         a. Acceptance by Engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
b. Inspection, approval, and recording locations of underground utilities.
d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Temporary sheet piling driven below bottom of structures shall be removed in manner to prevent settlement of the structure or utilities, or cut off and left in place if required.
e. Removal of trash and debris.
f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
g. Density testing having results meeting requirements specified herein.

5. In general, and unless otherwise indicated, material used for backfill of trenches and excavations around structures shall be suitable excavated material which was removed in the course of making the construction excavation. Unless otherwise specified or allowed by the Engineer the backfill and fill shall be placed in layers not to exceed 8 inches in thickness.

6. All fill and backfill under structures and pavement, and adjacent to structures, shall be compacted crushed stone or select fill as specified or as indicated on the Drawings. The fill and backfill materials shall be placed in layers not exceeding 8 inches in thickness.

7. All structures (including manholes) shall be placed on a 6-inch mat of screened stone unless otherwise indicated.

8. Suitable excavated material shall meet the following requirements:
   a. Free from large clods, silt lumps or balls of clay.
   b. Free from stones and rock fragments with larger than 12 inch max. dimension.
   c. Free from organics, peat, etc.
   d. Free from frozen material.

9. If sufficient suitable excavated material is not available from the excavations, and where indicated on the Drawings, the backfill material shall be select fill or common borrow, unless otherwise indicated, as required and as directed by the Engineer.

10. Do not backfill with, or on, frozen materials.

11. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.

12. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet.

13. Do not continue backfilling until the previously placed and new materials have dried sufficiently to permit proper compaction.

14. The nature of the backfill materials will govern the methods best suited for their placement and compaction. Compaction methods and required percent compaction is covered in Compaction section of this specification.

15. Before compaction, moisten or aerate each layer as necessary to provide a water content necessary to meet the required percentage of maximum dry density for each area classification specified.
16. Do not allow large masses of backfill material to be dropped into the excavation in such a manner that may damage pipes and structures.
17. Place material in a manner that will prevent stones and lumps from becoming nested.
18. Completely fill all voids between stones with fine material.
19. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
20. Deposit backfill and fill material evenly on all sides of structures to avoid unequal soil pressures.
21. Keep stones or rock fragments with a dimension greater than two inches at least one foot away from the pipe or structure during backfilling.
22. Leave sheeting in place when damage is likely to result from its withdrawal.
23. Completely fill voids left by the removal of sheeting with screened stone which is compacted thoroughly.

B. Pipe Bedding, Initial Backfill and Trench Backfill:
1. Place bedding and backfill in layers of uniform thickness specified herein, and as shown on the Drawings.
2. Thoroughly compact each layer by means of a suitable vibrator or mechanical tamper.
3. Install pipe bedding and initial backfill in layers of uniform thickness not greater than eight (8) inches.
4. Deposit the remainder of the backfill in uniform layers not greater than eight inches.
5. Provide underground utility marking tape for new utility trenches as shown on the Drawings. Refer to Section 02650 – Buried Utility Markings.
6. Where soft silt and clay soils are encountered the trench shall be excavated six inches below the normal bedding and backfilled with 6-inches of compacted sand.
7. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footings.
8. The following schedule lists the bedding materials for various types of pipe. Refer to the pipe trench detail for dimensional requirements.

**BEDDING REQUIREMENTS**

DI or Concrete Pipe Screened stone or select fill.

PVC or PE Pipe Screened stone.
9. The following schedule lists the initial backfill requirements for various types of pipes. Refer to the pipe trench detail for dimensional requirements.

**INITIAL BACKFILL REQUIREMENTS**

- **DI or Concrete Pipe**
  - Screened stone or select fill

- **PVC or PE Pipe**
  - Screened stone

10. Special bedding and backfill requirements shown on the Drawings supersede requirements of this section.

C. Improper Backfill:
   1. When excavation and trenches have been improperly backfilled, and when settlement occurs, reopen the excavation to the depth required, as directed by the Engineer.
   2. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.
   3. Excavation, backfilling, and compacting work performed to correct improper backfilling shall be performed at no additional cost to the Owner.

D. Ground Surface Preparation:
   1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, scarify or break-up sloped surface steeper than 1 vertical to 4 horizontal.
   2. When existing ground surface has a density less than that specified under Compaction section of this Specification for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

3.4 **COMPACTION**

A. General:
   1. Control soil compaction during construction to provide not less than the minimum percentage of density specified for each area classification.

B. Percentage of Maximum Density Requirements:
   1. Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D1557 as indicated.
      a. **Structures**: Compact each layer of backfill or fill material below or adjacent to structures to at least 95% of maximum dry density (ASTM D1557).
      b. **Off Traveled Way Areas**: Compact each layer of backfill or fill material to at least 90% of maximum dry density (ASTM D1557).
      c. **Walkways**: Compact each layer of backfill or fill material to at least 93% of maximum dry density (ASTM D1557).
d. **Roadways, Drives and Paved Areas:** Compact each layer of fill, subbase material, and base material to at least 95% of maximum dry density (ASTM D1557).

e. **Pipes:** Compact bedding material and each layer of backfill to at least 90% maximum dry density (ASTM D1557). Where backfilling with excavated material, compact to native field density.

f. **Embankments:** Compact each layer of embankment material to at least 95% of maximum dry density (ASTM D1557).

C. **Moisture Control:**

1. Where subgrade or a layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, in quantities controlled to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory level.

D. **Compaction Methods:** The Contractor may select any method of compaction that is suitable to compact the material to the required density.

1. **General:** Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. All voids left by the removal of sheeting shall be completely backfilled with suitable materials and thoroughly compacted.

2. **Tamping or Rolling:** If the material is to be compacted by tamping or rolling, the material shall be deposited and spread in uniform, parallel layers not exceeding the uncompacted thicknesses specified. Before the next layer is placed, each layer shall be tamped as required so as to obtain a thoroughly compacted mass. Care shall be taken that the material close to the excavation side slopes, as well as in all other portions of the fill area, is thoroughly compacted. When the excavation width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe or structure, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar powered equipment instead of by tamping. For compaction by tamping or rolling, the rate at which backfilling material is deposited shall not exceed that permitted by the facilities for its spreading, leveling, and compacting as furnished by the Contractor.

E. **Reconditioning Compacted Areas:** Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.5 **GRADING:**

A. **General:**

1. Grading shall consist of that work necessary to bring all areas to the final grades.
2. Uniformly grade areas within limits of work requiring grading, including adjacent transition areas.
3. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines:
1. Grade areas adjacent to building to drain away from structures and to prevent ponding.
2. Grade surfaces to be free from irregular surface changes, and as follows:
   a. Lawn or Unpaved Areas: Finish grade areas to receive topsoil to within not more than 1" above or below the required subgrade elevations.
   b. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1/2" above or below the required subgrade elevation.
   c. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 3/8" above or below the required subgrade elevation.

C. Grading Surface of Fill Under Building Slabs:
1. Grade surface to be smooth and even, free of voids, and compacted as specified, to the required elevation.
2. Provide final grades within a tolerance of 1/2" along 10 feet.

D. Compaction:
1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

E. Protection of Graded Areas:
1. Protect newly graded areas from traffic and erosion. Keep free of trash/debris.
2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

3.6 BASE COURSE AND LEVELING COURSE
A. General:
1. Base course consists of placing the specified materials in layers to support a leveling course or paved surface, as indicated in the Drawings.

B. Grade Control:
1. During construction, maintain lines and grades including crown and cross-slope of base course and leveling course.

C. Placing:
1. Place base course on prepared subbase conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base materials.
2. Place leveling course on prepared base course, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compaction.

D. Shaping and Compacting:
1. All layers of aggregate base course and leveling course shall be compacted to the required density immediately after placing. As soon as the compaction of any layer has been completed, the next layer shall be placed.
2. The Contractor shall bear full responsibility for and make all necessary repairs to the base leveling courses and the subgrade until the full depth of the base leveling courses is placed and compacted. Repairs shall be made at no additional cost to the Owner.

3. If the top of any layer of the aggregate base or leveling course becomes contaminated by degradation of the aggregate or addition of foreign materials, the contaminated material shall be removed and replaced with the specified material at the Contractor's expense.

END OF SECTION
SECTION 02225

FLOWABLE FILL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Provide and install flowable fill material in authorized excavation(s) as shown on the Drawings and/or as specified herein.
B. Related Work Specified Elsewhere:
   1. Earthwork, excavation, backfilling, compaction, piping, manholes, testing and pavement are specified in the appropriate sections of this Division.

1.2 QUALITY ASSURANCE
A. Perform work in accordance with ACI 229, Controlled Low-Strength Materials, or as specified here-in.

1.3 SUBMITTALS
A. Submit Mix designs for each mixture to be provided at least 15 days prior to production.

1.4 TESTING
A. Flowability: Reference ASTM D 6103
   1. A 3-inch diameter by 6-inch long open ended cylinder is placed vertically on a level surface and filled to the top with flowable fill. The cylinder is then lifted vertically to allow the material to flow out onto the level surface. The test is considered passing when the material spread is at least 7-inches in diameter and there is no noticeable segregation.

PART 2 - PRODUCTS

2.1 MATERIALS
A. General: Materials shall meet the following requirements:
   1. Portland Cement, Type I or II - ASTM C150.
   2. Fly Ash (LOI limits do not apply) - ASTM C618.
   3. Fine Aggregate/Mineral Filler – ASTM C 33, ASTM or non-ASTM sands or mineral fillers with 100% passing the 1/2" sieve may be considered which produce an acceptable flow and desired performance characteristic. Soils with fine clays will not be considered. All other than ASTM C 33 materials must receive prior approval from the Engineer.
   4. Air Entraining Admixtures - As Per Manufacturer's Specifications.
   5. Light Weight Cellular Admixture - As Per Manufacturer's Specifications.
B. Standard Flowable Fill:
   1. Compressive strength at 28 days less than 1200 psi
C. Excavatable Flowable Fill:
1. Compressive strength at 28 days between 100-200 psi.
2. Mix:
   a. Portland Cement: 50-100 lb/yd³
   b. Fly Ash: up to 350 lb/yd³, lime content not to exceed 10% by weight.
   d. Water: 325-600 lb/yd³, for Class F fly ash and cement-only mixtures up to 1000 lb/yd³ may be acceptable.

D. Low Density Flowable Fill:
1. The preformed foam shall produce stable air cells capable of resisting the chemical and physical forces imposed during mixing, placing and setting.
2. Submit the foaming agent Manufacturer's recommended mixing procedures and approved mixing equipment to the Engineer.
3. Methods of placement must not cause a change in density due to loss of air content beyond predictable ranges.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Flowable fill shall be produced and delivered using standard concrete construction equipment and practices.
B. Placing flowable fill shall be by chute, pumping, or other method approved by the Engineer.
C. The flowable fill shall be discharged directly from the mixer truck into the space to be filled.
D. No flowable fill shall be placed on frozen ground.
E. At the time of placement the flowable fill shall have a temperature of at least 40 degrees F.
F. When flowable fill is placed in freezing temperatures, the material should be covered with blankets and protected from freezing until hardening.
G. The Contractor shall provide all necessary means to confine the material within a designated space.
H. Formed walls or other bulkheads shall be constructed to withstand hydrostatic pressure exerted by flowable fill where necessary and as determined by the Engineer.
I. The Contractor is responsible to ensure underground utilities, including but not limited to pipes, tanks, structures, cables, etc. are secured to prevent floating.
J. No compaction or vibration of the material is required.
K. Where flowable fill is being used as pipe bedding it shall be placed in lifts to ensure lateral support of the pipe develops along the side of the pipe before continuing with the backfilling.
L. When paving over flowable fill in cold weather, any frozen material on the surface shall be scraped off and removed prior to paving.
M. The flowable fill shall be left undisturbed until the material obtains sufficient strength. Sufficient strength for paving is achieved when the flowable fill can support the weight of foot traffic without apparent deformation. Sufficient strength
for supporting vehicular traffic is 2.5 tons per square foot as measured by a pocket penetrometer.

N. Trenches shall be covered and barricaded until hardening occurs.

END OF SECTION
SECTION 02260
FILTER FABRIC

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Furnish all materials and install filter fabric of the types, dimensions and in the location(s) shown on the Drawings and specified herein.
B. Related Work Specified Elsewhere:
   1. Temporary Erosion Control, Riprap and Stone Ditch Protection are specified in the appropriate sections of this Division.

1.2 QUALITY ASSURANCE
A. A competent laboratory must be maintained by the manufacturer of the fabric at the point of manufacture to ensure quality control.
B. During all periods of shipment and storage, the fabric shall be wrapped in a heavy duty protective covering to protect the fabric from direct sunlight, ultraviolet rays, temperatures greater than 140°F, mud, dirt, dust and debris.

1.3 SUBMITTALS
A. Manufacturer shall furnish certified test reports with each shipment of material attesting that the fabric meets the requirements of this Specification

PART 2 - PRODUCTS

2.1 MATERIALS
A. Filter fabric for use in stabilization, drainage, underdrains, landscaping and beneath structures shall be formed in widths of not less than six (6) feet and shall meet the requirements of Table 1. Both woven and non-woven geotextiles are acceptable; however no "slit-tape" woven fabrics will be permitted for drainage, underdrain, and erosion control applications.

<table>
<thead>
<tr>
<th>Geotextile Mechanical Property</th>
<th>Test Method</th>
<th>Minimum Permissible Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength (both directions)</td>
<td>ASTM D4595-86</td>
<td>120 pounds</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>ASTM D4632-86</td>
<td>50 percent</td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
<td>ASTM D3786-87</td>
<td>210 psi</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D3787</td>
<td>60 pounds</td>
</tr>
<tr>
<td>Trapezoid Tear Strength</td>
<td>ASTM D4533-85</td>
<td>50 pounds</td>
</tr>
<tr>
<td>Water Flow Rate</td>
<td>ASTM D4491-85</td>
<td>120 gal/min/sf</td>
</tr>
<tr>
<td>Equivalent Opening Size (EOS)</td>
<td>ASTM D4751</td>
<td>U.S. Std. Sieve #80</td>
</tr>
<tr>
<td>Coefficient of Permeability</td>
<td>ASTM D4491-85</td>
<td>0.2 cm/sec</td>
</tr>
</tbody>
</table>
The geotextile shall have property values expressed in "typical" values that meet or exceed the values stated above as determined by the most recent test methods specified above.

B. Filter fabric for use in reinforcement shall meet the requirements of Table 2. Woven and non-woven geotextiles are acceptable.

<table>
<thead>
<tr>
<th>Geotextile Mechanical Property</th>
<th>Test Method</th>
<th>Minimum Permissible Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength (both directions)</td>
<td>ASTM 4595-86</td>
<td>195 pounds</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>ASTM D4632-86</td>
<td>20 percent</td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
<td>ASTM D3786-87</td>
<td>340 psi</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D3787</td>
<td>85 pounds</td>
</tr>
<tr>
<td>Trapezoid Tear Strength</td>
<td>ASTM D4533-85</td>
<td>85 pounds</td>
</tr>
<tr>
<td>Equivalent Opening Size (EOS)</td>
<td>ASTM D4751</td>
<td>U.S. Std. Sieve number(s) between #20 and #100</td>
</tr>
</tbody>
</table>

The geotextile shall meet or exceed the "typical" values stated above as determined by the most recent test methods specified above.

C. Filter Fabric for use under riprap shall meet the requirements as specified in Section 02271 - Riprap and Stone Ditch Protection.

D. For Silt Fence, refer to Section 02270 - Temporary Erosion Control Execution

PART 3 - EXECUTION

3.1 Install filter fabric as shown on the drawings or as directed in appropriate specifications in this division or in accordance with manufacturer's instructions or as directed by the engineer.

END OF SECTION
SECTION 02270

TEMPORARY EROSION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Work under this section shall include provision of all labor, equipment, materials and maintenance of temporary erosion control devices, as specified herein, as shown on the Drawings and as directed by the Engineer.
   2. Erosion control measures shall be provided as necessary to correct conditions that develop prior to the completion of permanent erosion control devices, or as required to control erosion that occurs during normal construction operations.
   3. Construction operations shall comply with all federal, state and local regulations pertaining to erosion control.
   4. After awarding of or after being awarded the Contract, prior to commencement of construction activities, Contractor will meet with Engineer to discuss erosion control requirements and develop a mutual understanding relative to details of erosion control.

B. Related Work Specified Elsewhere:
   1. Site work is specified in appropriate sections of this Division.

C. Design Criteria:
   1. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
   2. Stabilize disturbed earth surfaces in the shortest time and employ such temporary erosion control devices, as may be necessary, until such time as adequate soil stabilization has been achieved.

1.2 SUBMITTALS
A. Contractor shall submit a written Erosion Control Plan for review by the Engineer and Owner prior to the start of construction. The Erosion Control Plan shall denote the Contractor’s proposed erosion and sedimentation control measures and the locations and extent of the proposed erosion control measures. The Contractor’s Erosion Control Plan shall also include technical information, as applicable, on the materials to be employed as part of the erosion and sedimentation control measures.
B. Contractor shall furnish the Engineer, in writing, the Contractor’s work plan giving proposed locations for storage of topsoil and excavated material, before beginning construction. A schedule of work shall accompany the work plan. Acceptance of this plan will not relieve the Contractor of his responsibility for completion of the work as specified.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Baled Hay:
   1. At least 14" by 18" by 30" securely tied to form a firm bale, staked as necessary to hold the bale in place.

B. Sand Bags:
   1. Heavy cloth bags of approximately one cubic foot capacity filled with sand or gravel.

C. Mulches:
   1. Loose hay, straw, peat moss, wood chips, bark mulch, crushed stone, wood excelsior, or wood fiber cellulose.
   2. Type and use shall be as specified by the "Maine Erosion and Sedimentation Control Best Management Practices" prepared by the Maine DEP, herein after referred to as the BMP.

D. Mats and Nettings:
   1. Twisted Craft paper, yarn, jute, excelsior wood fiber mats, glass fiber and plastic film.
   2. Type and use shall be as specified in the BMP.

E. Permanent Seed:
   1. Conservation mix appropriate to the predominant soil conditions as specified in the BMP and subject to approval by the Engineer.

F. Temporary Seeding:
   1. Use species appropriate for soil conditions and season as specified in the BMP and subject to approval by the Engineer.

G. Water:
   1. Contractor shall provide water and equipment to control dust, as directed by the Engineer.

H. Silt Fence:
   1. Silt Fence shall be one of the commercially available brands, meeting the following requirements:

<table>
<thead>
<tr>
<th>Geotextile Mechanical Property</th>
<th>Test Method</th>
<th>Minimum Permissible Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength</td>
<td>ASTM D-4632</td>
<td>124 pounds</td>
</tr>
<tr>
<td>(both directions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D-4833</td>
<td>60 pounds</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>ASTM D-4751</td>
<td>#30</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>ASTM D-4491</td>
<td>8 gal/min/ft²</td>
</tr>
</tbody>
</table>
2.2 CONSTRUCTION REQUIREMENTS

A. Temporary Erosion Checks:
   1. Temporary erosion checks shall be constructed in ditches and other locations as necessary.
   2. Baled hay, sand bags or siltation fence may be used in an arrangement to fit local conditions.

B. Temporary Berms:
   1. Temporary barriers shall be constructed along the toe of embankments when necessary to prevent erosion and sedimentation.

C. Temporary Seeding:
   Areas to remain exposed for a time exceeding 3 weeks shall receive temporary seeding as indicated below:

<table>
<thead>
<tr>
<th>Season</th>
<th>Seed</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer (5/15 - 8/15)</td>
<td>Sudangrass</td>
<td>40 lbs/acre</td>
</tr>
<tr>
<td>Late Summer/Early Fall (8/15 - 9/15)</td>
<td>Oats</td>
<td>80 lbs/acre</td>
</tr>
<tr>
<td></td>
<td>Annual Ryegrass</td>
<td>40 lbs/acre</td>
</tr>
<tr>
<td>Fall (9/15 - 10/1)</td>
<td>Winter Rye</td>
<td>112 lbs/acre</td>
</tr>
<tr>
<td>Winter (10/1 - 4/1)</td>
<td>Mulch w/Dormant Seed</td>
<td>80 lbs/acre*</td>
</tr>
<tr>
<td>Spring (4/1 - 7/1)</td>
<td>Oats</td>
<td>80 lbs/acre</td>
</tr>
<tr>
<td></td>
<td>Annual Ryegrass</td>
<td>40 lbs/acre</td>
</tr>
</tbody>
</table>

* seed rate only

D. Silt Fence shall be supported by posts and installed per the manufacturer’s recommendations.
E. Mulch All Areas Receiving Seeding:
   Use either wood cellulose fiber mulch (750 lbs/acre); or straw mulch with chemical tack (as per manufacturer's specifications). Wetting for small areas may be permitted. Biodegradable netting is recommended in areas to be exposed to drainage flow.
F. Erosion control matting for slopes and ditches shall be anchored with pegs and/or staples per manufacturer's recommendations. Contractor shall provide matting along the flowline of all ditches and swales having a longitudinal slope in excess of 0.01 ft/ft, and on all slopes in excess of 3(H) to 1(V).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Temporary Erosion Checks:
   1. Temporary erosion checks shall be constructed in ditches and at other locations designated by the Engineer. Engineer may modify the Contractor's arrangement of silt fences, hay bales and sandbags to fit local conditions.
2. Baled hay, silt fences, or sandbags, or some combination, may be used in other areas, as necessary, to inhibit soil erosion.

3. Siltation fence shall be located and installed as shown on plans or as required to comply with all Federal, State and Local Regulations.

B. Erosion control matting for slopes and ditches shall be installed where indicated on the Drawings and as required to stabilize the soil until permanent vegetative stabilization is established.

C. Maintenance:
Erosion control features shall be installed prior to excavation wherever appropriate. Temporary erosion control features shall remain in place and shall be maintained until a satisfactory growth of grass is established. Contractor shall be responsible for maintaining erosion control features throughout the life of the construction contract. Maintenance will include periodic inspections by the Owner or Engineer for effectiveness of location, installation and condition with corrective action taken by the Contractor, as appropriate.

D. Removing and Disposing of Materials:
1. When no longer needed, material and devices for temporary erosion control shall be removed and disposed of upon approval by Engineer.
2. When removed, such devices may be reused in other locations, provided they are in good condition and suitable to perform the erosion control for which they are intended.
3. When dispersed over adjacent areas, the material shall be scattered to the extent that it causes no unsightly conditions nor creates future maintenance problems.
4. Sedimentation basins, if no longer required, will be filled in, the pipe removed, the surface loamed and grass cover shall be established.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. This work consists of furnishing all plant, labor, equipment, and materials and performing all work necessary to place a protective covering of erosion-resistant material on the slopes of embankments, streambanks, slopes of channels, or as directed by the Engineer. The work shall be done in accordance with these Specifications and in conformity with the lines and grades shown on the Drawings or established by the Engineer.

B. Types of riprap included in this specification:

1. Riprap - Riprap consists of stone dumped in place on a prepared slope of either a filter blanket or a filter fabric backing to form a well-graded mass with a minimum of voids.

2. Filter Fabric Backing - A filter fabric backing consists of a filter fabric overlain by a layer of coarse aggregate placed on the bank before placing the riprap to prevent the bank material from passing through the riprap protection.

1.2 SUBMITTALS

A. Submittals shall be in accordance with 01340 – Submittals, and the General Conditions of the Construction Contract.

B. Submit test results (including gradation analysis) and source location for all riprap material to be used at least 10 working days prior to its use on the site. Contractor shall identify and provide access to borrow sites.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Definition of the materials:

1. Riprap:

a. Stone used for riprap shall be hard, durable, angular in shape; resistant to weathering and to water action; free from overburden, spoil, shale and organic material; and shall meet the gradation requirements for the class specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders shall not be accepted without written permission of the Engineer. Broken concrete may be substituted for stone with written authorization of the Engineer. Shale and stone with shale seams are not acceptable. The minimum weight of the stone shall be 155 pounds per cubic foot as computed by multiplying the specific gravity (bulksaturated-surface-dry basis, AASHTO Test T 85) times 62.3 pounds per cubic foot.
b. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stones smaller than the specified 10 percent size and spalls shall not be permitted in an amount exceeding 10 percent by weight of each load.

2. Filter Fabric Backing:
   a. Coarse Aggregate:
      i. The coarse aggregate shall be composed of tough, durable particles, reasonably free from thin, flat, and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities in excess of those approved by the Engineer.
   
   b. Filter Fabric:
      i. The filter fabric shall be formed in widths of not less than six (6) feet.
      
      ii. A competent laboratory must be maintained by the producer of the fabric at the point of manufacture to ensure quality control. During all periods of shipment and storage, the fabric shall be maintained, wrapped in a heavy-duty protective covering to protect the fabric from direct sunlight, ultraviolet rays, temperatures greater than 140°F, mud, dirt, dust and debris.
      
      iii. The vendor shall furnish certified test reports with each shipment of material attesting that the fabric meets the requirements of this Specification.
<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaking Load &amp; Elongation</td>
<td>ASTM D5034, D5035, Grab Test Method, constant rate of travel 12&quot; per minute.</td>
<td>Tensile Strength: 200 lbs any direction.</td>
</tr>
<tr>
<td>Weight Change in Water</td>
<td>CRD-C 575 or 6631 in Fed. Std.</td>
<td>Less than 1%</td>
</tr>
<tr>
<td>Bursting Strength</td>
<td>ASTM D751, using Diaphragm Bursting Tester</td>
<td>400 lbs. per square inch</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D751, modified</td>
<td>120 lbs.</td>
</tr>
<tr>
<td>Seam Breaking Strength</td>
<td>ASTM D 1683, 1” square jaws, constant rate of traverse 12” per min.</td>
<td>180 lbs.</td>
</tr>
<tr>
<td>Abrasion Resistance Strength:*</td>
<td>ASTM D1175, modified</td>
<td>Tensile 55 lbs.</td>
</tr>
<tr>
<td>Percent of Open Area</td>
<td></td>
<td>Not less than 5%</td>
</tr>
<tr>
<td>Equivalent Opening Size</td>
<td></td>
<td>U.S. Standard Sieve No. 70</td>
</tr>
<tr>
<td>Permeability</td>
<td></td>
<td>0.02 to 0.3 cm/sec.</td>
</tr>
<tr>
<td>Specific Gravity Weight</td>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximately .05 lb/sq/ft.</td>
</tr>
<tr>
<td>Seam sewn with polypropylene thread at point of manufacture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packaged in burlap</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Tensile strength determined by Breaking Load & Elongation by the method stated in the first listing of Table 1.
B. Gradation of Coarse Aggregate for Filter Fabric Backing:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing By Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>2&quot;</td>
<td>85 - 100</td>
</tr>
<tr>
<td>1&quot;</td>
<td>35 - 70</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>10 - 30</td>
</tr>
<tr>
<td>No. 4</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

C. Gradation of Riprap Stone:

<table>
<thead>
<tr>
<th>Size of Stone</th>
<th>% of Total Weight</th>
<th>Smaller Than The Given Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 lb.</td>
<td>100</td>
<td>Class I</td>
</tr>
<tr>
<td>60 lb.</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>25 lb.</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2 lb.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>700 lb.</td>
<td>100</td>
<td>Class II</td>
</tr>
<tr>
<td>500 lb.</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>200 lb.</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>20 lb.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2,000 lb.</td>
<td>100</td>
<td>Class III</td>
</tr>
<tr>
<td>1,400 lb.</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>700 lb.</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>40 lb.</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**PART 3 - EXECUTION**

3.1 CONSTRUCTION DETAILS

A. Slopes to be protected by riprap shall be free of brush, trees, stumps, and other objectionable material and be dressed to a smooth surface. All soft or spongy material shall be removed to the depth shown on the Drawings or as directed by the Engineer and replaced with approved material. Filled areas will be compacted thoroughly. A toe trench shall be dug and maintained until the riprap is placed.

1. Riprap
   a. Stone for riprap shall be placed on the prepared slope or area in a manner which will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids. The entire mass of stone shall be placed in conformance with the lines, grades, and thicknesses shown on the Drawings. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation will not be permitted.
b. The larger stones shall be well distributed and the entire mass of stone shall conform to the gradation specified on the Drawings. All material going into riprap protection shall be so placed and distributed so that there will be no large accumulations of either the larger or smaller sizes of stone.

c. It is the intent of these Specifications to produce a compact riprap protection in which all sizes of material are placed in their proper proportions. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure the results specified.

d. Unless otherwise authorized by the Engineer, the riprap protection shall be placed in conjunction with the construction of the embankment with only sufficient lag in construction of the riprap protection as may be necessary to allow for proper construction of the portion of the embankment protected and to prevent mixture of embankment and riprap. The riprap protection shall be maintained until accepted, and any material displaced by any cause shall be replaced.

e. Riprap stone shall not be dropped from a height greater than one foot onto the filter blanket.

2. Filter Blanket:
   a. A filter blanket shall be placed on the prepared slope or area to the full specified thickness using methods which will not cause segregation of particle sizes within the bedding. The surface of the finished layer should be reasonably even and free from mounds or windrows.

3. Filter Fabric Backing:
   a. A filter fabric shall be placed in the manner and at the locations shown in the Drawings or as directed by the Engineer. At the time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage. The fabric shall be placed with the long dimension parallel to the centerline of the channel or shoreline unless otherwise directed by the Engineer, and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide a minimum width of 36 inches of overlap for each joint. Overlap joints and seams shall be measured as a single layer of cloth. Securing pins with washers shall be inserted through both strips of overlapped cloth at not greater than the following intervals along a line through the midpoint of the overlap.

<table>
<thead>
<tr>
<th>Pin Spacing</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 feet</td>
<td>Steeper than 3:1</td>
</tr>
<tr>
<td>3 feet</td>
<td>3:1 to 4:1</td>
</tr>
<tr>
<td>5 feet</td>
<td>Flatter than 4:1</td>
</tr>
</tbody>
</table>

The fabric shall be turned down and buried two (2) feet at all exterior limits.
b. Additional pins regardless of location shall be installed as necessary to prevent any slippage of the filter fabric. The fabric shall be placed so that the upstream strip of fabric will overlap the downstream strip. Should the Engineer direct that the fabric be placed with the long dimension perpendicular to the centerline of the channel or shoreline, the lower strip of fabric shall overlap the next higher strip. Each securing pin shall be pushed through the fabric until the washer bears against the fabric and secures it firmly to the foundation. The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric. Any damage to the fabric during its installation or during placement of riprap shall be replaced by the Contractor. The work shall be scheduled so that the filter blanket shall be covered with riprap as soon as possible following filter blanket placement. Any damage to the filter material during placement of riprap shall be corrected prior to proceeding with the work.

c. Securing pins for anchoring filter fabric shall be 3/16 inch steel bars, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of not less than 1.5 inches. The length of the pin shall not be less than 18 inches.

d. A layer of coarse aggregate shall be placed on the filter fabric to the full specified thickness using methods which will not cause segregation of particle sizes. The surface of the finished layer shall be reasonably even and free from mounds or windrows.

END OF SECTION
SECTION 02435

CULVERTS AND STORM DRAINS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Provide and install culvert or storm drain pipe and sections of the type(s), size(s) and in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere:
   1. Excavation and backfill, dewatering, catch basins, pavement, borrow and bedding material are specified in the appropriate sections in this division.

1.2 SUBMITTALS
A. Submit, in duplicate, sworn certificates of inspections and tests performed at the location of manufacturers.
B. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

1.3 DELIVERY, STORAGE AND HANDLING
A. Exercise care when handling pipe to prevent damage of any nature to pipe and finish.
B. Immediately remove damaged materials and replace at no additional cost to the Owner.
C. Store materials above ground on platforms, skids or other adequate supports.

1.4 FIELD QUALITY CONTROL
A. Acceptance will be on the basis of tests of materials and inspection of the complete product.
B. Inspection may be made at the place of manufacture or on the construction site after delivery, or both, and the pipe shall be subject to rejection at any time due to failure to meet all of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture.
C. Immediately remove from the project site all rejected pipe.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Pipe shall be one of the following as specified on the Drawings.
   1. Polyvinyl Chloride (PVC) Pipe
   2. Corrugated Polyethylene (PE) Pipe
   3. Corrugated Polypropylene (PP) Pipe
   4. Reinforced Concrete Pipe
B. Materials for pipes shall conform to Standards listed as follows:

1. PVC (Polyvinylchloride) Pipe. This pipe and fittings shall conform to the requirements of AASHTO M278. All pipe shall be supplied with gasket type joints meeting the requirements of ASTM D3212.

2. Corrugated polyethylene pipe. This pipe and fittings shall conform to the requirements of AASHTO M252 and AASHTO M294 or ASTM F2648. The pipe joint system shall be watertight (WT) and shall meet or exceed the current ASTM D3212 Lab Test Requirements and the current ASTM F1417 Watertight Field Test Requirements.

3. Corrugated polypropylene pipe. This pipe and fittings shall conform to the requirements of AASHTO M252 and AASHTO M294 or ASTM F2764. The pipe joint system shall be watertight (WT) and shall meet or exceed the current ASTM D3212 Lab Test Requirements and the current ASTM F1417 Watertight Field Test Requirements. Acceptable products:
   i. SaniTite HP dual wall polypropylene pipe (ADS, Inc.)
   ii. Or equal

4. Concrete Pipe. This pipe shall conform to the requirements of AASHTO Reinforced M170, (ASTM C76)

PART 3 - EXECUTION

3.1 INSPECTION
A. Examine areas to receive piping for the following:
   1. Obstructions that adversely affect the installation and quality of the work.
   2. Deviations beyond allowable tolerances for clearances.
B. Examine pipe and fittings before installation to assure no defective materials are incorporated.
C. Start the work only when conditions are satisfactory.
D. Remove and replace all defective materials at no additional cost to the Owner.

3.2 INSTALLATION
A. Do not install pipe, nor backfill, between December 15 and April 1 without the written permission of the Engineer.
B. Begin laying the pipe at the downstream end.

END OF SECTION
SECTION 02441

MULCH

PART 1 - GENERAL

1.1 DESCRIPTION
A. Furnish all labor, materials, equipment and transportation required to furnish and spread mulch of the types and in the quantities indicated on the plans and as specified under this item.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Hay or Straw Mulch:
   1. Shall consist of long fibered hay or straw, reasonably free of noxious weeds and other desirable material.
   2. No material shall be used which is so wet, decayed or compacted as to inhibit even and uniform spreading. No chopped hay, grass clippings or other short fibered material shall be used unless directed by the Engineer.
B. Cellulose Fiber Mulch:
   1. Shall consist of elongated virgin wood fibers capable of producing a strong yellow-brown reaction with Graff C stain for the presence of lignin in accordance with Tappi test T401 OS-74. The ash content shall not exceed 2.0%.
   2. The material shall be non-toxic to plants and animals on contact and shall contain a green color sufficient to provide a definite contrast with the ground surface.
   3. It shall be supplied in uniform packages not exceeding 100 pounds each and marked to show the air dried weight for tank mixing purposes.
C. Wood Chips:
   1. Shall be obtained from green wood and shall average 1/8 inch in thickness with 50 percent having an area of not less than 1 square inch nor more than 8 square inches.
   2. Not more than a total of 2 percent by volume shall consist of sawdust, shavings and leaves.
   3. The mulch shall contain no foreign material injurious to plant growth.
   4. Wood chips made from badly weather or decayed material will not be accepted.
   5. Wood chips which have been stored long enough to become decayed will not be accepted unless approved by Engineer.
D. Bark Mulch:
   1. Shall consist of soft wood bark fragments of such size and texture as to successfully resist washing or blowing under normal conditions, but capable of being easily and uniformly spread around the plants.
   2. No large peel strips and decayed material will be permitted.
E. Stone Mulch:
   1. Shall be clean native stone, except limestone, consisting of stone particles passing a 3/4 inch screen, but retained on a 1/4 inch screen.
   2. This material shall be free from dust, dirt or other foreign matter.

F. Mulch Binder:
   1. Shall be emulsified asphalt of a type and trade acceptable to the Engineer.
   2. May be diluted with water to ensure even distribution.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hay or Straw Mulch:
   1. Shall be spread evenly and uniformly over the designated areas.
   2. Unless otherwise directed by the Engineer, hay or straw mulch shall be applied at the rate of one to two tons per acre.
   3. Unless otherwise authorized, the mulch shall be anchored in place by uniformly applying an approved mulch binder.

B. Cellulose Fiber Mulch:
   1. Shall be applied as a water-borne slurry.
   2. Shall be applied at a rate of not less than 60 pounds of mulch material per 1000 square foot unit of area.

C. Wood Chip or Bark Mulch:
   1. Shall be placed to cover the slope with a three-inch-deep blanket unless otherwise directed.

D. Stone Mulch:
   1. Shall be placed as shown on the Drawings or directed by the Engineer.

END OF SECTION
PART I - GENERAL

1.1 DESCRIPTION
A. Work Included:
1. Perform the following items of work as required to complete the work of this section as shown on the Drawings and as specified hereunder:
   a. Spread stockpiled topsoil and furnish and spread any additional topsoil, required to meet the requirements of this section.
   b. Furnish and sow grass seed/or sod in all areas within the work area to the extent indicated on the Drawings, and in existing grass areas which have been damaged or disturbed by the work of this Contract.
   c. Furnish and install plant materials in all areas within the work area as indicated on the Drawings.
   d. Provide maintenance services as specified hereunder.
2. Examine all other sections of the Specifications and all Drawings for the relationship of the work under this section and the work of other trades. Cooperate with all trades in performing the work under this section.

1.2 SUBMITTALS AND TESTING
A. Seed:
1. Furnish the Engineer with duplicate signed copies of a statement from the vendor, certifying that each container of seed delivered to the project site is fully labeled in accordance with the Federal Seed Act and is at least equal to the specification requirements.
2. This certification shall appear in, or with, all copies of invoices for the seed.
3. Each lot of seed shall be subject to sampling and testing, at the discretion of the Engineer, in accordance with the latest rules and regulations under the Federal Seed Act.
B. Topsoil:
1. Inform the Engineer, within 30 days after the award of the Contract, of the sources from which the topsoil is to be furnished. It is the intent of this section that all topsoil which can be recovered from the site shall be used. Furnish additional topsoil as required.
2. Obtain representative soil samples, taken from several locations in the area under consideration for topsoil removal, to the full stripping depth.
3. Have soil samples tested by an independent soil testing laboratory, approved by the Engineer, at the Contractor's expense.
4. Have soil samples tested for physical properties and pH (or lime requirement), for organic matter, available phosphoric acid, and available potash, in accordance with standard practices of soil testing for agricultural use.
5. Approval, by the Engineer, to use topsoil for use in the work will be dependent upon the results of the soils tests.
C. Lime and Fertilizer:
1. Furnish the Engineer with duplicate copies of invoices for all lime and fertilizer used on the project showing the total minimum carbonates and minimum percentages of the material furnished that pass the 90 and 20 mesh sieves and the grade furnished.
2. Each lot of lime and fertilizer shall be subject to sampling and testing at the discretion of the Engineer.
3. Sampling and testing shall be in accordance with the official methods of the Association of Official Agricultural Chemists.
4. Upon completion of the project, a final check may be made comparing the total quantities of fertilizer and lime used to the total area seeded. If the minimum rates of application have not been met, the Engineer may require the Contractor to distribute additional quantities of these materials to meet the minimum rates.

1.3 DELIVERY, STORAGE AND HANDLING
A. Seed:
1. Furnish all seed in sealed standard containers, unless exception is granted in writing by the Engineer.
2. Containers shall be labeled in accordance with the United States Department of Agriculture's rules and regulations under the Federal Seed Act in effect at the time of purchase.
B. Fertilizer:
1. Furnish all fertilizer in unopened original containers.
2. Containers shall be labeled with the manufacturer's statement of analysis.

1.4 JOB CONDITIONS
A. Topsoil:
1. Do not place or spread topsoil when the subgrade is frozen, excessively wet or dry, or in any condition otherwise detrimental, in the opinion of the Engineer, to the proposed planting or to proper grading.
B. Seeding and Planting:
1. Work Seasons - Perform seeding and planting work only between the dates of 1 May to 20 June and 15 August to 1 October, except as otherwise directed in writing by the Engineer.
2. Weather Conditions:
   a. Do not perform seeding work when weather conditions are such that beneficial results are not likely to be obtained, such as drought, excessive moisture, or high winds.
   b. Stop the seeding work when, in the opinion of the Engineer, weather conditions are not favorable.
   c. Resume the work only when, in the opinion of the Engineer, conditions become favorable, or when approved alternate or corrective measures and procedures are placed into effect.
PART 2 - PRODUCTS

2.1 MATERIALS FOR GRADING AND SEEDING

A. Topsoil:
   1. Fertile, friable, natural topsoil typical of the locality, without admixture of subsoil, refuse or other foreign materials and obtained from a well-drained site. Mixture of sand, silt, and clay particles in equal proportions.
   2. Free of stumps, roots, heavy of stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, weeds, sticks, brush or other deleterious matter.
   3. Not less than 4 percent nor more than 20 percent organic matter.
   4. Topsoil depth shall be 4-inches, unless otherwise indicated.

B. Fertilizer:
   1. Fertilizer shall be used to counteract soil deficiencies as indicated by the soil analysis and as approved by the Engineer. It should be a complete fertilizer, a standard product complying with the state and federal fertilizer laws, part of the elements of which are derived from organic sources, containing the following percentages by weight:

      Nitrogen  10N - Minimum 75 percent organic

   The fertilizer shall be delivered to the site in the original unopened containers bearing the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. The fertilizer shall be spread at the rate of 17 to 20 lbs/1000 sq-ft.

C. Lime:
   1. Provide lime which is ground limestone containing not less than 85 percent of total carbonate and of such fineness that 90 percent will pass a No. 20 sieve and 50 percent will pass a No. 100 sieve.
   2. Coarser materials will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing a No. 100 sieve. No additional payment will be made to the Contractor for the increased quantity.

D. Soil Enrichers:
   1. They shall be one of the following materials:
      a. Peat Moss - Finely shredded and consisting of not less than 90 percent organic matter.
      b. Sawdust - rotten.
   2. They shall be natural and suited to horticultural use. They shall not contain lumps, roots or other foreign matter over two inches in diameter. They shall be free from noxious weeds, seeds and other elements harmful to lawns. They shall be subject to inspection approval by the Engineer at the source and upon delivery and shall contain no more than 35 percent moisture by weight at the time of incorporation into the soil.
E. Mulch for Hydro Seeding:
   1. Mulch material shall meet the following requirements:
      a. Hay or straw - Hay or straw mulch shall consist of long fibered hay or straw, reasonably free from noxious weeds or other undesirable material. No material shall be used which is so wet, decayed, or compacted as to inhibit even and uniform spreading. No chopped hay, grass clippings or other short fibered material shall be used unless directed.
      b. Wood cellulose fiber - Wood cellulose fiber mulch shall consist of natural wood cellulose fiber containing no materials which will inhibit seed germination or plant growth. Sufficient non-toxic water-soluble green dye shall be added to provide a definite color contrast to the ground surface to aid in even distribution. Wood fiber mulch shall be supplied in uniform packages not exceeding 100 pounds each. Each package shall be marked to show the air-dry weight.

F. Mulch Binder for Hydroseeding:
   1. Material for mulch binder shall be emulsified asphalt.
      a. Emulsified asphalt mulch binder shall be a type acceptable to the Engineer and may be diluted with water to assure even distribution.

G. Grass Seed Mixture
   1. Fresh, clean, new crop seed. Seed may be mixed by an approved method on the site or may be mixed by the dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers which shall bear the dealer's guaranteed statement of the composition of the mixture and the percentage of purity of each variety. The Dealers Guarantee Statement shall be delivered to the Engineer.
   2. Grass seed shall be composed of the following varieties which shall be mixed in the proportions and shall test to 80 percent minimum purity, and 80 percent germination.
      Percent Proportion by Weight:
      a. MDOT Roadside Mixture (cross-country locations):
         1) Creeping Red Fescue  40 percent
         2) Kentucky Bluegrass  25 percent
         3) Kentucky 31 Fescue   30 percent
         4) White Clover     5 percent
      NOTE: Add 1 pound White or Dutch Clover per acre.
      b. Lawn Areas (unless otherwise directed by Engineer):
         1) Kentucky 31 Fescue  25 percent
         2) Chewing Fescue     15 percent
         1) Creeping Red Fescue 15 percent
         2) Pennfine Perennial Rye 25 percent
         3) Lynn Perennial Rye  10 percent
         4) Common Annual Rye  10 percent

H. Sod (for use as directed by the Engineer):
   1. Preferable two-year growth, at least 85 percent weed-free, solid landscaping sod composed of perennial fescues, Kentucky bluegrass's. Submit one 12 by
12-inch piece of sod, with source location, for approval of the Engineer, before ordering sod for the work.

2.3 STORAGE OF MATERIAL
A. Materials such as fertilizers, ground limestone, etc. shall be stored in weatherproof storage areas and in such a manner that their effectiveness will not be impaired.

PART 3 - EXECUTION

3.1 PREPARATION
A. Equipment:
   1. Provide all equipment necessary for the proper preparation of the ground surface and for the handling and placing of all required materials.
   2. Demonstrate to the Engineer that the equipment will apply materials at the specified rates.
B. Subsoil Preparation:
   1. Before spreading topsoil, the subgrade shall be raked by approved means. Remove all stones greater than four inches and all debris or rubbish to a depth of six inches. Such materials shall be removed from the site.
C. Screening:
   1. All topsoil shall be screened clear of all stones greater than one inch, sticks, plants, and all other foreign materials before being spread.
   2. During the screening of topsoil, commercial fertilizers and lime as required by the soil analysis shall be mixed with the topsoil so that they are evenly distributed throughout the screened topsoil.
   3. At the completion of this operation, topsoil is referred to as improved topsoil for the purpose of this specification and the Drawings.

3.2 SEED AND SOD BED PREPARATION
A. Spread improved topsoil uniformly over subgrade and all areas where the existing grade has been changed and areas disturbed by construction operations except for those areas indicated on the site plans to be paved. No subsoil, topsoil, or improved topsoil shall be handled in any way when in a wet or frozen condition.
B. Fine rake surface to receive seed or sod.
C. After natural settlement and a light rolling, the completed work shall conform to the lines, grades, pitches, and spot elevations shown on the plans.
D. Seeding may be done immediately thereafter, provided the seed bed has remained in a good friable condition and has not become wet.

3.3 SEASON
A. Do all seeding work within the dates herein specified.
B. If special conditions exist which may warrant a variance in the above dates, submit a written request to the Engineer stating the conditions and proposed variance. Permission for the variance will be given if, in the opinion of the Engineer, the variance is warranted.
C. If seeding is authorized between May 15 and August 15, annual rye shall be sown separately in addition to the specified seed mix. Sow at the rate of six to eight pounds per 1000 square feet.

3.4 SEEDING AND SODDING

A. Immediately before seeding and sodding, the ground shall be restored as necessary to a loose friable condition by discing or other approved method to a depth of not less than two inches. The surface shall be cleared of all debris and of all stones one inch or more in diameter.

B. Seed all areas to be seeded with the specified grass seed, sowing evenly with an approved mechanical seeder at the rate specified in the seed mix schedule. Sow one half the seed in one direction and the other half at right angles to the first seeding. Cultipacker or approved similar equipment may be used to cover the seed and to firm the seed bed in one operation. In areas inaccessible to Cultipacker, the seeded ground shall be lightly raked and rolled in two directions with a water ballast roller. Extreme care shall be taken during seeding and raking to ensure that no change shall occur in the finished grades and that the seed is not raked from one spot to another.

C. The hydraulic spray method of sowing seed may be used where approved by the Engineer. This work shall be done with an approved machine operated by a competent crew. Seed and fertilizing materials shall be mixed with water in the tank of the machine and kept thoroughly agitated, so the materials are uniformly mixed and suspended in the water at all times during operation. The spraying equipment must be designed and operated to distribute seed and fertilizing materials evenly and uniformly on the designated areas at the required rates. If the Engineer finds the application uneven or otherwise unsatisfactory, he may require the hydraulic spray method to be abandoned and the balance of the work done as specified herein. Seed must be lightly raked into the surface of the soil unless seeding is to be followed within 24 hours by mulching.

1. Applying Mulch - At the option of the Contractor, any of the following types of mulch material may be applied.

   a. Hay or straw mulch shall be spread evenly and uniformly over the designated areas. Unless other directed, mulch shall be applied to a thickness of 1". Too heavy application of mulch shall be avoided, and lumps and thick spots shall be thinned. Unless otherwise authorized, the mulch shall be anchored in place by uniformly applying an asphalt mulch binder. Application of a concentrated stream of mulch binder will not be allowed. Asphalt mulch binder may be omitted when authorized by the Engineer and when there is a danger of the asphalt contaminating the surface of nearby structures, houses, vehicles, or other objects. Other methods of anchoring mulch may be used subject to the approval of the Engineer.

   b. Wood fiber mulch shall be applied as a water-borne slurry. The wood fiber and water shall be thoroughly mixed and sprayed on the area to be covered so as to form a uniform mat of mulch at the rate of not less than 30 pounds per 1,000 square feet unit of area. Wood fiber mulch may be mixed with the proper quantities of seed, fertilizer and lime as required.
in this section, or may be applied separately after seeding has been carried out. In the latter case, it must be applied within 24 hours after seeding.

2. Maintenance - The Contractor shall maintain the mulch by repairing any damaged mulch and by correcting any shifting of the mulch due to wind, water or other causes, until an acceptable growth of grass has been achieved, regardless of the acceptance status of the seeding. Contractor shall supply additional mulch necessary as a result of damage or seed failure. Repairs to mulched areas and furnishing of additional mulch shall be incidental to this item. If wood fiber is used, any reseeding will require additional wood fiber mulch.

D. Do not perform broadcast seeding work during windy weather.

E. Compacting:
   1. Compact the entire area immediately after the seeding operations have been completed.
   2. Compact by means of a cultipacker, roller, or other equipment approved by the Engineer weighing 60 to 90 pounds per linear foot of roller.
   3. If the soil is of such type that a smooth or corrugated roller cannot be operated satisfactorily, use a pneumatic roller (not wobbly wheel) that has tires of sufficient size to obtain complete coverage of the soil.
   4. When using a cultipacker or similar equipment, perform the final rolling at right angles to the prevailing slopes to prevent water erosion, or at right angles to the prevailing wind to prevent dust.

F. Thoroughly wet soil surfaces before sodding. Place sod pieces tightly together, tamping gently into position as the work progresses. After each area of sodding is completed, roll the entire surface in two directions with a water ballast roller, and soak the newly sodded areas.

G. After the grass has started, all of the areas greater than five square feet which fail to show a uniform stand of grass for any reason whatsoever shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass.

H. At the time of the first cutting, set mower blades two inches high. All lawns shall receive at least two mowings before acceptance. Schedule for mowing shall be coordinated with the Engineer.

I. Maintenance shall also include all temporary protection fences, barriers and signs and all other work incidental to proper maintenance.

J. Maintain grass areas until a full stand of grass is indicated, which will be a minimum of 45 days after all seeding or sodding work is completed and shall not necessarily relate to Substantial Completion of the General Contract.

K. Protection and maintenance of grass areas shall consist of watering, weeding, cutting, repair of any erosion and reseeding as necessary to establish a uniform stand of the specified grasses, and shall continue until Acceptance by the Engineer of the work of this section. It shall also include the furnishing and applying of such pesticides as are necessary to keep grass areas free of insects and disease. All pesticides shall be approved by Engineer prior to use.
3.5 **SEEDING AND SODDING INSPECTION FOR PROVISIONAL ACCEPTANCE**  
A. The Engineer shall inspect all work for Provisional Acceptance upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.  
B. Upon completion and reinspection of all repairs or renewals necessary in the judgment of the Engineer, the Engineer shall certify in writing to the Owner as to the Provisional Acceptance of the work of this section.  
C. Upon approval of the Provisional Acceptance by the Owner, the Owner will assume maintenance of the lawn areas.

3.6 **GUARANTEE**  
A. The Contractor shall submit a written guarantee to the Engineer, after Provisional Acceptance of grass, covering reseeding of grass areas which do not survive through one full growing season after the date of Provisional Acceptance, at no cost to the Owner.

3.7 **CLEAN-UP**  
A. Any soil or similar material which has been brought on to paved areas by hauling operations or otherwise shall be removed promptly, keeping these areas clean at all time.  
B. Upon completion of work under this section all excess stones, debris, and soil resulting from work under this section, which have not previously been cleaned up, shall be removed from the project site.

END OF SECTION
SECTION 02513A
BITUMINOUS CONCRETE PAVING (MAINE)

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Furnish all plant, labor, equipment and materials required to install bituminous
concrete pavement courses, including sidewalks, driveways, temporary and
permanent trench paving and restoration of pavement markings as shown on the
Drawings and as specified herein.
   2. Remove bituminous asphaltic and/or Portland cement pavement, and replace
bituminous asphaltic pavement, base, binder courses and surface courses,
including overlay and temporary pavement, within the area(s) shown on the
Drawings and as directed by the Engineer.
   3. Keep pavement removal to a minimum width suitable for the required
construction.
   4. Apply pavement markings to the permanent paving as specified.
B. Work Not Included: Removal and replacement of paving for the convenience of the
Contractor will not be considered for payment.
C. Related Work Specified Elsewhere (When Applicable):
   1. Excavation, backfill, aggregate base and subbase.

1.2 QUALITY ASSURANCE
A. Materials: Use only materials furnished by a bulk bituminous concrete producer
regularly engaged in the production of hot mixed, hot laid bituminous concrete.
B. Equipment: Provide, maintain and operate pavers, dump trucks, tandem, 3-wheel
and pneumatic tired rollers well suited to the mixtures being placed. Provide,
maintain and operate hand equipment as required. When applicable, provide,
maintain and operate trimming equipment and materials.
C. Mix Requirements, Method of Placement and Compaction: All mixes shall conform
to the State of Maine Department of Transportation's SUPERPAVE mix standards.

1.3 WARRANTY
A. Contractor shall warranty all patch and trench paving of disturbed pavement for one
year from the date of initial placement of pavement in each area. Any remedial paving
completed during the one-year warranty period for the paving shall be warranted by
the Contractor for one year from the date of the completion of the remedial paving.

1.4 SUBMITTALS
A. A Job Mix Formula approved by the State of Maine Department of Transportation's
Central Laboratory in Bangor shall be submitted for each mixture to be supplied at
least 15 calendar days prior to production.
B. Delivery slips shall be furnished with each load of mix delivered to the project. Information shall include:
   2. Date.
   3. Project.
   4. Identification of material.
   5. Gross, tare and net weights.
   7. Stamped by a licensed public weighmaster.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Hot Bituminous Paving Mix:
      1. Binder Course - Maine D.O.T. Type 19.0 mm Superpave Mix
      2. Surface Course - Maine D.O.T. Type 12.5 mm Superpave Mix
      3. Sidewalks and Drives - Maine D.O.T. Type 9.5 mm Superpave Mix
   B. Composition of Mixtures - Control Points

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C. Tack Coat:
   1. Emulsified type, Grade RS-1, CRS-1, HFMS-1, CSS-1, 1h

D. Pavement markings shall be in accordance with Section 02577.

PART 3 - EXECUTION

3.1 GENERAL
   A. Grade Control:
      1. The Contractor shall establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.
B. Trench areas shall receive initial paving as the work progresses where trenches are in paved streets. Not more than 300 linear feet of backfilled trench shall be left unpaved.

C. Paving shall not be delayed by more than 30 days from the date of review and initial acceptance of the completed Work below pavement by the Engineer unless directed by the Owner or Engineer.

D. Reset all existing manholes to finished grade as required at no additional cost to the Owner.

3.2 PAVEMENT REMOVAL

A. General:
   1. Exercise extreme care in the removal of pavement so that pavement will not be unnecessarily disturbed or destroyed.
   2. Mechanically cut pavement to be removed to a straight line, unless otherwise directed by the Engineer.
   3. All pavement removed shall become the property of the Contractor and disposed of at locations acceptable to or designated by the Owner at no additional cost to the Owner.

3.3 SURFACE PREPARATION

A. Tack coats shall conform to Section 410 of the Maine D.O.T. Standard Specifications.

B. Tack Coat:
   1. Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.05 to 0.15 gallons per square yard of surface.

3.4 WEATHER AND SEASONAL LIMITATIONS

A. The State of Maine is divided into 2 paving zones as follows:
   1. Zone 1 - Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.
   2. Zone 2 - Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.

B. The Contractor may place Hot Mix Asphalt Pavement for use other than a traveled way wearing course in either Zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer (placed in the shade at the paving location) is 2°C (35.6°F) or higher and the area to be paved is not frozen. The Contractor may place Hot Mix Asphalt Pavement as traveled way wearing course in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th, provided the air temperature determined as above is 10°C (50°F) or higher. For the purpose of this Subsection, the traveled way includes truck lanes, ramps, approach roads and auxiliary lanes.

C. Hot Mix Asphalt Pavement used for curb, driveways, sidewalks, islands, or other incidentals is not subject to seasonal limitations, except that conditions shall be satisfactory for proper handling and finishing of the mixture. Unless otherwise specified, the Contractor shall not place Hot Mix Asphalt Pavement on a wet or frozen surface, and the air temperature shall be 2°C or higher.
3.5 **PLACING THE MIX**

A. **General:**
   1. Place asphalt concrete mixture on prepared surface. Minimum allowable temperature for placing is 250°F (121.1°C). Maximum shall be 325°F (162.7°C). Place in areas inaccessible to paving machine and small areas by hand. Place each course to required grade, cross-slope and compacted thickness.

B. **Protection:**
   1. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened to the extent that the pavement will not be damaged.

3.6 **PAVEMENT MARKINGS**

A. Material, approved by the Engineer, is to be furnished and applied after the installation of permanent paving.

B. Apply pavement markings in accordance with existing markings and as specified in Section 02577. Match paint color, marking dimensions, layout and other details with existing markings in the vicinity of the project.

3.7 **REMEDIAL WORK**

A. Required remedial paving, as directed by the Engineer or Owner, shall be completed promptly and in accordance with the Specifications.

B. Roadway striping and pavement markings that are disturbed will be restored to original condition or better.

**END OF SECTION**
SECTION 02527

BITUMINOUS CONCRETE CURBS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. This work shall consist of constructing a hot-mixed, hot-laid bituminous concrete curb on a completed bituminous surface in accordance with these Specifications and within reasonable close conformity to the lines and grades shown on the Drawings or established by the Engineer.
B. Related Work Specified Elsewhere:
   1. Section 02513A, Bituminous Concrete Paving - Maine.

1.2 QUALITY ASSURANCE
A. Use only materials which are furnished by a bulk bituminous concrete producer which is regularly engaged in production of hot-mix, hot laid bituminous concrete and approved for use by the MDOT.

1.3 SUBMITTALS
A. Certificates:
   1. Provide certificates in lieu of laboratory test reports.
   2. Certify that materials comply with Specification requirements.

1.4 JOB CONDITIONS
A. Weather Limitations:
   1. Bituminous concrete curbs shall not be placed on a wet surface.
   2. Construct between the dates of May 1 and November 22, and then only when the air temperature in the shade is 40°F or above.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Materials for bituminous concrete curbing shall be as required in Section 609 of the State of Maine Department of Transportation's "Standard Specifications for Highways and Bridges," latest version.

PART 3 - EXECUTION

3.1 PERFORMANCE
A. Conditioning of the Existing Surface:
   1. Thoroughly clean of all objectionable material.
   2. Apply a light tack coat of 0.08 to 0.20 gallons per fifteen linear feet of curb area.
B. Equipment:
1. The curb shall be placed by an approved power operated extruding type machine using the shape mold called for. A tight bond shall be obtained between the base and the curb. The Engineer may permit the placing of curbing by other than mechanical curb placing machines when short sections or sections with short radii are required. The resulting curbing shall conform in all respects to the curbing produced by the machine.

C. Placing:
1. Place mix at temperature between 275°F and 325°F.
2. Where conditions necessitate joints in curb, they shall be constructed to ensure bond between old and new sections of the curb. Prior to placing the new curb material, the old joint shall be tack coated.

D. Curing:
1. Protect from traffic until the heat of the mix has dissipated and the mix has obtained the proper hardness.

E. Backfilling:
1. Backfill as soon as possible after mix has obtained the proper degree of hardness.

END OF SECTION
SECTION 02577

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. This work shall consist of providing final reflective pavement lines and
      markings during paving operations as shown on the plans. It shall consist of
      providing temporary pavement markings during construction.

PART 2 - PRODUCTS

2.2 MATERIALS - PAINT
A. Pavement Marking Paint for final and temporary pavement marking shall meet the
   requirements of Federal Specification TT-P-1952D. Either Type N, regular dry
   traffic paint or Type F, fast dry traffic paint may be used.

PART 3 - EXECUTION

3.1 GENERAL
A. All pavement lines and markings shall be applied in accordance with the Manual on
   Uniform Traffic Control Devices. Longitudinal lines placed on tangent roadway
   segments shall be straight and true. Longitudinal lines placed on curves shall be
   continuous smoothly curved lines consistent with the roadway alignment. All
   pavement markings placed shall meet the tolerance limits shown on the plans.
B. Broken lines shall consist of alternate 3 m [10 ft] painted line segments and 9m [30
   ft] gaps. Temporary pavement marking lines, will be applied as many times as
   necessary to properly delineate traffic lanes for the safe passage of traffic. Bi-
   directional delineators may be used in place of temporary lines. Delineators will be
   applied at 12 m [40 ft] intervals.
C. In overnight lane closure areas that are not to be overlaid, temporary plastic lines or
   raised pavement markers shall be used through the length of the taper.
D. The plastic final pavement lines and markings shall be applied in accordance with
   the manufacturer's recommendations by the inlay method of application.

3.2 ESTABLISHMENT PERIOD
A. Inlaid plastic pavement lines and marking material furnished and installed under
   this contract for final pavement markings shall still be subject to a six-month period
   of establishment.
B. The period of establishment shall commence as soon as the plastic pavement lines
   and markings are complete and in place and shall continue for six months. At the
   end of the establishment period, a minimum of 95% of the plastic pavement lines
   and markings shall still be in place to be acceptable.
C. If less than 95% of the plastic pavement lines and markings are in place after six
   months, the Contractor shall replace all unsatisfactory plastic pavement lines and
markings on the project without additional payment. Plastic pavement lines and markings designated for replacement shall be installed according to these specifications, unless otherwise directed. Plastic pavement lines and markings replaced at the end of the six month establishment period will not be subject to a further establishment period.

3.4 PREPARATION OF SURFACE FOR PAINT
A. Immediately before applying the pavement marking paint to the pavement or curb, the surface shall be dry and entirely free from dirt, grease, oil, or other foreign matter. Surface preparation for application of plastic markings shall conform to the manufacturer's recommendations.

3.5 APPLICATION OF PAINT
A. Prior to applying paint for final pavement lines, the Contractor shall perform a test for paint thickness by furnishing and placing a piece of smooth, clean metal with an area of at least 0.1 m² [144 in²] in the path of the striping truck. The striping truck shall be passed over the piece of metal, painting the surface as it passes, without applying beads. The result of this test will be used to determine the pressure setting and speed of the truck when applying paint to obtain the specified thickness. Additional paint thickness testing may be required on the final paint markings. The wet thickness of paint without beads on final pavement lines shall be a minimum of 0.400 mm [16 mils].
B. On other final pavement markings and on curb, where the paint is applied by hand painting or spraying, application shall be in two uniform covering coats, each at least 0.25 mm [10 mils] thick. Before the second coat of paint has dried, the glass beads shall be applied by a pressure system that will force the glass beads onto the undried paint as uniformly as possible.
C. Glass beads shall be applied to the final and temporary pavement lines, marking and curb at the rate of 0.72 kg/L [4.5 lb/gal] of paint and in sufficient quantity to assure complete and uniform coverage of hand painted surfaces.
D. Temporary painted lines and markings shall be applied as specified for permanent painted lines, except that the thickness shall be a minimum of 0.400 mm [16 mils].
E. Temporary pliant polymer marking material shall be used for temporary markings on the final pavement and on pavements not to be resurfaced when such pavement markings do not conform to the final pavement markings pattern.
F. Newly painted lines, markings and curb shall be protected from traffic by the use of cones, stationary vehicles or other approved methods until the paint is dry.

3.6 REMOVING LINES AND MARKINGS
A. When it is necessary to remove pavement lines and markings, it shall be done by grinding, high temperature flame, sand blasting, solvent or other acceptable means. The method chosen must be capable of completely eradicating the existing line or marking without damage to the pavement. Burning and grinding to remove temporary markings from final pavement or from existing pavement not to be resurfaced will not be permitted.

END OF SECTION
SECTION 02601

MANHOLES, COVERS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Construct manholes, covers, frames, brick masonry, inverts and apply waterproofing in conformance with the dimensions, elevations, and locations shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere (when applicable):
   1. Final sewer testing is specified in this Division.
   2. Pipe, excavation, backfill, paving and dewatering are specified in the appropriate Sections in this Division.
   3. Concrete and grout are specified in Division 3.

1.2 QUALITY ASSURANCE
A. Precast Manhole Base, Barrel and Top Sections:
   1. Conform to ASTM C478 except as modified herein, and on the Drawings.
   2. Average strength of 4,000 psi at 28 days.
   3. Testing:
      a. Determine concrete strength by tests on 6-inch by 12-inch vibrated test cylinders cured in the same manner as the bases, barrels and tops.
      b. Have tests conducted at the manufacturer's plant or at a testing laboratory approved by the Engineer.
      c. Have not less than 2 tests made for each 100 vertical feet of precast manhole sections.
B. Frames and Covers:
   1. Acceptable Manufacturers:
      a. EJ Castings
      b. Neenah Foundry Company.
      c. Or equal
C. Exterior Chimney Wrap/Seal
   1. Acceptable Manufacturers:
      a. Sealing Systems, Inc. Infi-Shield Uni-Band
      b. Or equal
D. Masonry:
   1. Brick: Shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.
   3. Hydrated Lime: ASTM C207
   4. Sand: ASTM C33
E. Waterproofing:
   1. Acceptable Manufacturers:
      a. Karnak #220 AF Fibered Emulsion Dampproofing, Karnak Corp., Clark, NJ.
b. PPS 922 Superseal, International Precast Supply.
   c. Or equal.

F. Pipe connections shall conform to ASTM C 923, "Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

1.3 SUBMITTALS
A. Submit shop drawings and manufacturer's literature in conformance with Section 01340.
B. Precast Manhole Sections: Submit test results and receive approval from the Engineer prior to delivery to the site.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLE SECTIONS
A. Dimensions, shall be as shown on the Drawings:
   1. Base & Riser Sections:
      a. Diameter: As shown on the Drawings.
      b. Length: As required.
      c. Wall Thickness: Not less than 5 inches.
      d. Joints: Bell-and-spigot or tongue-and-groove formed on machine rings to ensure accurate joint surfaces.
   2. Tops:
      a. Diameter: Eccentric cone type, 24 inches I.D. at top, 48 inches I.D. at bottom unless otherwise shown on the Drawings.
      b. Height: 3 or 4 feet.
      c. Wall thickness: Not less than 5 inches at the base, tapering to not less than 8 inches at the top.
      d. Joints: Bell-and-spigot or tongue-and-groove formed on machine rings to ensure accurate joint surfaces.
      e. Exterior face of cone sections shall not flare out beyond the vertical.
   3. Flat Slab Tops:
      a. Location: Where shallow installations do not permit the use of a cone-type top and where indicated on the Drawings.
      b. Slab thickness: Not less than 6 inches.
      c. Constructed to support an HS-20 wheel loading.

B. Openings:
   1. Provide openings in the risers to receive pipes entering the manhole.
   2. Make openings at the manufacturing plant.
   3. Size: To provide a uniform annular space between the outside wall of pipe and riser.
   4. Location: To permit setting of the entering pipes at the correct elevations.
   5. Openings shall have a flexible watertight union between pipe and the manhole base.
      a. Cast into the manhole base and sized to the type of pipe being used.
b. Type of flexible joint being used shall be approved by the Engineer. Install materials according to the Manufacturer's instructions. Acceptable materials:
   i. Lock Joint Flexible Manhole Sleeve made by Interpace Corporation.
   ii. Kor N Seal made by National Pollution Control System, Inc.
   iii. Press Wedge II made by Press-Seal Gasket Corporation.
   v. Or equivalent.

C. Joints:
1. Joint gaskets to be flexible self-seating butyl rubber joint sealant installed according to manufacturer's recommendations. Install a double row of joint sealants for every manhole joint. For cold weather applications, use adhesive with joint sealant as recommended by manufacturer.
   Acceptable Materials: 
   a. Kent-Seal No. 2
   b. Ram-Nek
   c. Or equivalent.
2. Joints between precast sections shall conform to related standards and manufacturer's instructions.
3. All manholes greater than 6 ft. diameter and all manholes used as wet wells, valve pits and other dry-pit type structures shall be installed with exterior joint collars. The joint collar shall be installed according to the manufacturer's instructions. Acceptable materials: MacWrap exterior joint sealer as manufactured by Mar-Mac Manufacturing Company; or equivalent.

D. Waterproofing:
1. The exterior surface of all manholes shall be given two coats of waterproofing material at an application rate as recommended by the manufacturer.
2. The coating shall be applied after the manholes have cured adequately and can be applied by brush or spray in accordance with the manufacturer's written instruction.
3. Sufficient time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

E. Frost Protective Wrapping:
1. The frost protective wrap shall be constructed of an ultraviolet resistant polyethylene material and shall be a minimum thickness of 6 mils.

2.2 FRAMES AND COVERS
A. Standard Units:
   1. Made of cast iron conforming to ASTM A48-76, Class 30 minimum.
   2. Have machined bearing surfaces to prevent rocking.
   3. Castings shall be smooth with no sharp edges.
   4. Constructed to support an HS-20 wheel loading.
   5. Dimensions and Style shall conform to the Drawings, Standard castings differing in non-essential details are subject to approval by the Engineer:
      a. Covers -solid with sewer in 3-inch letters diamond pattern.
      b. Frame - 24-inch diameter clear opening, with flange bracing ribs.
   6. Minimum weight of frame and cover shall be 370 lbs.
2.3 **EXTERIOR CHIMNEY WRAP/SEAL**

A. One-piece flexible, molded wrap/seal manufactured from rubber and non-hardening butyl mastic.

B. Shall meet the following minimum standards:
   1. Elongation  ASTM D412  350%
   2. Tensile  ASTM D412  1,200 PSI/min
   3. Hardness  ASTM D2240  60 Duro

C. The wrap/seal shall not need any heat for be molded to the frame and chimney.

2.4 **MASONRY**

A. Brick:
   1. Sound, hard, uniformly burned, regular and uniform in shape and size, compact texture, and satisfactory to the Engineer.
   2. Immediately remove rejected brick from the work.

B. Mortar:
   1. Composition (by volume):
      a. 1 part Portland cement.
      b. 1/2 part hydrated lime.
      c. 4-1/2 parts sand.
   2. The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed 3 times the sum of the volume of cement and lime.

C. Cement shall be Type II Portland cement.

D. Hydrated lime shall be Type S.

E. Sand:
   1. Shall consist of inert natural sand.
   2. Grading:

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**PART 3 - EXECUTION**

3.1 **PERFORMANCE**

A. Precast Manhole Sections:
   1. Perform jointing in accordance with manufacturer's recommendations and as approved by the Engineer.
   2. Install riser sections and tops level and plumb.
   3. Make all joints watertight.
   4. When necessary, cut openings carefully to prevent damage to barrel sections and tops. Replace damaged manhole sections and tops at no additional cost to the Owner.
5. When manhole steps are included in the Work, install barrel sections and tops so that steps are in alignment.

B. Drop Manholes:
1. The difference in elevation between the invert of the inlet pipe and outlet pipe is to be either less than 6-inches (which does not require a drop manhole) or more than 24-inches (which does require a drop manhole).
2. Where difference in elevation between the invert of the inlet pipe to the invert of the outlet pipe exceeds 24 inches and/or where indicated on the Drawings, construct a drop manhole as shown on the Drawings or as directed by the Engineer.

C. Adjust to Grade:
1. Adjust tops of manholes to grade with brick masonry.
2. Concrete rings are acceptable for adjusting to grade.
3. In paved areas, set frame and cover to final grade after binder pavement is placed and the grade of surface pavement has been determined.

D. Pipe Connections to Manholes: Connect pipes to manholes with joint design and materials approved by the Engineer. Special care shall be taken to ensure that the openings through which pipes enter the structure are watertight.

E. Invert Channels:
1. After manhole and all pipes entering or exiting the manhole have been installed, construct the invert channels and shelf.
2. Channels to be smooth and semicircular in shape conforming to the inside of the adjacent sewer section.
3. Make changes in direction of flow with smooth curves having a radius as large as permitted by the size of the manhole.
4. Stop the pipes at the inside face of the manhole where changes of direction occur.
5. Form invert channels and shelf with brick. Form invert channels and shelf with smooth and carefully shaped 2500 psi concrete with no voids. Coat concrete with non-slip, hi-build epoxy coating.
6. The maximum change in elevation from the invert of the inlet pipe to the invert of the outlet pipe is 6-inches. Shape invert to make smooth transition in vertical grade.
7. Slope the floor of the manhole (shelf) to the flow channel, as shown on the Drawings.

F. Masonry:
1. Laying Brick:
   a. Use only clean bricks in brickwork for manholes.
   b. Moisten the brick by suitable means until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
   c. Lay each brick in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and thoroughly bond as directed.
   d. Construct all joints in a neat workmanlike manner. Construct the brick surfaces inside the manholes so they are smooth with no mortar extending beyond the bricks and no voids in the joints. Maximum mortar joints shall be 1/2 inch.
e. Outside faces of brick masonry shall be plastered with mortar from ¼-inch to 3/8-inch thick.
f. Completed brickwork shall be watertight.

2. Curing:
   a. Protect brick masonry from drying too rapidly by using burlaps which are kept moist, or by other approved means.
   b. Protect brick masonry from the weather and frost as required.

G. Frames and Covers:
   1. Set all frames in a full bed of mortar, true to grade and concentric with the manhole opening.
   2. Completely fill all voids beneath the bottom flange to make a watertight fit.
   3. Place a ring of mortar at least one inch thick around the outside of the bottom flange, extending to the outer edge of the manhole all around its circumference.
   4. Clean the frame seats before setting the covers in place.

H. Exterior Chimney Wrap/Seal
   1. Clean frame’s flange and chimney with a wire brush and a whisk broom.
   2. Frame and chimney must be dry.
   3. Apply an aerosol primer on frame flange and chimney per manufacturer’s recommendations.
   4. Install wrap/seal around chimney.
   5. Remove tape from the butyl mastic on top section of wrap and seal it to the frame’s flange.

I. Plugging and Patching:
   1. Fill all exterior cavities with non-shrink grout and with bituminous waterproofing once the concrete and mortar has set.
   2. Touch up damaged waterproofing.

J. Cleaning:
   1. Thoroughly clean manholes, frames and covers of all debris and foreign matter.

K. Bedding and Backfilling:
   1. Bedding of manholes shall be 6 inches of 3/4" screened stone.
   2. Backfill a minimum of 18 inches all around manhole with common borrow.

L. Frost Protective Wrap:
   1. The Contractor shall comply with the manufacturer's instructions for the particular conditions of installations in each case.
   2. Clean each manhole exterior of all dirt and remove any sharp protrusions.
   3. Apply two 6-inch wide vertical strips of bituminous waterproofing material and/or duct tape at the wrap seam from the top to bottom of the manhole per layer.
   4. Prior to installing pipe through each manhole or valve pit, wrap each manhole to the maximum depth of frost penetration, but not less than 5 feet below grade, with four layers of the polyethylene material by beginning the wrap at the adhesive strip and proceeding around the manhole, valve pit, etc., continuously by overlapping the adhesive strip by 24 inches on the final layer. Cut the polyethylene wrap in areas where piping exits the manhole. The size of the cut is to be equivalent to the pipes outside diameter.
5. Tuck and pleat the polyethylene wrap at the top of each manhole in a continuous manner, minimizing the size of each fold. Extend the polyethylene wrap past the top of the manhole frame and temporarily tuck the remainder inside the frame, until final backfill and paving.

6. In paved areas, cut the polyethylene wrap flush with the manhole rim after the pavement is in place.

7. In unpaved areas, pull the polyethylene wrap together, and tie around frame with galvanized wire.

8. Protect the installed frost barrier from harmful weather exposures and from possible physical abuses, where possible by prompt installation of concealing work or, where that is not possible, by temporary covering or enclosure.

9. Backfill around the manhole/frost barrier with material as outlined in Section 02200 - Earthwork.

3.2 MANHOLE TESTING

A. General:
   1. Perform a vacuum test on all manholes
   2. Perform all testing in the presence of the Engineer.
   3. Suitably plug all pipes entering each manhole and brace plugs to prevent blow out.

B. Vacuum Test:
   1. The manhole shall be tested by a vacuum test after assembly of the manhole, connection piping and backfilling. Vacuum testing to be conducted prior to construction of invert channels.
   2. Plug all lifting holes completely with non-shrink grout.
   3. Properly tighten all boot clamps and brace all plugs to prevent them from being sucked into the manhole.
   4. Install the testing equipment according to the manufacturer's instructions.
   5. A vacuum of 10 inches of Hg shall be drawn on the manhole and the loss of 1 inch of Hg vacuum timed. The manhole shall be considered to have passed the test if the time for the loss of 1 inch of Hg vacuum is:
      a. Greater than 2 minutes for manholes less than 10-feet deep.
      b. Greater than 2.5 minutes for manholes 10 to 15-feet deep.
      c. Greater than 3 minutes for manholes more than 15-feet deep.
   6. If the manhole fails the initial test, the Contractor shall locate the leak(s) and make repairs. The manhole shall be retested until a satisfactory test result is obtained.

C. Manhole Repairs:
   1. Correct leakage by reconstruction, replacement of gaskets and/or other methods as approved by the Engineer.
   2. The use of lead-wool or expanding mortar will not be permitted.

D. After the manholes have been backfilled and prior to final acceptance, any signs of leaks or weeping visible inside the manholes shall be repaired and the manhole made watertight.

END OF SECTION
SECTION 02615

DUCTILE IRON PIPE & FITTINGS
(BURIED APPLICATIONS)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide and install ductile iron pipe and fittings of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.

B. Related Work Specified Elsewhere:
   1. Pipe and Pipe Fittings - General is specified in the appropriate Section in Division 15.
   2. Earthwork is specified in this Division.
   3. Ductile Iron Pipe & Fittings for Interior/Exposed Applications is specified in Section 15062.

1.2 SUBMITTALS

A. Submit shop drawings in accordance with the applicable section of Division 1 and the General Conditions of the Construction Contract.

B. Submit manufacturer’s “Certification of Conformance” that pipe and fittings meet or exceed the requirements of these Specifications.

C. Submit manufacturers installation instructions and specifications for all pipe and fittings.

1.3 QUALITY ASSURANCE

A. Standards (As Applicable):
   4. Ductile iron pipe centrifugally cast in metal or sand lined molds: ANSI A21.51 (AWWA C151).

B. Acceptable Manufacturers:
   1. Tyler
   2. Griffin
   3. Union
   4. US Pipe
   5. Or equivalent.

1.4 DELIVERY, STORAGE & HANDLING

A. Exercise extra care when handling ductile iron pipe because it is comparatively brittle.
B. Exercise extra care when handling cement lined pipe because damage to the lining will render it unfit for use.

C. Protect the spherical spigot ends and the plain ends of all pipe during shipment by wood lagging securely fastened in place.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. General:
   1. All exterior (buried) ductile iron pipe shall have push-on or mechanical joints unless otherwise specified or shown on the Drawings. Pipe within valve pits and other structures is considered interior pipe and shall be flanged.
   2. Unless otherwise shown on the Drawings or in the pipe schedule, the minimum thickness of ductile iron pipe shall be:
      a. For pipe 4 inches in diameter and larger: Class 52.
      b. Pipe with flanges: Class 53.
   3. Pipe for use with sleeve type couplings shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
   4. Pipe shall be double thickness cement lined and seal coated unless noted otherwise on the Drawings, and except for air piping lines which shall be completely unlined.
   5. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the manufacturer of the couplings.
   6. Factory applied bituminous coatings (in accordance with AWWA C151) shall be furnished on the exterior of all underground piping unless specified otherwise.
   7. The outside of pipe within structures and exposed shall not be coated with bituminous coating, but shall be thoroughly cleaned and given one shop coat of Intertol Rustinhibitive Primer 621 by Koppers Co.; Multiprime by PPG Industries; Chromox 13R50 Primer made by Mobil Chemical Co.; or equivalent.

B. Joints (as shown on Drawings or as specified):
   1. Push-on and Mechanical Joint:
      a. The plain ends of push-on pipes shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.
      b. Provide gaskets manufactured from a composition material suitable for exposure to the fluid to be contained within the pipe.
      c. Bolts and nuts for buried mechanical joints shall meet the AWWA C-111 requirements and be made of high strength, low alloy steel.
   2. Flanged:
      a. Provide specially drilled flanges when required for connection to existing piping or special equipment.
      b. Flanges shall be long-hub screwed tightly on pipe by machine at the foundry prior to facing and drilling.
c. **Gaskets:**
   i. Ring type of rubber with cloth insertion.
   ii. Thickness of gaskets 12 inches in diameter and smaller: 1/16 inch.
   iii. Thickness of gaskets larger than 12 inches in diameter: 3/32 inch.

d. **Fasteners:**
   i. Make joints with bolt, studs with a nut on each end, or one tapped flanged with a stud and nut.
   ii. The number and size of bolts shall meet the requirements of the applicable ANSI standard.
   iii. Nuts, bolts, and studs shall be Grade B meeting the requirements of ASTM A307.
   iv. After jointing, coat entire joint with bituminous material compatible with pipe coating unless other coating required by Section 09900.

e. When applicable, provide and install flange clamps as shown on the Drawings.

3. **Joint Bracing:**
   a. Provide joint bracing to prevent the piping from pulling apart under pressure as required and as shown on the Drawings.
   b. **Types of bracing:**
      i. Mechanical joint follower gland pipe restrainers.
         1) Ductile iron gland and restraining ring.
         2) Bolts and nuts shall be 316 stainless steel.
         3) Gasket shall be standard MJ gasket -ANSI/AWWA-C111/A21.11.
         4) Working pressure 350 psi, up to 8 inches; 250 psi, 10 inches to 16 inches.
         5) Test pressure two times working pressure.
         6) Grip Rings™, Romac Industries, or other equivalent as approved by Engineer.
      ii. Other types of bracing as shown on the Drawings.

2.2 **FITTINGS**
   A. **Standard Fittings:**
      1. Pressure rating of 350 psi for D.I. compact fittings and 250 psi for all others unless indicated otherwise on the Drawings or as specified.
      2. Joints the same as the pipe with which they are used or as shown on the Drawings.
      3. Cement lining and seal coat as specified for pipe.
      4. Factory applied bituminous coatings shall be furnished for all underground fittings.

**PART 3 - EXECUTION**

3.1 **INSPECTION**
   A. Provide all labor necessary to assist the Engineer to inspect pipe, fittings, gaskets, and other materials.
   B. Carefully inspect all materials at the time of delivery and just prior to installation.
C. Carefully inspect all pipe and fittings for:
   1. Defects, such as weak structural components, that adversely affect the execution and quality of work.
   2. Deviations beyond allowable tolerances for pipe clearances.
D. Immediately remove all rejected materials from the project site.

3.2 INSTALLATION
A. General:
   1. Install in strict accordance with the pipe and fitting manufacturer's instructions and recommendations and as specified or as shown on the Drawings.
   2. Thrust resistant system is required at all fittings on pressure pipe.
B. Assembling Joints:
   1. Push-on Joints:
      a. Insert the gasket into the groove of the bell.
      b. Uniformly apply a thin film of special lubricant over the inner surface of the gasket that will contact the spigot end of the pipe.
      c. Insert the chamfered end of the plain pipe into the gasket and push until it seats against the bottom of the socket.
   2. Bolted Joints:
      a. Remove rust preventive coatings from machined surfaces prior to assembly.
      b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.
      c. After jointing coat all bolts with bituminous material compatible with the pipe coating required herein and/or in Section 09900.
   3. Flanged Joints:
      a. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
      b. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.
   4. Mechanical Joints:
      a. Thoroughly clean, with a wire brush, surfaces that will be in contact with the gaskets.
      b. Lubricate the gasket, bell, and spigot by washing with soapy water.
      c. Slip the gland and gasket, in that order, over the spigot and insert the spigot into the bell until properly seated.
      d. Evenly seat the gasket in the bell at all points, center the spigot, and firmly press the gland against the gasket.
      e. Insert the bolts, install the nuts finger tight, and progressively tighten diametrically opposite nuts uniformly around the joint to the proper tension with a torque wrench.
      f. The correct range of torque (as indicated by a torque wrench) and the length of wrench (if not a torque wrench) shall not exceed:
         i. Range or Torque: 60-90 ft.-lbs.
         ii. Length of Wrench: 10 inches.
If effective joint sealing is not attained at the maximum torque specified above, disassemble, thoroughly clean, and reassemble the joint. Do not overstress the bolts to tighten a leaking joint.

5. Bell and Spigot Joints:
   a. Thoroughly clean the bell and spigots and remove excess tar and other obstructions.
   b. Insert the spigot firmly into place and hold securely until the joint has been properly completed.

C. Fabrication:
   1. Tapped Connections:
      a. Make all tapped connections as shown on the Drawings or as required by the Engineer.
      b. Make all connections watertight and of adequate strength to prevent pullout.
      c. Drill and tap normal to the longitudinal axis of the pipe.
      d. Taps in fittings shall be located where indicated by the manufacturer for that particular type of fitting.
      e. The maximum sizes of taps in pipes and fittings without busses shall not exceed the sizes listed in the appendix of ANSI A21.51 based on 2 full threads for ductile iron and 3 full threads for cast iron.
   2. Cutting:
      a. Perform all cutting as set forth in AWWA C600.
      b. Carefully chamfer all cut ends to be used with push-on joints to prevent damage to gaskets when pipe is installed.

D. Pipe Deflection:
   1. Push-on and Mechanical Joints:
      a. The maximum permissible deflection of alignment at joints shall be limited to that given in AWWA C600.
   2. Flexible Joints:
      a. The maximum deflection in any direction shall not exceed the manufacturer's instructions and recommendations.

END OF SECTION
SECTION 02615B
PRE-INSULATED DUCTILE IRON PIPE & FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish and install pre-insulated pipe system and accessories where shown on the Drawings.
B. Related work specified elsewhere (where applicable):
   1. Earthwork is specified in Division 2.
   2. Ductile Iron Pipe & Fittings (Interior/Exposed Applications) is specified in Division 15.

1.2 QUALITY ASSURANCE
A. Provide ductile iron pipe and fittings of domestic origin.
B. Acceptable Manufacturers:
   1. Urecon, Ltd.
   2. Tricon Piping Systems, Inc.
   3. Or approved equal meeting all requirements of Part 2 of this Section.
C. Manufacturer shall submit shop drawings for approval.
   1. Shop drawings shall show jacket system, insulation, end seals, joint kits, etc.
   2. The entire system shall be factory engineered.
   3. The product shall be manufactured in accordance with ISO 9001-2000 Standards or approved equal.
D. A representative of the manufacturer shall be present for all critical periods.
   1. Critical periods shall include but not be limited to:
      a. Inspection of materials for damages after receipt at jobsite.
      b. Supervision of joint assembly.
      c. Supervision of hydrostatic testing.
      d. Other supervision as required to provide a complete integral system.

PART 2 - PRODUCTS

2.1 MATERIALS
The service pipe shall be ductile iron manufactured in accordance with ANSI/AWWA C151/A21-51. Push-on joints and mechanical joints shall be in accordance with ANSI/AWWA C111/A21.11. CLASS 52.
A. Ductile iron pipe shall meet EPA American Iron and Steel requirements. Refer to Supplementary Conditions.
B. Insulation
   1. Material: rigid polyurethane foam, factory applied.
   2. Thickness: 50 mm (2 in.) minimum or as required.
   3. Density: (ASTM D 1622) 35 to 46 kg/m³ (2.2 to 3.0 lbs/ft³).
   4. Closed cell content: (ASTM D 2856) 90%, minimum.
   5. Water absorption: (ASTM D 2842) 4.0% by volume.
   6. Thermal conductivity: (ASTM C518) 0.020 to 0.026 W/m °C.

C. Outer Jacket
   1. The outer jacket shall be constructed of one of the following:
      i. Seamless, High-Density Polyethylene (HDPE) ASTM D-1248 with the
         following properties:
         1. ASTM D-638 Ultimate Elongation: 850%
         2. ASTM D-638 Tensile Yield Strength: 3,300 psi
         3. ASTM D-3350 Resin Type III, Grade P34
         4. ASTM D-790 Tangential Flexural Modulus: 175,000 psi
      ii. 18-gauge, hot-dipped galvanized steel, spiral lock seam jacket.
   2. Jacket outer diameter shall not exceed 19.80” inches (maximum).

D. Insulation Kits for Fittings
   1. Insulation kits for fittings shall consist of rigid polyisocyanurate or urethane
      foam insulation complete with a thin elastomeric coating on the outside surfaces
      for strength during transit and installation, and fabricated HDPE, galvanized
      steel or aluminum outer protective jacket consistent with that on the factory
      insulated pipe. All kits to be supplied complete with stainless steel bands, band-
      it clips, and stainless-steel screws to suit.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. All pre-insulated piping shall be installed per the manufacturer's recommendations.
   B. Assembled pre-insulated ductile iron pipe and fittings system shall be pressure tested
      by in accordance with Specification Section 02755 – Final Sewer Testing.
SECTION 02617
UNDERDRAIN PIPE

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Provide and install Type B and Type C underdrain pipe of the type(s), size(s)
      and in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere:
   1. Excavation and backfill, pavement, borrow and bedding material are specified
      in the appropriate sections in this Division.
   2. Pipe & Pipe Fittings - General is specified in Division 15.

1.2 QUALITY ASSURANCE
A. Standards:
   1. Bituminous Coated Corrugated Metal Underdrains:
      a. Pipe - AASHTO M 36-78, Type III
      b. Coating - AASHTO M 190-78, Type A.
   3. Perforated Concrete Pipe
      a. Pipe AASHTO M 175M/M 175
   4. ABS Pipe for Underdrain
      a. Pipe, ASTM D2680
      b. Perforations, AASHTO M36, Type III
B. Gauge and Type:
   1. BCCMU
      a. Gauge: 16
   2. CAAU
      a. Type III, Class I (helically corrugated pipe with perforations)
      b. Gauge: 0.060 inch

1.3 SUBMITTALS
A. Submit shop drawings in accordance with the General Conditions of the Construction
   Contract.

1.4 DELIVERY, STORAGE AND HANDLING
A. Exercise care when handling underdrain pipe to prevent damage of any nature to pipe
   and finish.
B. Immediately remove damaged materials and replace at no additional cost to the
   Owner.
C. Store materials above ground on platforms, skids, or other adequate supports.
PART 2 - PRODUCTS

2.1 MATERIALS
   A. Pipe:
      1. As specified above.
   B. Joints:
      1. Coupling Bands: Same applicable requirements as the underdrain pipe being joined.

PART 3 - EXECUTION

3.1 INSPECTION
   A. Examine areas to receive piping for the following:
      1. Obstructions that adversely affect the installation and quality of the work.
      2. Deviations beyond allowable tolerances for clearances.
   B. Examine pipe and fittings before installation to assure no defective materials are incorporated.
   C. Start the work only when conditions are satisfactory.
   D. Remove and replace all defective materials at no additional cost to the Owner.

3.2 INSTALLATION
   A. Do not install underdrains nor backfill between December 15 and April 1 without the written permission of the Engineer.
   B. Begin laying the underdrain at the downstream end.
   C. Join flexible underdrain by coupling bands.

END OF SECTION
SECTION 02622

POLYVINYL CHLORIDE (PVC) NON-PRESSURE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Provide and install PVC non-pressure pipe and fittings of the size(s) and type(s) and in the locations shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere: (When Applicable)
   1. Excavation and backfill, dewatering, pavement, borrow and bedding material, and cleaning and testing requirements are specified in the appropriate sections of this Division.
   2. Pipe & Pipe Fittings - General is specified in Division 15

1.2 QUALITY ASSURANCE
A. Manufacturers:
   1. Certain-Teed.
   3. Or equivalent.

1.3 SUBMITTALS TO THE ENGINEER
A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.
B. Submit manufacturer's "Certification of Conformance" that pipe and fittings meet or exceed the requirements of these Specifications.
C. Submit other documents as specified in the appropriate Sections of this Division.

1.4 DELIVERY STORAGE AND HANDLING
A. Provide all labor necessary to assist the Engineer to inspect pipe, fittings, gaskets and other materials.
B. Carefully inspect all materials at the time of delivery and just prior to installation.
C. Carefully inspect all pipe and fittings for:
   1. Defects and damage
   2. Deviations beyond allowable tolerances for joint dimensions.
D. Examine area and structures to receive piping for:
   1. Defects, such as weak structural components that adversely affect the execution and quality of work.
   2. Deviations beyond allowable tolerance for pipe clearances.
E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.
F. Immediately remove all rejected materials from the project site.
PART 2 - PRODUCTS

2.1 MATERIALS
A. Pipe and Fittings:
   1. The polyvinyl chloride pipe and fittings, including those required for stubs, shall conform to ASTM standard specification for PVC Sewer Pipe and Fittings, Designation D 3034 (SDR 35) (4" to 15"), F679 (18" to 27"), or F1760-01 (for recycled pipe, all diameters).
   2. Straight pipe shall be furnished in lengths of not more than 14 feet.
   3. Saddles will not be allowed.
B. Joints:
   1. Joints for the polyvinyl chloride pipe shall be push-on joints using factory installed elastomeric ring gaskets.
   2. The gaskets shall be securely fixed into place by the manufacturer so that they cannot be dislodged during joint assembly.
   3. The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and ground water, and which will endure permanently under the conditions of the proposed use.
   4. The joints shall conform to ASTM Specifications for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals, Designation D3212-76.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Inspection:
   1. Each pipe unit shall be inspected before being installed. No single piece of pipe shall be laid unless it is generally straight.
   2. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16 inch per foot of length.
   3. If a piece of pipe fails to meet this requirement for straightness it shall be rejected and removed from the site.
   4. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.
B. Installation in Trenches:
   1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in the appropriate Sections of these Specifications.
   2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.
   3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
   4. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.
   5. Lay each pipe length so it forms a close joint with the adjoining length and bring the inverts to the required grade.
6. Pipe and fittings shall be installed to the lines and grades indicated on the drawings or as required by the Engineer. Care shall be taken to insure true alignments and gradients.

7. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer, or any other unyielding object.

8. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.

9. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.

10. Take all necessary precautions to prevent floatation of the pipe in the trench.

11. Bedding and backfill for all pipe materials shall be as specified in Section 02200, Earthwork, and as shown on the Drawings.

C. Jointing:

1. All pipe and fittings shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the completed work.

2. All joint surfaces shall be cleaned. Immediately before jointing the pipe, the bell or groove shall be lubricated in accordance with the manufacturer's recommendation.

3. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe units together so that they will fit with a minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends.

4. Install adapters, acceptable to the Engineer, when connecting pipes constructed from different materials.

5. Immediately after making a joint, fill the holes for the joints with bedding material, and compact.

6. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.

D. Temporary Plugs:

1. When pipe installation work in trenches is not in progress, close the open ends of the pipe with temporary watertight plugs.

2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.

3. Do not use the pipelines as conductors for trench drainage during construction.

E. Service Connections:

1. All service connections to new pipe shall utilize a wye fitting.

2. All service connections must enter the top half of the mainline pipe.

F. Pipe Deflection:

1. Pipe provided under this specification shall be installed so there is no more than a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (normal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
2. The Contractor shall wait a minimum of 30 days after completion of a section of sewer, including placement and compaction of backfill, before measuring the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Engineer. Refer to Section 02755.

3. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem as the Engineer may require without additional compensation.

G. Testing:
1. Clean and test pipe in accordance with appropriate sections of this Division.

END OF SECTION
SECTION 02628
HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install and test all polyethylene pipe, pipe fittings and appurtenances of the type(s) and size(s) and in the location(s) as shown on the Drawings and as herein specified.
B. Related Work Specified Elsewhere:
   1. Earthwork is specified in Section 02200.
   2. Pipe and Pipe Fittings - General is specified in Section 15050.

1.2 QUALITY ASSURANCE
A. Pressure rating or pressure class of pipe as shown on the Drawings or specified herein.
B. Standards:
   1. ANSI/AWWA C901-02: Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½" (13 mm) through 3" (76 mm) for Water Service.
   2. AWWA C 906-99: Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4" (100 mm) through 63" (1,575 mm) for Water Distribution and Transmission.
13. 49 CFR 192 subpart F, 192.281, selected requirements for plastic joints; 192.282, requirements for qualifying joining procedures; 192.285, specifies qualifying persons to make joints; and 192.287, specifies inspection of joints.

14. Fusion Operators: Operators shall meet the minimum qualification requirements outlined in 49 CFR 192 subpart F, 192.285 and shall have documented experience with successful butt fusion of pipe larger than 24 inch diameter.

15. Joint Fusion Data: Fusion plate temperature (oF), interfacial fusion pressure (psi), interfacial contact fusion time (sec.), and cooling time (min.) shall be recorded by data logger for computer download or recorded by the operator(s) in a field book for each joint fusion completed.

16. Pipe deemed damaged or unacceptable to the Engineer shall be replaced at no additional cost to the Owner. Pipe shall be adequately protected during storage to prevent external damage to the pipe side wall or ends. Pipe with gouged side walls will be rejected by the Engineer.

17. Exterior pipe markings shall include the nominal pipe diameter, SDR, and rated working pressure.

C. Acceptable Pipe and Fitting Supplier/Manufacturers:
   1. PolyPipe, Inc. "PW Pipe"
   2. KWH Pipe, "Sclairpipe"
   3. Performance Pipe
   4. "Isco-Pipe"
   5. "Poly-Cam"
   6. "Friatec"
   7. Vari-Tech "Performance Pipe"
   8. Independent Pipe Products, Inc.
   9. Or approved equal.

1.3 SUBMITTALS
   A. Submit shop drawings in accordance with the applicable section of Division 1 and the General Conditions of the Construction Contract.
   B. Submit manufacturer's "Certification of Conformance" that pipe and fittings and other piping appurtenances meet or exceed the requirements of these Specifications.
   C. Submit experience statement for operator(s) to complete the pipe fusion to demonstrate the minimum experience and qualification requirements described in paragraph 1.2.B.14.
   D. Following pipe construction, submit joint fusion data in an electronic spreadsheet format as a record to document joint fusion quality control.
   E. Submit manufacturers installation instructions and specifications for all fittings, couplings, adapters, saddles, etc.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Pipes shall be either Iron Pipe Size (IPS) or Ductile Iron Pipe Size (DIPS) with SDR ratings as indicated in the pipe schedule.
B. Polyethylene compounds utilized in the manufacture of products furnished under this specification shall be listed in PPI TR-4, with a minimum cell classification of PE 445574C for PE 4710 materials, as defined in ASTM D3350. Pipe shall be in conformance with AWWA C901, AWWA C906, or CSA B137.1. They shall have a PPI recommended Hydrostatic Design Basis (HDB) of 1600 psi (PE4710) at a temperature of 73.4°F (23°C).

C. All materials which come in contact with water, including lubricants, shall be evaluated, tested and certified for conformance with NSF/ANSI Standard 61.

D. Clean re-work material of the same type grade, and cell classification generated from the manufacturer's own pipe and fitting production may be used by the same manufacturer as long as the pipe, tubing and fittings produced meet all the requirements of AWWA C901, AWWA C906, or CSA B137.1.

E. Pipe furnished under this specification shall be manufactured using compounds complying with the requirements above. Dimensional and performance characteristics shall conform to the requirements of AWWA C901, AWWA C906, or CSA B137.1.

F. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed in a concentration of not less than 2%.

G. The polyethylene resin compound shall have a resistance to environmental stress cracking as determined by procedure detailed in ASTM D 1693 with sample preparation by procedure C of ASTM D 4703 of not less than 40 hours.

H. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

I. Polyethylene fittings shall have the same pressure rating as the pipe itself for all pressurized pipeline applications.

J. Polyethylene fittings shall be molded style for diameters up to 12 inches and fabricated style for diameters larger than 12 inches.

2.2 PIPE SCHEDULE

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<tr>
<th>PIPE IDENTIFICATION</th>
<th>DIA. (inches)</th>
<th>SDR</th>
<th>IPS/DIPS</th>
<th>WORKING PRESSURE RATING (PSI)</th>
<th>DE-BEAD REQUIRED INSIDE PIPE</th>
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<td>8</td>
<td>17</td>
<td>DIPS</td>
<td>125</td>
<td>Yes</td>
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2.3 ADAPTERS AND COUPLINGS (AS APPLICABLE)

A. Polyethylene Mechanical Joint Adapter

1. For joining IPS or DIPS size polyethylene pipe to any ANSI\AWWA C153 ductile iron fitting and valve.

2. Molded from NSF listed PE 4710 resin.

3. Adaptor shall meet requirements of AWWA C901, 906.

4. Adaptor kit to include anchor fitting, epoxy coated ductile iron retainer gland ring, gasket, and long tee-bolts, and rubber gasket.

5. Provide stainless steel stiffeners as necessary.
B. Polyethylene Flanged Adapter
   1. For joining IPS or DIPS size polyethylene pipe to ANSI B16.1, ANSI B16.5, or ANSI A21.10 (AWWA C110) flange as required.
   2. Molded from NSF listed PE 4710 resin.
   3. Adaptor kit to include epoxy coated ductile iron backing ring, gasket, and long tee-bolts, and rubber gasket.
   4. Adaptor shall meet requirements of AWWA C901, 906.

C. Polyethylene Wall Anchor
   1. For restraining polyethylene pipe in cast-in-place concrete headwall.
   2. Molded from NSF listed PE 4710 resin.
   3. Pressure rating and size shall be the same as the required pipe and fitting SDR.
   4. IPS or DIPS to match required pipe size.

D. Polyethylene Electrofusion Coupling
   1. For joining plain ends of polyethylene pipe where butt fusion is not practical as approved by the Engineer.
   2. Molded from NSF listed PE 4710 resin or fabricated from pipe meeting NSF requirements with an integral heating element and electrical leads to connect the heating element power supply.
   3. Pressure rating and size shall be the same as the required pipe and fitting SDR.

E. Polyethylene Electrofusion Saddle
   1. For installation corporation stops in HDPE pipe for water service connection or manual air release valve.
   2. Molded from NSF listed PE 4710 resin with an integral heating element and electrical leads to connect the heating element power supply.
   3. Pressure rating and size shall be the same as the required pipe and fitting SDR.

F. Threaded HDPE Transition Adapter, Unions, and Threaded Adapters
   1. For joining polyethylene pipe to threaded fittings and valve ends (NPT.
   2. HDPE end of transition adapters be SDR rated to match required pipe SDR.
   3. HDPE end of transition adapters shall be molded from NSF listed PE 4710 resin.
   4. All metallic materials shall be constructed of Type 316 Stainless Steel.
   5. Coupling transition end shall be Male NPT.
   6. IPS or DIPS to match required pipe size.

G. Blind Flanges
   1. Molded from NSF listed PE 4710 resin.
   2. Pressure rating and size shall be the same as the required pipe and fitting SDR.

2.4 FABRICATION

A. Thermal Butt-Fusion:
   1. Join the pipe to itself, or to the polyethylene fittings or to the flange connections by means of thermal butt-fusion.
   2. Have all fusion performed by personnel trained by the pipe supplier or other qualified persons, using tools approved by the pipe supplier.
   3. The polyethylene fittings and flanged connections to be joined by thermal butt-fusion shall be from the same type, grade and class of polyethylene compound as the polyethylene pipe unless otherwise approved.
   4. Joint strength must be equal to that of the adjacent pipe.
B. Socket Fusion (When Applicable)
   1. Join the pipe to socket type fittings by means of socket fusion
   2. Have all fusion performed by personnel trained by the pipe supplier or other qualified persons, using tools approved by the pipe supplier.
   3. The polyethylene fittings to be joined by thermal socket-fusion shall be from the same type, grade and class of polyethylene compound as the polyethylene pipe unless otherwise approved.

C. Electrofusion (When Applicable)
   1. Applies to the installation of electrofusion couplings and saddles.
   2. Have all fusion performed by personnel trained by the pipe supplier or other qualified persons, using tools approved by the pipe supplier.
   3. The coupling or saddle shall be joined using heat created by electric current from a control box.
   4. Install clamps to hold the fitting in place during the fusion process.

D. Flanged Joints
   1. Flange joining of sections of pipe is allowed to facilitate the pipe installation process as approved by the Engineer.
   2. Joints shall include full face gaskets.
   3. Flange bolts shall be tightened to the same torque value and tightening pattern recommended by the manufacturer.
   4. Flange bolts and nuts shall be Type 316 stainless steel and have tensile strength equivalent to SEA Grade 3.
   5. Use flat Type 316 stainless steel washers between the nut and backup ring.
   6. Retighten bolts to the manufacturer recommended torque value after an hour to offset the effects of compression set.

E. Mechanical Connections: The mechanical connections of the polyethylene pipe to auxiliary equipment shall be in accordance with the pipe suppliers written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPES AND FITTINGS
A. Installation in Trenches:
   1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in the appropriate Sections of these Specifications.
   2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.
   3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
   4. Install joint and transition adapters in accordance with the manufacturer’s recommendations.
   5. Joining surfaces must be clean and dry.
   6. Pipe and fittings shall be installed to the lines and grades indicated on the drawings or as required by the Engineer. Care shall be taken to insure true alignments and gradients.
7. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer, or any other unyielding object.
8. Pipe must not be dumped, dropped, pushed or rolled into the trench. Provide appropriate equipment to lift move and lower the pipe into the trench as necessary.
9. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
10. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
11. Take all necessary precautions to prevent floatation of the pipe in the trench.
12. Bedding and backfill for all pipe materials shall be as specified in Section 02200, Earthwork, and as shown on the Drawings.

3.2 TESTING
A. Joint Quality
1. 12" diameter and smaller - On each day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out. The test strap shall be 12" or 30 times the wall thickness in length (minimum) and 1" or 1.5 times the wall thickness in width (minimum). Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
2. All fused joints shall be visually inspected by qualified fusion operators and the Engineer during construction to assure uniform alignment and beading.

B. Leak Test
1. Refer to Section 15050 for Testing.

END OF SECTION
SECTION 02646

VALVE BOXES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish and install valve boxes of type(s) and size(s) and in the locations shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere:
   1. Gate Valves are specified in Section 02641

1.2 QUALITY ASSURANCE
A. All valve boxes shall be manufactured by one manufacturer.
B. Qualifications of Manufacturer: Products to have been proven reliable in similar installations over a reasonable number of years.
C. Acceptable Manufacturers:
   1. Tyler
   2. Quality Water Products
   3. Bibby-Ste-Croix
   4. Or Equivalent

1.3 SUBMITTALS
A. Submit shop drawings in accordance with the applicable section of Division 1 and the General Conditions of the Construction Contract.
B. Submit manufacturer’s “Certification of Conformance” that all valve boxes meet or exceed the requirements of these Specifications.
C. Submit manufacturers installation instructions and specifications for all valve boxes.

PART 2 - PRODUCTS

2.1 MATERIALS
A. The valve box shall be ductile iron or cast iron, slip type two-piece integral base, 5-1/4 inch shaft. Top section with flanges.
B. The cover shall be ductile iron or cast iron, with the word "Water" cast in cover for water piping or with the word “Sewer” for sanitary sewer piping.
C. Valve boxes shall have a belled base section.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Installation as shown on the Drawings and/or as specified herein.
   1. When installation is complete, no pressure shall be exerted by valve box on the water main/sewer force main or on the valve.
   2. Be of such length as required without full extension. Minimum lap 6 inches.

END OF SECTION
SECTION 02650

BURIED UTILITY MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. This work shall consist of providing and installing utility line markings above all buried lines installed as part of this contract and replacing existing markings disturbed as part of this contract. Buried utilities are indicated on the Civil and Electrical Drawings.

B. Related Work Specified Elsewhere:
   1. Pipe, excavation, backfill, insulation are specified in the appropriate Sections in this Division.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and color shall be in accordance with latest AASHTO specifications for pipe and utility marking.

B. Marking tape color shall be in accordance with latest American Public Works Association (APWA) Uniform Color Code and American National Standards Institute ANSI Standard Z535.1, Safety Color Code specifications for buried utility marking as noted in the Schedule below.

1. Schedule

<table>
<thead>
<tr>
<th>Marker Color</th>
<th>Buried Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Potable Water &amp; Associated lines</td>
</tr>
<tr>
<td>Green</td>
<td>Sanitary Sewers, Storm Drain and other Drain lines</td>
</tr>
<tr>
<td>Orange</td>
<td>Telecommunication, signal, alarm</td>
</tr>
<tr>
<td>Red</td>
<td>Electric Power lines cables conduits and lighting cables</td>
</tr>
<tr>
<td>Yellow</td>
<td>Gas, Oil, Steam, Petroleum or Gaseous Material Lines</td>
</tr>
</tbody>
</table>

2. Warning Information shall be in Black Letters with typical wording of:
   a. "CAUTION: BURIED (NAME OF UTILITY LINE) BELOW"

C. For ferrous pipe material use 0.004" minimum polyethylene film; 6" wide clearly marking type of buried utility.

D. For non-ferrous pipe material (e.g. Concrete, PVC, PE, etc.) use detection tape composite of polyethylene and metallic core 6" wide clearly marking type of buried utility.

E. Seton Identification Products, New Haven, CT, Utility Safeguard LLC or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Marking tape shall be installed over utility lines centerline and buried 24" below grade.

B. Markings damaged during opening of trench shall be reinstalled with 2' overlap at broken sections.

END OF SECTION
SECTION 02655
COUPLINGS & CONNECTORS FOR BURIED APPLICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Furnish and install couplings and connectors of the type and size in the location shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE
A. Minimum pressure rating equal to that of the pipeline in which they are to be installed.
B. Couplings and connectors, other than those specified herein, are subject to the Engineer's approval.

PART 2 - PRODUCTS

2.1 MATERIALS
A. All Couplings and Connectors:
   1. Gasket Materials: Composition suitable for exposure to the liquids to be contained within the pipes.
   2. Diameters to properly fit the specific types of pipes on which couplings and connectors are to be installed.
B. Sleeve Type Transition Couplings
   1. Buried Couplings:
      a. Ductile iron center sleeve and end rings made per ASTM A536, Grade 65-45-12
      b. Two wedge-section virgin SBR rubber gaskets compounded for water service,
      c. Nuts and bolts shall be ductile iron low alloy steel per ANSI/AWWA A21.11/C-111.
      d. Couplings shall be long barrel type.
      e. Coupling shall be fusion bonded epoxy coated meeting NSF 61 standards for potable water applications
      f. Acceptable Manufacturers:
         i. Romac Industries Model 501
         ii. Ford style FC1 and FC2A
         iii. Smith Blair
         iv. Or Equal
C. Solid Sleeve Couplings
   1. Solid sleeves shall be ductile iron with mechanical joint ends.
   2. Couplings shall meet AWWA/ANSI C-153/A21.53 and C-111/A21.11 for joints, and C-104/A21.4 for cement lining in sizes 3"-24".
   3. Nuts and bolts shall be ductile iron low alloy steel per ANSI/AWWA A21.11/C-
D. Flexible Couplings for drain connections
   1. Rubber material with stainless steel clamps
   2. Must provide a positive seal against infiltration and exfiltration
   3. Coupling materials must conform to ASTM C443, C564, and D1869.

E. Mechanical Joint Adaptors (Foster Adaptor®)
   1. Required to connect fittings and valves with mechanical joints
   2. Ductile iron construction mechanical joint bolt pattern.
   3. Bolts and nuts shall meet AWWA C-111.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sleeve Type Couplings:
   1. Thoroughly clean pipe ends a minimum of 12-inches from the ends prior to
      installing couplings, and use soapy water as a gasket lubricant.
   2. Slip an end ring and gasket over each pipe and place the center sleeve centered
      over the joint.
   3. Insert the other pipe length into the center sleeve the proper distance.
   4. Press the gaskets and end rings evenly and firmly into the center sleeve flares.
   5. Insert the bolts, finger tighten and progressively tighten diametrically opposite
      nuts uniformly around the adapter with a torque wrench applying the torque
      recommended by the manufacturer.
   6. Insert and tighten the tapered threaded lock pins.

B. Install thrust rods, supports, and other provisions to properly support pipe weight and
   axial equipment loads.

END OF SECTION
SECTION 02751
SEWER FLOW CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: During the replacement of sewer lines and manholes, the contractor shall by-pass each section temporarily out of service. During sewer line joint testing the contractor shall control flows in sewer lines when they exceed 1/4 of the pipe diameter or when inspection of the complete periphery of the pipe is necessary to effectively conduct inspection operations.
B. Related Work Specified Elsewhere:
   1. Temporary Bypass Pumping Systems: Section 01515
   2. Sewer line cleaning is specified in the appropriate sections in this Division.
   3. Final sewer testing is specified in Division 2.

1.2 SUBMITTALS
A. In accordance with the requirements of Section 01340. Additional specific information required is listed below.
   1. Proposed schedule, sequence of construction, duration of activities and description of sewer control methods to be utilized for each element of the project.
   2. Technical data (including capacity and fuel tank size) of any portable temporary pumping equipment to be used during normal Contractor work hours.
   3. Supplemental information required under Section 01515 for sewer flow control which extends beyond Contractor work hours.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 COORDINATION OF WORK
A. Provide all labor and equipment necessary to coordinate work of this section and maintain communications.
B. Notify all personnel, including but not limited to the Owner, Engineer, and Utility Companies seven days in advance of any temporary bypass pumping work. The Owner will identify personnel to be notified in addition to those identified by the Contractor.
C. Contractor shall coordinate temporary bypass pumping operations with the Owner and Engineer on a daily basis.

3.2 PERFORMANCE
A. General
   1. The Contractor shall install and test all sewer flow control methods to the satisfaction of the Owner and Engineer prior to proceeding with the Work.
2. The Contractor shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.

B. Plugging or Blocking:
1. Insert plug at a manhole upstream of line to be replaced, inspected and tested.
2. Plug shall be so designed that all or any portion of the sewage flows can be released.
3. Flows shall be shut off or substantially reduced during line testing.

C. Pumping and Bypassing:
1. When required, supply the necessary pumps, conduits and other equipment (including standby equipment) to divert the flow of sewage around the line in which work is being performed.
2. Furnish the necessary labor and 24-hour supervision to set up, test and operate the pumping and bypassing system.
3. Any temporary pumps, piping, fuel storage, or other appurtenances associated with the portable temporary pumping equipment shall be either located above the 100-year flood elevation or protected against flotation or other damage which would be caused by a flood event.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
   A. Work Included: Provide all equipment necessary for the proper cleaning of sewers prior to joint testing operations and/or closed-circuit television inspection.
   B. Related Work Specified Elsewhere: Sewer line joint testing and closed-circuit television inspection are specified in this Division.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. High Velocity Hydro-Cleaning Equipment shall:
      1. Have a minimum of 400 feet of high-pressure hose.
      2. Have multiple high velocity nozzles, as follows:
         a. Standard 35-degree nozzle with multiple rear jets and one front jet.
         b. Sand nozzle capable of transporting sand and gravel to the downstream manhole; and
         c. Rotating nozzle for removal of grease and scale.
      3. Include a high velocity gun for washing and scouring manhole walls and floor.
      4. Be capable of producing flows from a fine spray to a long distance solid stream.
      5. Include a water tank, auxiliary engines and pumps, and a hydraulically driven hose reel.
      6. Have equipment operating controls located above ground.

PART 3 - EXECUTION

3.1 PERFORMANCE
   A. Select cleaning equipment based on the conditions of the lines at the time the work commences.
      1. Light cleaning (small amounts of debris exist within the sewer line): Use high pressure water jetting equipment, brushes and swabs.
      2. Heavy cleaning (large deposits of debris or heavy root growth exist within the sewer line): Use high pressure water jetting equipment specifically designed for the intended use.
   B. Use selected equipment to remove all dirt, grease, rock and other deleterious materials and obstructions.
   C. Protect existing sewer lines from damage caused by improper use of cleaning equipment.
   D. Take precautions to avoid damage or flooding to public or private property being served by the line being cleaned.
   E. Removal of Materials:
      1. Remove all solids and semi-solids at the downstream manhole of the section being cleaned.
2. Passing material from one section of a line to another will not be permitted.

F. Disposal of Materials: Remove from the site and dispose of all solids or other waste materials recovered during the cleaning operations in an approved manner.

3.2 FIELD QUALITY CONTROL
A. Acceptance of this portion of work may be made upon completion of subsequent television inspection and shall be to the complete satisfaction of the Engineer.

END OF SECTION
SECTION 02753
TELEVISION INSPECTION OF SEWERS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish all necessary labor, materials, supervision and equipment to satisfactorily inspect gravity sewer mains as required by the Contract Documents by means of a closed-circuit television (CCTV) system.
B. Related Work Specified Elsewhere: Sewer line cleaning and sewer flow control are specified in the appropriate sections in this Division.

1.2 QUALITY ASSURANCE
A. CCTV work shall be completed and delivered per the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) standards. Operators of CCTV equipment shall be NASSCO PACP certified.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT
A. The cameras shall be designed and constructed for sewer line inspection work. The mechanical design of the lens shall allow it to turn and rotate 360 degrees to provide a close up view of sewer pipe walls and sewer service pipes. The camera shall be designed to maintain proper orientation of the picture while the lens is turning and rotating.
B. The cameras shall be operative in 100% humidity conditions.
C. The lighting for the cameras shall be suitable to allow a clear picture of service pipes and the entire periphery of the mainline sewer pipe, such that joints, root intrusions, cracks, offset joints, deposits, etc. can be seen and identified by the Engineer.
D. The lens focus and rotational capabilities and the light intensity will be remotely controlled from an above ground television "studio".
E. The cameras shall produce a continuous, full color picture with a quality acceptable to the Engineer.

PART 3 - EXECUTION

3.1 PERFORMANCE
A. Flow Control:
   1. A minimum of 75% of the periphery of the sewer line shall be visible at all times.
   2. The Engineer may require that the line be plugged so that the entire periphery can be inspected. For details on sewer flow control, see Section 02751.
B. Operation:
   1. Perform inspection of sewer lines after lines have been suitably cleaned.
2. When inspecting newly constructed sewer lines, introduce water into the sewer lines to be tested from the upstream manhole prior to the television inspection, but no more than 24 hours in advance of the inspection.
3. Lines will be suitably isolated from the remainder of the sewer line as required.
4. Move the cameras through the line in either direction at a moderate rate, not to exceed 30 feet per minute, as recommended by NASSCO.
5. The Engineer may require Contractor to pull cameras back to get a second view of a section of the pipe.
6. Use manual winches, power winches, television cable reel powered rewinds, high-pressure hose and reels on jet-cleaning trucks, or a flexible pole, to move the camera through the sewer.
7. If, during the inspection operation, the camera will not pass through the entire pipe section, the Contractor shall set up the equipment so that the inspection can be performed from the opposite manhole on the pipe segment.
8. The screen monitor and winch operators shall be in full communication at all times.
9. Remove all wires, screens, sand bags, etc. used in the television inspection process from the sewers at the completion of inspection of each sewer section.

C. Measurement:
1. Measurement for location of defects, service connections, etc., shall be accurate to two tenths (0.2) of a foot over the length of the section being inspected.

D. Records:
1. Printed records shall be provided, reflecting location of defects, service connections, etc., and shall be recorded per PACP standards and stored to a NASSCO-certified digital reporting software:
   a. Keep records and supply to the Engineer when the work has been completed.
   b. Show the exact location in relation to adjacent manholes, of each infiltration point discovered by the television camera.
   c. Show locations of laterals, unusual conditions, roots, break-in storm sewer connections, collapsed sections, presence of scale and corrosion, and other discernible features.
2. Inventory the houses and apparent empty lots bordering each section of sewer line that is inspected and compare results to the number and location of house services found during the inspection. Log inconsistencies and report them to the Engineer.
3. Video / Photographs:
   a. Two copies of the video shall be provided in DVD format, downloaded or output from a NASSCO certified software: one copy to the Engineer and one copy to the Owner.
   b. The video shall be digitally recorded, indexed by pipe section (labeled by manhole number or other means acceptable to Engineer) and allow for printing of still photographs.
c. Photographs shall be printed at Engineer's request and shall be identified on the back as follows:

Date________________; Section: MH#_________ to MH#________
Diameter of Sewer ____; Distance from MH#_______ is ________LF
Description of item photographed _______________________
________________________________________________

END OF SECTION
SECTION 02755

FINAL SEWER TESTING

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Final sewer testing work includes the performance of testing and inspecting each and every length of sewer pipe, pipe joints and each item of appurtenant construction.
   2. Perform testing at a time acceptable to the Engineer, which may be during construction operations, after completion of a substantial and convenient section of the work, or after completion of all pipe laying operations.
   3. Provide all labor, pumps, pipe, connections, gages, measuring devices and all other necessary apparatus to conduct tests.
B. Related Work Specified Elsewhere (When Applicable):
   1. Excavation, backfill, dewatering, pipe, pipe fittings and manholes are specified in the appropriate Sections in this Division.
   2. Manhole testing is specified in Section 02601 - Manholes, Covers and Frames.

PART 2 - PRODUCTS
Not Applicable

PART 3 - EXECUTION

3.1 PERFORMANCE
A. General:
   1. All sewers, manholes, and appurtenant work, in order to be eligible for acceptance by Engineer, shall be subjected to tests that will determine the degree of watertightness.
   2. Thoroughly clean and/or flush all sewer lines to be tested, in a manner and to the extent acceptable to the Engineer, prior to initiating test procedures.
   3. Perform all tests and inspections in the presence of the Engineer and the plumbing or building inspector in accordance with the requirements of the local and state plumbing codes.
   4. Perform testing by test patterns determined by or acceptable to the Engineer.
   5. Remedial Work:
      a. Perform all work necessary to correct deficiencies discovered as a result of testing and/or inspections.
      b. Completely retest all portions of the original construction on which remedial work has been performed.
      c. Perform all remedial work and retesting in a manner and at a time acceptable to by the Engineer at no additional cost to the Owner.
B. Alignment Tests (Gravity Sewers):
   1. Perform tests for the correctness of horizontal and vertical alignment on each and every length of gravity sewer pipeline between manholes.
2. Alignment tests to be conducted after all pipe has been installed and backfilled.
3. The observation test shall be conducted after all upstream work has been completed and the pipeline cleaned of debris.
4. Notify the Engineer at least 24 hours in advance of the proposed observation testing.
5. Introduce water into the sewer lines to be tested from the upstream manhole prior to the observation test but no more than 24 hours in advance of the test.
6. Beam a source of light, acceptable to the Engineer, through the pipeline from both ends and the Engineer will directly observe the light in the downstream, and/or upstream manhole of each test section.
7. The length of pipe between manholes, diameter of pipe and amount of light observed in the manhole at the end of each pipe section will determine acceptance of the alignment test by the Engineer.
8. The amount of vertical and horizontal deflection shall not be greater than the ASTM allowance and (manufacturer's recommendations) for the pipe being tested.
9. No standing water shall be allowed. The presence of standing water shall be cause for rejection of that pipe (including manhole) section.
10. Improper alignment will be corrected by re-excavation and resetting of pipe at no additional cost to the Owner.

C. Pipe Deflection: (Gravity Sewers)
1. Pipe provided under this specification shall be installed so there is no more than a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (normal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
2. The Contractor shall wait a minimum of 30 days after completion of a section of sewer, including placement and compactation of backfill, before measuring the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Engineer.
3. Should the installed pipe fail to meet this requirement, Contractor shall do all work to correct the problem as the Engineer may require without additional compensation.

D. Inspection of Appurtenant Installations:
1. Completely inspect, at a time determined by the Engineer, all manholes and inlets to ascertain their compliance with the Drawings and Specifications.
2. Provide access to each manhole and inlet and check the following characteristics:
   a. Shape and finish of invert channels,
   b. Watertightness and finish of masonry structures,
   c. Elevation and attachment of frames, covers, and openings,
   d. Pattern and machining of covers, and
   e. Drop connection arrangements.

E. Manhole Leakage Testing:
1. Specified in the "Manholes, Covers and Frames" Section in Division 2.

END OF SECTION
SECTION 03010
CONCRETE MODIFICATIONS AND REPAIRS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Concrete Modifications and Repairs

1.2 RELATED SECTION
   A. Section 01340 - Submittals
   B. Section 03300 - Cast-in-Place Concrete
   C. Section 03346 - Concrete Finishing and Curing

1.3 REFERENCES
   A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
   B. ACI 301 – Standard Specifications for Structural Concrete
   C. ACI 306.1 – Standard Specification for Cold Weather Concreting
   D. ACI 308.1 – Standard Specification for Curing Concrete
   E. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete
   F. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   H. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.4 SUBMITTALS
   A. Submit product data and material safety data sheets for repair materials. Indicate the intended use and locations for all products.
   B. Submit methods to be used to protect the concrete during cold weather. The Engineer’s review shall be for information only as the Contractor is responsible for the means and methods of protection of concrete placed during cold weather.
   C. Submit methods to be used to protect the concrete during hot weather. The Engineer’s review shall be for information only as the Contractor is responsible for the means and methods of protection of concrete placed during hot weather.
   D. Submit curing methods.
1.5 ENVIRONMENTAL CONDITIONS
A. Environmental Conditions are defined as follows:
   1. Cold Weather:
      a. Cold weather is defined as any and all periods when for more than three
         consecutive days the average daily outdoor temperature drops below
         40°F. (The average daily temperature is the average of the highest and
         lowest temperature during the period from midnight to midnight.) When
         temperatures higher than 50°F occur during more than half of any 24-hour
         duration, the period shall not be regarded as cold weather.
      b. When freezing temperatures may occur during periods not defined as cold
         weather, concrete surfaces shall be protected against temperatures lower
         than 35°F for at least the first 24 hours after the concrete placement.
   2. Hot Weather - Job-site conditions that accelerate the rate of moisture loss or
      rate of cement hydration of freshly mixed concrete, including an ambient
      temperature of 80°F or higher, and an evaporation rate that exceeds 1 kg/m²/h.

1.6 QUALITY ASSURANCE
A. Perform work in accordance with ACI 301, ACI 306.1 and ACI 308.1, except as
   modified herein.
B. All curing and repair materials shall meet all Federal and State regulations pertaining
   to Volatile Organic Compounds (VOC) Compliance.

PART 2 - PRODUCTS

2.1 CURING MATERIALS
A. Curing and Sealing Compound:
   1. Acrylic water-based compound
   2. Conform to ASTM C309 Type 1 and ASTM C1315 Type 1 Class A, minimum
      25% solids.
   3. Acceptable products:
      a. Super Diamond Clear VOX by Euclid Chemical
      b. StarSeal 1315 by ChemMasters/Vexcon
      c. Vocomp 25 by WR Meadows
      d. Dress & Seal WB 25 by L&M Construction Chemicals
      e. Or equivalent.
B. Dissipating Resin Curing Compound:
   1. Conform to ASTM C309 Type 1
   2. Film must break down in two to four weeks.
   3. Acceptable products:
      a. Kurez-DR by Euclid Chemical Company
      b. Certi-Vex Enviocure 100, by ChemMasters/Vexcon
      c. Res-Cure-DS by Nox-Crete
      d. Or equivalent.
C. Curing, Sealing and Hardening Compound:
   1. Acrylic water-based compound
   2. Conform to ASTM C309 Type 1, Class A&B
   3. Acceptable products:
CONCRETE MODIFICATIONS AND REPAIRS

a. Starseal EF Medium Gloss by ChemMasters/Vexcon
b. Seal Cure-30 by WR Meadows
c. MasterKure HD200WB by Master Builders
d. Or equivalent.

D. Curing Water: Water shall be potable from a municipal water supply. The temperature of the curing water shall not be lower than 20°F cooler than the surface temperature of the concrete at the time the water and concrete come in contact.

E. Curing Blanket: Cellulose fabric sheets with an impervious layer on one side.
   1. Conform to ASTM C171
   2. Acceptable products:
      a. Conkure by Raven Industries
      b. UltraCure by Sika Industries
      c. CB Series Synthetic Curing Blankets by Eagle Industries
      d. Or equivalent.

F. Curing Paper: ASTM C171, regular or white waterproof paper.

2.2 CRACK SEALANT
A. Crack sealant for repair of failed sealant at previously repaired cracks, and other locations that may be identified by the Engineer in the field.
B. Crack sealant shall be a one or two-component, premium-grade, non-sag polyurethane-based elastomeric sealant for vertical and horizontal applications.
C. Conform to ASTM C920 Grade NS
D. Acceptable products:
   1. Sikaflex-2c NS EZ Mix by Sika Corporation
   2. Pourthane NS by WR Meadows
   3. Dynomic 100 by Tremco
   4. Or equivalent.

2.3 REPAIR MATERIALS
A. Grout Paint: 1 part portland cement, 1 part fine sand, and water for the consistency of thick paint.
B. Patching Mortar: 1 part of a mixture of white and grey Type II portland cement to 2.5 parts of damp loose sand. Cement type to match substrate.
C. Bonding Agent: For repair mortar - as recommended by the manufacturer. For concrete - as specified in Section 03300.
D. Repair of random cracks (dry – free of liquid or moisture):
   1. 2-component, 100% solids, moisture-tolerant, low-viscosity, high-strength, multipurpose, epoxy resin adhesive.
   2. Acceptable products:
      a. Sikadur 35 Hi-Mod LV by Sika Corporation
      b. Eucopoxy Injection Resin by Euclid Chemical Co.
      c. MasterInject 1380 by Master Builders
      d. Or equivalent

E. Repair of random cracks (wet - presence of liquid or moisture):
   1. Low viscosity polyurethane resin that expands and forms a closed cell foam when it comes in contact with water.
2. All cracks that are wet (either damp or leaking) at the time of repair shall be repaired with a material that is specifically intended for wet repair as recommended by the manufacturer.

3. Acceptable products:
   a. SikaFix HH Hydrophilic by Sika Corporation
   b. Dural Aqua-Fil by Euclid Chemical Co.
   c. MasterInject 1210 IUG by Master Builders
   d. Or equivalent

F. Repair of excessive cracking:
   1. Two component, 100% solids, moisture-tolerant, epoxy or urethane crack healer / penetrating sealer
   2. Acceptable products:
      a. Sikadur 55 SLV by Sika Corporation
      b. Euco Qwikstitch by Euclid Chemical Co.
      c. MasterSeal 370 by Master Builders
      d. Or equivalent

G. Repair of spalls, honeycombs areas and air voids and cementitious overlays:
   1. Polymer modified, non-sag cementitious repair mortar with corrosion inhibitor.
   2. Repair material shall include peastone for repairs of greater depth as required by the manufacturer. For repair areas involving depths generally in excess of three (3) inches, utilize a repair material suitable for the depth of repair.
   3. Acceptable products
      a. SikaTop 122 Plus or 123 Plus by Sika Corporation
      b. Duraltop Gel by Euclid Chemical Co.
      c. MasterEmaco N 400 by Master Builders
      d. Or equivalent

H. All repair materials shall be installed in accordance with the manufacturer’s recommendations.
I. All repair materials in contact with potable water shall be NSF Standard 61 approved.

PART 3 - EXECUTION

3.1 FINISHES
   A. Repair all defects and allow repair material to properly cure and match finish of surrounding concrete.
   B. Clean all exposed concrete surfaces and adjoining work stained by leakage of repair materials.

3.2 CRACK SEALANT
   A. Remove all existing joint sealant. Use a grinder with a “U”-shaped dry diamond blade and chase out the entire area to receive the sealant.
   B. Create a joint having regular and vertical sides with a minimum depth of ¼” and approximate 2:1 width to depth ratio. A ¼” deep joint shall be approximately ½” wide.
   C. Remove all residual dust and debris with a nylon bristle brush or wire wheel mounted to an angle grinder.
   D. Prepare and install sealant in accordance with the manufacturer’s instructions.
3.3 CURING
A. Curing shall begin immediately following the initial set of repair material. All repairs shall be cured to attain strength and durability by one of the following methods for a minimum of 7 consecutive days immediately after placement, and as recommended by the manufacturer.
   1. Moist Cure
      a. Ponding or continuous sprinkling. Intermittent wetting and drying is not an acceptable curing method.
      b. Application of curing paper kept continuously wet. Use wet methods for the first 24 to 30 hours. Lap side joints of paper 4 inches minimum and end joints 6 inches minimum. Tape joints or weigh down paper to prevent displacement. Repair any and all tears during the curing period. Apply paper no earlier than 24 hours, and no later than 30 hours, after finishing. The slab surface shall be maintained in a wet condition beneath the paper at all times. During cold weather, as previously defined, when moist cure is called for in this section, the application of water is not required except when a heated enclosure is provided.
   2. Application of concrete curing compounds.
      a. In accordance with the recommendations of the manufacturer of the repair material.
      b. When using dissipating resin curing compounds, allow curing compound to chemically break down and remove residuals and other foreign material prior to applying sealers and other coatings.
      c. The use of curing compounds on surfaces to receive an additional surface treatment is not allowed.
      d. For formed concrete, apply immediately after form removal.
B. Moisture loss from surfaces placed against wooden or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed.
C. After form removal of vertical elements, the concrete shall be cured for the balance of time remaining as specified above.
D. Cold Weather:
   1. Unless otherwise superseded by more stringent requirements within this Specification, conform to ACI 306.1 for placement of concrete in cold weather as defined in Part 1.5.
   2. Thermal protection must be provided immediately after repairs. Procedures for covering, insulating, housing and/or heating concrete shall be prearranged.
   3. Concrete structures shall be covered, insulated and heated as required to protect the concrete.
   4. Maintain concrete at the minimum temperature (measured at concrete surface) required by the manufacturer.
   5. Protect repairs from damage due to concentrated heat sources to prevent drying and local carbonation of concrete surfaces. Combustion heaters shall be properly vented and located so they do not apply heat directly to concrete surfaces. The use of direct fired heaters including salamanders and torpedoes is not permitted due to the potential damage to concrete surfaces exposed to...
elevated levels of carbon dioxide, which can result in soft, chalky surfaces and dusting throughout the life of the structure. The use of indirect fired heaters with combustion exhaust vented outside the enclosure is acceptable.

6. For those surfaces requiring curing compounds, reapply curing compounds every two days during heating period or at greater frequencies as required by the manufacturer.

7. The temperature shall be monitored at the surface of the concrete, including corners and edges, which are more vulnerable to low temperature. The concrete surface temperature shall be recorded a minimum of twice per each 24-hour period.

E. Hot Weather:
1. Unless otherwise superseded by more stringent requirements within this Specification, conform to ACI 308.1 for curing of concrete in hot weather as defined in Part 1.5.
2. Protect repairs from plastic shrinkage cracking and rapid evaporation of water.
3. Shade concrete from direct sun and protect from wind.

3.4 REPAIRS TO CONCRETE (GENERAL)
A. Definitions:
1. Honeycombed areas: Areas where voids are left in the concrete due to inadequate vibration and consolidation resulting in a failure of the mortar to effectively fill the spaces among coarse aggregate particles.
2. Spalls: Concrete that has chipped, flaked, scaled or broken off from the surface of the concrete.
3. Surface Defects: Those defects that affect the appearance of the finished concrete but do not affect the structural integrity.
4. Structural Defects: Those defects that affect the appearance of the finished concrete and the structural integrity.

B. Surface Defects:
1. Form tie holes
2. Air voids (bugholes) larger than those specified for the required surface finish
3. Honeycomb areas with a depth less than 1 inch
4. Blisters
5. Delaminations
6. Crusting
7. Visible construction joints, fins and burs
8. Non-uniform concrete color and appearance
9. Floors that are not level

C. Structural Defects:
1. Random cracks
2. Excessive cracking (crazing)
3. Spalls
4. Air voids (bugholes) and honeycombed areas with a depth greater than or equal to 1 inch

D. All repairs to newly placed concrete shall be at no additional cost to the Owner.
3.5 REPAIR OF SURFACE DEFECTS
A. As soon as the forms have been stripped and the vertical concrete surfaces exposed or concrete slabs have been finished and cured, repair all surface defects. All concrete repair work shall result in a concrete surface of uniform color and texture and shall be free of all irregularities.
B. Form Tie Holes: After cleaned and thoroughly dampened, apply grout paint and fill holes solid with patching mortar. For taper tie system as specified in Section 03300, Upon completion of tightness testing of structure (as applicable), the holes are to be fully packed with a cementitious crystalline waterproofing grout struck flush at both wall faces.
C. Air voids (bugholes): After cleaned and thoroughly dampened, apply grout paint and fill holes solid with patching mortar.
D. Honeycomb areas:
1. All honeycombed areas shall be removed to sound concrete by means of hand chisels or pneumatic chipping hammers or hydrodemolition.
2. Saw cut a 1/2 inch minimum square groove around the edges of the defective area perpendicular to the surfaces to serve as the boundary for concrete removal. Saw cut the edges perpendicular to the surface. No feather edges shall be allowed.
3. Remove all loose aggregate paste and debris and scrub clean. Thoroughly wet area to be repaired. Brush and scrub grout paint into the substrate of the area to be repaired.
4. Mix patching mortar using as little water as possible. Allow to stand with frequent manipulation of trowel to achieve stiffest consistency. Blend white and gray portland cement to achieve color match with surrounding concrete.
5. Prior to the set of grout paint (but after it has cast its water sheen), apply a stiff consistency of patching mortar to the area with a trowel. Leave patched surface slightly higher than surrounding surface. Do not finish for 1 hour minimum. Cure in same manner as adjacent concrete.
E. Blisters, delaminations and crusting: Repairs shall be similar to those for honeycomb areas. Depth of saw cut shall match the depth of the defective concrete.
F. Visible construction joints, fins and burrs: Remove by grinding until a smooth uniform surface is attained.
G. Concrete with an overall non-uniform color or appearance as determined by the Engineer shall be repaired with a complete cementitious overlay. Application of the overlay shall be in strict accordance with the manufacturer’s written instructions and recommendations
H. Finished Flatwork exceeding specified tolerances:
1. High areas shall be repaired by grinding after the concrete has cured 14 days.
2. Low areas shall be repaired by adding appropriate overlay material. Grind concrete if required to provide minimum overlay thickness as required by the manufacturer. Finish repair area to match adjacent concrete.

3.6 REPAIR OF STRUCTURAL DEFECTS
A. Remove and replace or repair all structural defects in newly placed concrete.
B. Repair all structural defects in existing concrete that are identified by the Engineer during construction. These repairs are identified either on the Structural Drawings or
in the Bid Form.

C. Unless otherwise indicated, all concrete defects shall be repaired in accordance with the specific repair material manufacturer’s recommendations.

D. Random cracks:
   1. Cleaning of cracks:
      a. Dry cracks: Crack or void must be dry at time of application. Remove all dust, debris or disintegrated material from cracks or voids by the use of oil-free compressed air or vacuuming. Cracks saturated with oil or grease must be chipped out to unsaturated concrete. "Vee" out cracks in horizontal surfaces slightly.
      b. Wet cracks: Clean the crack surface so that the crack can be located. If the crack is wide or high water flows are encountered, seal the surface of the crack with a surface sealing material as recommended by the manufacturer.
   2. Where cracks extend through horizontal members and are accessible, seal bottom of crack which is to receive the specified repair material.
   3. Patching of vertical wall or overhead cracks shall be accomplished in the same manner using a similar material of higher viscosity as recommended by the manufacturer.
   4. Apply specified repair material in strict accordance with manufacturer's recommendations.

E. Excessive cracking (Crazing):
   1. Floor slabs containing an excessive amount of cracks as defined herein, and which will remain exposed, shall receive topping after sealing of cracks in accordance with the above paragraph.
   2. Excessive cracking shall be defined as areas containing cracks averaging 1/64th-inch wide or greater, and in excess of 15 linear feet of cracks per 100 square feet of slab. In the event that excessive cracking occurs in isolated areas of a given floor, topping shall only be applied in the area of the cracks bounded by construction, expansion, or control joints.
   3. Apply specified repair material in strict accordance with manufacturer's recommendations.

F. Spalls and honeycomb areas:
   1. All weakened, damaged or disintegrated concrete shall be removed to sound concrete by means of hand chisels or pneumatic chipping hammers or hydrodemolition.
   2. Pneumatic chipping hammers shall not exceed 15 pounds.
   3. Saw cut a 1/2 inch minimum square groove around the edges of the defective area perpendicular to the surfaces to serve as the boundary for concrete removal. Saw cut the edges perpendicular to the surface. No feather edges shall be allowed.
   4. Remove defective concrete. If defective areas extend to reinforcement, chip out concrete to provide a clear space of at least 3/4 inch, and not less than 1/4” plus the repair mortar maximum aggregate size, all around the bar. Remove concrete along the bar to the point where the bar is fully bonded to the surrounding concrete and without loose corrosion products.
5. Apply specified repair material in strict accordance with manufacturer's recommendations.

END OF SECTION
SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Cast-In-Place Concrete indicated on the Contract Drawings
B. Formwork
C. Concrete deformed reinforcement bars and accessories
D. CMU deformed reinforcement bars
E. Epoxy anchorage of reinforcement
F. Epoxy and expansion anchors are specified herein but shall be provided and installed under the specification sections wherein the items requiring such anchors are specified.

1.2 PRODUCTS INSTALLED BUT FURNISHED UNDER OTHER SECTIONS
A. Anchor Rods  Section 05500 - Metal Fabrications
B. Pipe Sleeves  Section 15092 - Pipe Sleeves and Seals
C. Conduit  Division 16

1.3 RELATED SECTIONS
A. Section 01340 - Submittals
B. Section 01400 - Quality Control
C. Section 03305 - Concrete Testing
D. Section 03346 - Concrete Finishing and Curing
E. Section 03930 - Concrete Coatings
F. Section 05120 - Structural Steel
G. Section 05500 – Metal Fabrications
H. Section 15092 - Pipe Sleeves and Seals
I. Section 16050 - Basic Materials and Methods

1.4 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. AASHTO T 26 – Standard Method of Test for Quality of Water to Be Used in Concrete
C. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
D. ACI 301 - Specifications for Structural Concrete
E. ACI 306.1 – Standard Specification for Cold Weather Concreting
F. ACI 306R – Guide to Cold Weather Concreting
G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary
H. ACI 355.2 – Qualifications of Post-Installed Mechanical Anchors in Concrete
I. ACI 355.4 – Qualifications of Post-Installed Adhesive Anchors in Concrete
J. ACI SP-66 – ACI Detailing Manual
K. ASTM A615/A615M – Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
L. ASTM A706/A706M – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
M. ASTM A775/A775M – Standard Specification for Epoxy-Coated Reinforcing Steel Bars
N. ASTM A1064/A1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain or Deformed, for Concrete
O. ASTM A1094/A1094M – Standard Specification for Continuous Hot-Dip Galvanized Steel Bars for Concrete Reinforcement
P. ASTM C33/C33M – Standard Specification for Concrete Aggregates
Q. ASTM C40/C40M – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
S. ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
T. ASTM C94/C94M – Standard Specification for Ready Mixed Concrete
Y. ASTM C494/C494M – Standard Specification for Chemical Admixtures for Concrete
BB. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
DD. ASTM C989/C989M – Standard Specification for Slag Cement for Use in Concrete and Mortars
EE. ASTM C1116/C1116M – Standard Specification for Fiber-Reinforced Concrete
GG. ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures
II. ASTM C1293 – Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
KK. ASTM C1602/C1602M – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
NN. ASTM D516 – Standard Test Method for Sulfate Ion in Water
OO. ASTM D4130 – Standard Test Method for Sulfate Ion in Brackish Water, Seawater, and Brines
QQ. AWS D1.4/D1.4M – Structural Welding Code – Reinforcing Steel
RR. Concrete Reinforcing Steel Institute – 10MSP, Manual of Standard Practice
SS. Concrete Reinforcing Steel Institute - Placing Reinforcing Bars
TT. COE CRD-C 572 - Corps of Engineers Specifications for Polyvinylchloride Waterstops
UU. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.5 QUALITY ASSURANCE
A. Perform work in accordance with ACI 301, ACI 117 and ACI 306.1 as modified herein.
B. Expansion and epoxy anchors shall meet the following requirements:
   1. Expansion anchors shall be qualified for earthquake loading (use in cracked concrete) in accordance with ACI 355.2.
   2. Epoxy anchors shall be qualified for earthquake loading (use in cracked concrete) in accordance with ACI 355.4.
   3. Epoxy anchors installed shall be qualified in accordance with ACI 355.4 requirements for sensitivity to installation direction.
   4. Epoxy anchors shall be installed by personnel certified by an applicable certification program that includes written and performance tests in accordance with ACI/CRSI Adhesive Anchor Installation Certification program.

1.6 SUBMITTALS
A. Submit shop drawings for concrete and masonry reinforcement prior to fabrication, showing bar bends, details and placement and certified copies of Mill Test Reports for the reinforcement. Conform to ACI SP-66. Details shall include:
   1. Sizes, dimensions, and locations for reinforcement and supports
2. Bending diagrams and schedules
3. Splices
4. Dowel Bar Splicers and Mechanical Bar Splicers: product data including strength tests
5. Cover and clearances
6. Class designation and details for bar supports
7. Pertinent reinforced concrete details with dimensions and elevations
8. Embedded items furnished by other trades and/or under other sections of the specification that are to be cast in concrete where interference with reinforcement may occur
9. Show reinforcement on: Plan views of slabs, wall elevations and sections, beam elevations and details. Provide plan details at wall intersections and openings.

B. Submit Concrete Mixture designs including:
   1. Proportions for all ingredients, 28-day design compressive strength, water to cementitious materials ratio, admixture dosages, slump, air content and density.
   2. Cement Manufacturer's Certificates of conformance with ASTM C150/C150M or C595/C595M taken during the last 90 days.
   3. Supplementary Cementitious Materials: Source and test reports with certificates of conformance with ASTM C618 for fly ash and ASTM C989/989M for slag cement for actual material to be used in the Work taken during the last 90 days
   4. Aggregate: data not older than 90 days, except test data for soundness, abrasion, alkali reactivity – not older than 12 months. Fine and coarse aggregate data and test results shall include:
      a. Sources
      b. Specific Gravity
      c. Sieve analyses per ASTM C33/C33M, including fineness modulus of fine aggregate
      d. Organic impurities per ASTM C40/C40M (fine aggregate).
      e. Aggregate reactivity (fine and coarse aggregate), one of the following options:
         i. Aggregate test data in accordance with ASTM C1293,
         ii. Concrete mixture tests in accordance with ASTM C1293,
         iii. Concrete mixture tests in accordance with ASTM C1567,
         iv. Categorized in accordance with ASTM C1778 with testing in accordance with ASTM C1293 at 1-year, or ASTM C1260 at 16-days if ASTM C1293 test data is not available. Also indicate the total alkali loading contributed by portland cement in the submitted mixture/s.
      f. Soundness per ASTM C88 tested with magnesium sulfate (fine and coarse aggregate).
      g. Abrasion per ASTM C131/C131M or ASTM C535 (coarse aggregate).
   5. Product data and material safety data sheets for concrete admixtures.
6. Field performance and/or laboratory test reports meeting the criteria specified in ACI 301, Section 4, by testing agencies meeting ASTM E329:
   a. Field test data used to determine the standard deviation used for establishing the required average design strength, and field test data documenting that the proposed concrete proportions will produce an average compressive strength equal or greater than the required average compressive strength, shall be from within the previous 12 months.
   b. Laboratory trial batch data shall be from within the previous 12 months.

C. Submit product data and material safety data sheets for concrete accessories.
D. Submit sample concrete mixture delivery slip that shall include the following information:
   1. Serial number of ticket
   2. Date and project location
   3. Name and location of ready mixed concrete plant
   4. Truck number, time loaded, cubic yards delivered
   5. Mixture design
   6. Quantities of admixtures, with brand names
   7. Quantities and types of cement, fly ash and/or slag
   8. Quantity of water including quantity of water withheld
   9. Quantities of fine and coarse aggregate including moisture content, nominal maximum aggregate size
   10. Quantity of water added subsequent to plant batching
   11. Unloading time and location

E. Submit product data and material safety data sheets for form release agent.
F. Submit product data and personnel certifications for epoxy adhesive anchors. Data shall include:
   1. Material properties of anchors and epoxy adhesive
   2. ICC-ES AC308 report
   3. Allowable and ultimate loads of the anchor system
   4. Storage requirements
   5. Installation requirements including:
      a. Drilling method (diamond drill bit shall be prohibited)
      b. Drill bit diameter and depth of hole for each size anchor
      c. Hole cleaning procedure and required condition of hole
      d. Requirements for discarding initial discharge to ensure proper mixing
      e. Hole filling procedure
      f. Time period when anchor cannot be contacted or otherwise disturbed
      g. Gel and cure times as a function of temperature
      h. Installation temperature requirements for cartridges and base material
   6. Certifications for personnel installing epoxy adhesive anchors, in accordance with ACI/CRSI Adhesive Anchor Installation Certification program.

G. Submit product data and layout drawings for Architectural Form Liner and Rustication Strips.
H. Submit product data for form ties.
I. Submit product data with strength tests for dowel bar and mechanical bar splicers.
J. For conduit to be encased in concrete structures submit a conduit layout plan under Section 16050. The conduit layout plan shall be reviewed with no exceptions taken by the Engineer prior to submission of reinforcement shop drawings.

K. Submit methods to be used to protect the concrete during cold weather placements, as defined in Section 03346. The Engineer’s review shall be for information only as the Contractor is responsible for the means and methods of protection of concrete placed during cold weather.

L. Submit methods to be used to protect the concrete during hot weather placements. The Engineer’s review shall be for information only as the Contractor is responsible for the means and methods of protection of concrete placed during hot weather.

1.7 PRE-CONCRETE MEETING

A. Engineer shall hold meeting after the concrete mixture design has been reviewed by the Engineer and more than 14 days prior to the first concrete placement to review concrete procedures.

B. Meeting Minutes: Engineer shall record minutes of meeting and distribute to attending parties, within 10 business days of meeting.

C. Attendance: General Contractor shall coordinate the attendance of the following parties: Contractor; concrete supplier; concrete subcontractor; admixture manufacturer and concrete pumping contractor. Engineer shall coordinate the attendance of the following parties: Structural Engineer, Independent Testing Laboratory and Engineer’s Resident Project Representative.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Undamaged smooth form facing materials such as plywood, hardboard, metal and plastic that will produce a smooth form finish with fins and offsets not exceeding 1/8 inch. Surfaces shall be clean, free of scratches, mars and discolorations. The Engineer may reject formwork the Engineer deems to be unacceptable or that may produce concrete that will not meet the specified requirements including surface finish.

B. Steel: Minimum 16 ga. sheet, well matched, tight fitting, stiffened to resist loads without excess deflection.

C. Aluminum: Forms with unoxidized surfaces shall be pretreated with a calcium hydroxide and water paste followed by repeated water rinsing until hydrogen bubbles no longer form.

D. Chamfer Corners: Chamfer, Wood Strip Type; ¾" x ¾" minimum, maximum possible length.

E. Form Ties:
   1. Liquid retaining structures and backfilled walls of below grade rooms:
      a. Factory fabricated adjustable length assembly providing a minimum 1.5 inch break back dimension with minimum 1 inch diameter tapered plastic cones on both sides of the wall to leave a uniform hole for patching. All ties require a tightly fitted waterstop washer at the midpoint.
   2. Non-liquid retaining structures: Snap-off type, adjustable lengths designed to break back at least 1 inch from finished surface or ties as indicated above.
F. Form release agent: Non-staining colorless, compatible with finishes, and non-toxic for potable water and NSF 61 certified.
1. StarSeal EF Bio-Release by Vexcon
2. Q-2 Form Release by Unitex
3. Seacord RA II by Concord Chemical

G. Architectural Form Liner:
1. Material: Thermoformed rigid polymer alloy [Urethane elastomeric]
2. Grade: Uni-Cast, Multi-Cast, Dura-Cast, Ultra-Cast
3. Form liners for Textured Finish Concrete: Provide special forming materials to produce form surfaces with face design, texture, arrangement, and configuration as shown on drawings.
4. Liners to accommodate form pressures to a maximum 1000 psf. Comply with manufacturer's recommendations for support of large or deep patterns which may deform under pressure
5. Form Release agent: Form Release 7000
6. Reveals: Reveal StiX
7. Backup Strips: Expanded polystyrene foam strips provide additional support to prevent deflection of the form liner due to form pressures
8. Pattern: [xxx] by Greenstreak

H. Rustication Strips by Symons Elasto-Tex Model Number 30757 or equal.

I. Form all exposed circular structures with circular or segmented wood or steel forms.
If segmental forms are used the specified wall thickness and radius shall be maintained. Straight panels shall not exceed 2'-0" in width, and a maximum deflection angle of 3.5 degrees per panel joint. Circular structures (such as below grade slabs and fully buried tanks) not exposed to view may be formed with segmented panels that exceed the stated width and angle limits.

2.2 REINFORCEMENT
A. “Reinforcement” shall include all bars, anchorages, stirrups, dowels, ties, tie-wire, chairs and other steel supports, and spacers, as noted on the Contract Drawings, specified herein, and as required for the proper completion of the Work.
B. Bars: ASTM A615/A615M Grade 60; deformed new materials. Cold bent in accordance with CRSI 10MSP.
C. Welded wire fabric: ASTM A1064/A1064M. Flat sheets are required; rolls are not permitted.
D. Epoxy coated bars: ASTM A775/A775M.
F. Bolsters, chairs, spacers and other supports to properly position reinforcement shall conform to the “Bar Support” recommendations of CRSI 10MSP and shall be of adequate strength and design to prevent displacement of reinforcement and discoloration of concrete. Where concrete surfaces are exposed to view, weather and/or moisture supports shall be Class 1 Plastic, Plastic Protected, or epoxy coated. Supports for bottom reinforcement for slabs placed on soil or on a mud mat with no more than 3 inches of cover shall be Class 3 chairs with integral plates or precast concrete blocks not less than 4 inches square.
G. Expansion Joint Dowel Bar: Type 316 stainless steel.
2.3 FABRICATION OF REINFORCEMENT
A. Conform to CRSI Code of Standard Practice-Fabrication.
B. Cold bend bars.
C. Bend bars around revolving collar of recommended size.

2.4 EXPANSION ANCHORS
A. Approved for use in cracked concrete in accordance with ACI 355.2.
B. Stainless steel AISI Type 316 for galvanized and aluminum fabrications; zinc-plated for painted steel fabrications.
   1. Hilti Kwik-Bolt TZ or Hilti HSL, by Hilti Fastening Systems
   2. Trubolt+ Wedge Anchor by ITW Red Head
   3. Power Stud+ by Powers Fasteners
   5. Or equivalent

2.5 EPOXY ADHESIVE ANCHORS
A. Includes epoxy anchor systems and epoxy adhesive for threaded rods and steel reinforcement.
B. Approved for use in cracked concrete in accordance with ACI 355.4.
C. Materials:
   1. Anchor: AISC Type 316 Stainless Steel threaded rod with washer and nut.
   2. Adhesive:
      a. Epoxy adhesive for anchoring reinforcement to concrete shall be a two-component solid epoxy-based system supplied in manufacturer's standard side-by-side cartridge and dispensed through manufacturer's standard static-mixing nozzle. Except for gel times, epoxy adhesive shall conform to ASTM C881. The Grade, Class and Type of epoxy shall be that which is appropriate for the intended use.
      b. Epoxy adhesive shall pass the creep test requirements of ICC-ES AC308.
      c. Acceptable manufacturers:
         i. SET-XP or ET-HP by Simpson Strong Tie Co., Inc.,
         ii. HIT-RE 500-V3 or HIT HY-200 by Hilti, Inc.,
         iii. or equal.
D. Embedment depth for reinforcement: Unless otherwise indicated on the Drawings, the embedment depth shall be per the manufacturer's requirements such that:
   1. The ultimate strength exceeds the tensile strength of the bar.
   2. The ultimate strength divided by a minimum safety factor of 3.75 is at least 40 percent of the yield strength of the bar.

2.6 CONCRETE MATERIALS
A. Each cementitious material shall be furnished from one source throughout the Project.
B. Portland cement: ASTM C150/C150M; Type II.
C. Blended cements: ASTM C595/595M (MS) types, excluding type IS (≥70). Do not use blended cements conforming to ASTM C595/595M if they contain cements conforming to ASTM C1157/C1157M.
D. Supplementary Cementitious Materials:
1. Slag Cement: ASTM C989 - Grade 100 or 120.
2. Silica Fume: ASTM C1240
3. Fly Ash: ASTM C618 - Type F

E. Aggregates:
1. Prohibited: crushed hydraulic cement concrete and recycled aggregate.
2. Fine aggregate
   a. Shall meet FDOT requirements for structural concrete, or
   b. Shall consist of washed inert natural sand, free from mineral or other coatings, soft particles, clay, loam, organic or other deleterious materials conforming to the requirements of ASTM C33/C33M and the following requirements:

<table>
<thead>
<tr>
<th>SIEVE NO.</th>
<th>PERCENT PASSING</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>95 to 100</td>
</tr>
<tr>
<td>8</td>
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<td>16</td>
<td>50 to 85</td>
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<tr>
<td>50</td>
<td>5 to 30</td>
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<tr>
<td>100</td>
<td>0 to 10</td>
</tr>
<tr>
<td>200</td>
<td>0 to 3.0</td>
</tr>
</tbody>
</table>

The Fineness Modulus shall be between 2.3 to 3.1. The percentage retained between any two consecutive sieves shall not exceed 45%.

3. Coarse aggregate shall consist of a well graded crushed stone or a washed gravel conforming to the requirements of ASTM C33/C33M and the following requirements:

<table>
<thead>
<tr>
<th>SIEVE</th>
<th>PERCENT PASSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>85-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>10-30</td>
</tr>
<tr>
<td>No. 8</td>
<td>0-10</td>
</tr>
<tr>
<td>No. 16</td>
<td>0-5</td>
</tr>
<tr>
<td>No. 50</td>
<td>-</td>
</tr>
</tbody>
</table>

The limits of deleterious substances and physical property requirements shall be as listed in ASTM C33/C33M, Table 4, for severe weathering regions.
4. Fine Aggregate testing: Perform the following tests on samples of the fine aggregate:
   a. Organic Impurities (ASTM C40/C40M):
      i. Color of supernatant liquid above test sample tested in accordance with ASTM C40/C40M shall not be darker than standard (Organic Plate No. 3/Gardner Color Standard No. 11).
      ii. Use of a fine aggregate failing when tested in accordance with ASTM C40/C40M is not prohibited if when tested in accordance with ASTM C87 the relative strength at 7 days is not less than 95%.
   b. Soundness (ASTM C88):
      i. Fine aggregate sample tested in accordance with ASTM C88 for five cycles using magnesium sulfate (not sodium sulfate) shall have a weighted average loss not greater than 18%.
   c. Alkali Reactivity:
      i. Use one of the following four options:
         (1) Test aggregate in accordance with ASTM C1293. Aggregate having an expansion less than 0.04% at 1-year is acceptable for use.
         (2) Test concrete mixture with the aggregates and cementitious materials combination submitted, in accordance with ASTM C1293. Aggregates in mixtures having an expansion of less than 0.04% at 2-years are acceptable for use. (This option also satisfies coarse aggregate requirements.)
         (3) Test concrete mixture with aggregates and cementitious materials combination submitted, in accordance with ASTM C1567. Aggregates in mixtures having an expansion less than 0.10% at 16 days are acceptable for use. (This option also satisfies coarse aggregate requirements.)
         (4) Aggregate reactivity shall be categorized in accordance with ASTM C1778 with testing in accordance with ASTM C1293 at 1-year, or ASTM C1260 at 16-days if ASTM C1293 test data is not available. If the coarse and fine aggregates are of different reactivity, the level of protection shall be based on the more reactive aggregate. The alkali content contributed by the portland cement shall not exceed 4.0 lbs per cubic yard of concrete for moderately reactive aggregate and 3.0 lbs per cubic yard of concrete for highly reactive aggregate. The use of very highly reactive aggregate shall not be permitted.
      ii. Evidence of a satisfactory service record in lieu of testing for alkali reactivity is not permitted.

5. Coarse Aggregate testing: Perform the following tests on samples of the coarse aggregate:
   a. Abrasion (ASTM C131/C131M or ASTM C535):
      i. Coarse aggregate shall be tested in accordance with either ASTM C131/C131M (aggregate smaller than 1 1/2”) or ASTM C535 (aggregate larger than ¾”).
ii. Loss of the mass of the coarse aggregate by abrasion shall not exceed 50%.

b. Soundness (ASTM C88):
   i. Coarse aggregate sample tested in accordance with ASTM C88 for five cycles using magnesium sulfate (not sodium sulfate) shall have a weighted average loss not greater than 15%.

c. Alkali Reactivity:
   i. Use one of the following four options:
      (1) Test aggregate in accordance with ASTM C1293. Aggregate having an expansion less than 0.04% at 1-year is acceptable for use.
      (2) Test concrete mixture with the aggregates and cementitious materials combinations submitted, in accordance with ASTM C1293. Aggregates in mixtures having an expansion of less than 0.04% at 2-years are acceptable for use. (This option also satisfies fine aggregate requirements.)
      (3) Test concrete mixture with the aggregates and cementitious materials combination submitted, in accordance with ASTM C1567. Aggregates in mixtures having an expansion less than 0.10% at 16 days are acceptable for use. (This option also satisfies fine aggregate requirements.)
      (4) Aggregate reactivity shall be categorized in accordance with ASTM C1778 with testing in accordance with ASTM C1293 at 1-year, or ASTM C1260 at 16-days if ASTM C1293 test data is not available. If the coarse and fine aggregates are of different reactivity, the level of protection shall be based on the more reactive aggregate. The alkali content contributed by the portland cement shall not exceed 4.0 lbs per cubic yard of concrete for moderately reactive aggregate and 3.0 lbs per cubic yard of concrete for highly reactive aggregate. The use of very highly reactive aggregate shall not be permitted.

   ii. Evidence of a satisfactory service record in lieu of testing for alkali reactivity is not permitted.

F. Water:
   1. Potable from municipal water supply.
   2. Nonpotable water that meets ASTM C1602/C1602M and the following requirements:
      a. Chlorides as Cl: 1000 ppm - tested by ASTM C114 or by #4500, Argentometric Method from “Standard Methods for the Examination of Water and Wastewater”.
      b. Sulfate as SO4: 1500 ppm – tested by ASTM D516 or ASTM D4130.
      c. Equivalent alkalies (Na2O + 0.658 K2O): 300 ppm total alkali – tested by ASTM C114.
      d. Total inorganic solids by mass: 5000 ppm – tested by ASTM C1603.
      f. pH: 4.0 to 9.0 – tested by AASHTO T 26.
g. Presence of oil: none to slight – by visual observation.

G. Fibers:
1. Fibers shall be macrosynthetic fibers conforming to ASTM C1116/C1116M.
2. Dosage shall be as recommended by the fiber manufacturer, and not less than 3 pounds per cubic yard of concrete.

2.7 ADMIXTURES
A. Low Range Water Reducer: MasterPozzolith 210 by Master Builders/BASF; WRDA with HYCOL by GCP Applied Technologies; or equivalent meeting ASTM C494 Type A.
B. High Range Water Reducer (superplasticiser): Rheobuild 1000 or Glenium 3000 NS by Master Builders/BASF; Daracem 100 or ADVA 140M by GCP Applied Technologies; or equivalent meeting ASTM C494 Type F.
C. Water reducing-retarding agents: for use when ambient temperature is above 70°F, replace water reducing agent in whole or in part with water reducing-retarding agent meeting ASTM C494 Type D. Use amounts to produce concrete with a set time equal to that at 70°F without the retarder.
D. Air entraining agent: MasterAir AE 200 by Master Builders/BASF, DAREX II AEA by GCP Applied Technologies; or equivalent meeting ASTM C260.
E. Non-corrosive non-chloride accelerator: MasterSet FP 20 by Master Builders/BASF; Polarset by GCP Applied Technologies; or equivalent meeting ASTM C494 Type C or E.
F. Cementitious Waterproofing: per Section 07100.
G. Not permitted: Calcium chloride, thiocyanates or admixtures containing chloride ions.
H. All admixtures used for each mixture design shall be from one single manufacturer.

2.8 ACCESSORIES
A. Expansion Joint Fillers (Expansion joints and slab isolation joints):
   1. For joints less than ½” thick: J-Joint polyethylene foam with tear off strip for sealant, or equivalent; joint filler to be slab thickness in depth less 0.5 inch for sealant. Foamastic by Hohmann & Barnard Co., Stripoff by AH Harris, or equivalent.
   2. For joints ½” thick or greater: Self expanding cork by W.R. Meadows or Hohmann & Barnard Inc., or equivalent meeting ASTM D1752 Type III, size as indicated on the Drawings.
B. Epoxy bonding agent:
   1. Two or three-part water-based epoxy
   2. Acceptable products:
      a. Armatec 110 EpoCem by Sika Corporation
      b. Corr-Bond by Euclid Chemical Company
      c. Epobond by L&M Construction Chemicals, Inc.
      d. MasterEmaco P124 by Master Builders/BASF
      e. or equivalent.
C. Cementitious bonding agent:
   1. Grout paint: 1 part portland cement, 1 part fine sand, water for consistency of thick paint
D. Structural inserts: of type and size shown on the drawings; Richmond Screw Anchor or Heckman Building Products, Hohman and Barnard, Dayton Sure-Grip or equivalent.

E. Bond Breaker: Thompson's Water Seal or equivalent, or form release agent (as specified in 2.1.F).

F. Expansion Dowel Caps (Plastic): No. 87 dowel Caps as manufactured by Heckmann Building Products, Inc., Type F-46 Dowel Caps by Dayton Superior, Speed Load by Greenstreak, or equivalent.

G. Cast-in-place Reglet: 26 gage minimum stainless steel. Type 304 "CO" concrete reglet, foam filled with connector clips and flashing by Fry Reglet Corporation, #230 Standard Flashing Reglet by Heckmann Building Products or equivalent.

H. Expanded Coil Inserts. Minimum 4,000 lb min safe working load, minimum 4 ½” length. F-57 by Dayton Superior, CI-56 by Patterson, or equivalent. Required size to match inserted bolt.

2.9 CONCRETE CLASS
A. Class A: Reinforced structural concrete, garage floors, and exterior (non-structural) slabs-on-ground
B. Class B: Concrete fill, pipe encasements

2.10 CONCRETE MIXTURE DESIGN
A. Concrete class:
   1. Class A: \( f'c = 4,500 \, \text{psi}, \max w/cm = 0.42, \min w/cm = 0.39 \)
   2. Class B: \( f'c = 4,000 \, \text{psi}, \max w/cm = 0.45 \)
B. Maximum nominal aggregate size:
   1. Coarse aggregate shall conform to the grading given in Table 3 of ASTM C33/C33M for sizes (i.e., nominal maximum aggregate sizes) No. 467 (1 ½"), No. 57 (1"), No. 67 (3/4"), No. 7 (1/2"), and No. 8 (3/8").
   2. Nominal maximum aggregate size shall be as follows:
      a. 1 ½": All slabs placed on ground, foundation mats and footings, and walls that are at least 15 inches thick, except where the clear spacing between reinforcement bars is less than 2 inches.
      b. ¾": All other locations, except as specified elsewhere or upon written approval of the Engineer.
      c. Concrete Fill:
         i. ½": minimum thickness less than 2 ½ inches and fills screeded into place by process equipment,
         ii. ¾": minimum thickness from 2 ½ inches to less than 6 inches,
         iii. 1 ½": minimum thickness of 6 inches or greater
      d. Electrical Ductbanks: 3/8"
C. Air entrainment:
   1. All concrete, except as noted below, shall be air entrained in accordance with the nominal maximum aggregate size, with a tolerance of plus or minus 1.5%:
      a. No. 8 (3/8") – 7.5%
      b. No. 7 (1/2") – 7.0%
      c. No. 67 (3/4") – 6.0%
      d. No. 57 (1") – 6.0%
c. No. 467 (1 ½") – 5.5%

D. Supplementary cementitious materials may be included as follows.
   1. Portland Cement - No less than 50% of the total by weight.
   2. Slag Cement - If used, no less than 25% and no greater than 35% of the total by weight.
   3. Silica Fume – If used, no less than 5% and no greater than 10% of the total by weight.
   4. Fly Ash - If used, no less than 15% and no greater than 25% of the total by weight.
   5. Total Fly Ash + Slag + Silica Fume – No greater than 50% of the total by weight.
   6. Total Fly Ash + Silica Fume – No greater than 35% of the total by weight.

E. The slump shall be 4” with a 1” plus or minus tolerance at the point of delivery, without use of a high range water reducer. When a high range water reducer is used, the slump shall be as stated above before it is added, and a maximum of 8” at the point of delivery after it is added.

F. Water:
   1. The amount of water carried on the aggregate and the effect of admixtures is included in the water content. Provide that water carried on the aggregate is determined periodically by test and the amount of free water on the aggregate is subtracted from water added to the mixture.
   2. Maximum amount of water: that required to produce a plastic mixture of the strength and water to cementitious materials ratio specified and the required density, uniformity and workability. Consistency of the mixture: that required for the specific placing conditions and methods.

G. High Range Water Reducing admixtures shall be used for all concrete to be pumped or with a specified water to cementitious ratio below 0.50. High range water reducer shall be added either at the concrete batch plant or on site to obtain the slumps as indicated above.

H. Concrete shall be furnished from one supplier and batch plant during the project.

2.11 SELECTION OF CONCRETE PROPORTIONS
A. The Concrete producer shall select the concrete mixture proportions on the basis of past field performance or the use of trial mixtures, both in accordance with ACI 301, Section 4, "Concrete Mixtures".
B. Adjustments to required average strength (f’cr):
   1. Adjustments in the required average strength may be made during the progress of the work to compensate for either high or low average compressive strengths.
   2. When a minimum of fifteen 28-day compressive strength tests from this project are available, the average strength and standard deviation shall be computed.
   3. Should these determinations indicate an excessive compressive strength with a low standard deviation as determined by the Engineer, modification of the concrete mixture may be made to achieve a lower average strength based upon a new standard deviation.
   4. Should these determinations indicate a lower average strength than anticipated, the Engineer will require corrective measures to be taken immediately which may include one or more of the following but not limited to:
a. An increase in the cementitious materials
b. Changes in mixture proportions
c. A reduction in the delivery time
d. Closer control of air content.
e. Decrease in the water to cementitious materials ratio.
f. An improvement in the quality of the testing, including strict compliance with standard test procedures.
g. Procedural changes as deemed necessary by the Engineer.

2.12 STORAGE OF MATERIALS

A. Protect materials from ground and the elements.
B. Maintain cement in dry condition.
C. Store reinforcement and all other embedded items on skids.
D. Store PVC waterstop in a location that is protected from sunlight, precipitation, soiling, etc. Keep surface applied waterstop dry.
E. Remove defective materials, as determined by the Engineer, from site immediately.
Do not store on site.

PART 3 - EXECUTION

3.1 FORMWORK

A. Conform to ACI 301.
B. Verify lines, level, and measurements before proceeding.
D. Allow no concrete leakage. Provide continuous, straight, smooth exposed surfaces.
E. Treat forms with form release agent prior to erecting forms. Do not apply form release agent at formed surfaces of construction joints designed with continuous reinforcement and remove all traces from formed joint prior to subsequent concrete placement. Protect reinforcement from contact with form release agent. Form release agent that contacts reinforcement shall be thoroughly removed.
F. Earth forms not permitted for below grade walls, slabs and footings.
G. Camber formwork as necessary.
H. Provide removable wall panels to allow cleaning and inspection.
I. Chamfer all exposed outside corners and edges 0.75 inch unless otherwise noted.
J. Clean out inside of forms of all foreign materials prior to concrete placement.
K. Install architectural form liner and rustication strips according to Manufacturer's recommendations.
L. Install reinforcement spacers in slabs, beams, walls, columns, and all other concrete members as required to maintain specified clear cover.
M. Maintain specified tolerances.
N. Maintain forms and shores supporting the cast concrete for the minimum time periods indicated below:
   1. Walls and Vertical Surfaces:
      a. Walls containing liquids (subjected to internal hydrostatic pressure) and backfilled walls of interior spaces - 48 Hours
      b. All other walls – 36 hours
c. Forms may be unlocked after 24 hours but shall remain in place for the indicated time periods

2. Elevated Beams and Slabs:
   a. “Clear span” of slabs shall be the shorter span of a slab panel.
   b. Clear spans less than 10 feet – 4 days
   c. Clear spans between 10 feet and 20 feet – 7 days
   d. Clear spans greater than 20 feet – 14 days
   e. Cantilevered slabs and beams with clear spans not exceeding 4 feet – 7 days

3. Time periods listed above represent cumulative number of days or hours during which the temperature of the air surrounding the concrete is above 50°F and the concrete has been damp and no loss of moisture has occurred.

4. Alternate form removal periods:
   a. Alternately to the stripping times specified above, additional concrete cylinders may be made of representative concrete, field-cured, and tested at no additional cost to the Owner.
   b. The supporting forms and shores may be removed when the concrete strength of the field-cured cylinders, as tested per ASTM C39/C39M is a minimum of 70 percent of the specified design strength.
   c. General Contractor shall notify the Engineer 24 hours in advance of casting the field-cured cylinders.
   d. Field-cured cylinders - where noted on the plans and/or when used by the Contractor, specimens shall be field-cured in accordance with ASTM C31/C31M under conditions that are not more favorable than the most unfavorable conditions for the portions of the concrete that the test specimens represent.

O. Reshore as required.

P. Form pressures increase with the use of concrete with High Range Water Reducers. Design forms accordingly.

Q. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form release agent as specified for new formwork.

R. Form Liners:
   1. Form Liner Preparation:
      a. Before placing concrete, verify that lines and levels of formwork and form liner patterns are within allowable tolerances.
      b. On multiple use liners, clean liner before each use. Replace damaged liner whose continued use or repair would negatively impact the aesthetics of the concrete finish.
      c. Apply form liner compatible release agent at rate recommended by manufacturer. Attempt to schedule concrete pour soon after application of release agent to avoid precipitation, dust, and debris. Protect reinforcement from exposure to release agents.
   2. Form Liner Installation:
      a. Seal form liner joints, form liner accessories' joints, and tie holes to prevent cement paste from bleeding.
b. Provide solid backing at form liner butt joints to prevent deflection.
c. Miter cut form liners as required at corners to continue pattern around corners. Caulk any gaps between the adjacent form liners at corners to prevent concrete getting past the liners.
d. Construct form liner and accessories to sizes, shapes, lines and dimensions shown.
e. Provide openings, offsets, keyways, recesses, chamfers, blocking, and screeds as required to achieve architectural concrete textured finish.
f. Drill or pierce liner to accommodate form ties.
g. Anchor liner to form on centers not to exceed 18 inches. Decrease centers as necessary to accommodate form stripping pressures without damaging liner intended for multiple use.
h. Install backup strips as required to prevent deflection of the liner due to form pressures.

3. Concrete Placement:
   a. Form pressures shall not exceed the maximum pressures recommended by the form liner manufacturer.
   b. Keep concrete lifts less than 24 inches. Thoroughly vibrate concrete to achieve good consolidation, and eliminate entrapped air thereby minimizing voids. Internally vibrate through to previous lift to avoid lift lines. Avoid vibrator contact with the form liner.

4. Form Liner Accessory Installation:
   a. Form rustication lines located as indicated by nailing rustication strips to formwork within specified tolerances.
   b. Tightly form corners indicated to have chamfers with [rounded] [triangular] PVC chamfer strips. Corners with chamfers shall be smooth, continuous lines that are uniformly straight.

3.2 REINFORCEMENT
A. Conform to the CRSI Code of Standard Practice.
B. Do not weld reinforcement unless the Engineer takes no exceptions - in writing. When permitted, welding shall be in accordance with AWS D1.4/D1.4M.
C. Splicing reinforcement:
   1. Welded wire fabric: Install in longest sheets practical. Welded wire fabric shall be lapped 1½ wire spacings and a minimum of 12 inches and securely tied at maximum 24 inches on center. Offset end laps in adjacent sheets.
   2. Reinforcement bars: Splices shall be located as shown on the Contract Drawings. Where not shown, splices shall be located away from areas of maximum stress, and shall be reviewed, with no exceptions taken, by the Engineer. Minimum splice lengths shall be as indicated on the Contract Drawings.
D. Provide bar supports and spacers.
E. Reinforcement shall be securely tied at intersections with tie wire or clips in a manner that will keep all metal away from exposed concrete surfaces.
F. Cutting, heating, and bending of reinforcement embedded in the concrete will not be allowed.
G. Mechanical connections shall be installed in accordance with the manufacturer's recommendations and as shown on the Drawings. Additional mechanical connections proposed by the Contractor will not be allowed unless the Engineer has reviewed and takes no exceptions in writing.

H. Epoxy coating damaged shall be repaired with patching material conforming to ASTM A775/A775M.

I. All parts of mechanical connections on epoxy coated reinforcement, including steel splice sleeves, bolts and nuts shall be coated with the same material used for repair of epoxy coating damage.

J. All reinforcement within an area of a continuous concrete placement shall be installed, supported, and secured before beginning concrete placement.

3.3 **EMBEDDED ITEMS**

A. Contractor shall coordinate the installation and securing of all embedded items such as anchor rods, dovetail slots, waterstops, pipes, conduit, pipe hanger inserts, nosings, embedded angles, steel dowels and all other required embedded items indicated in the Contract Documents.

B. Expansion joint dowels shall be held horizontally in forms to prevent displacement and to allow at least one inch of expansion after installation.

C. Contractor shall coordinate number and layout of masonry dowels with the mason prior to installation.

D. All embedded items shall be secured prior to concrete placement. Embedded items shall not be placed during or after concrete placement.

E. Pipes or conduits for embedment within a slab, wall or beam, other than those merely passing through, shall satisfy the following:
   1. Shall not be larger in outside diameter than one-third (1/3) the thickness of the slab, wall, or beam.
   2. Shall not be spaced closer than 3 diameters on center.
   3. Shall not significantly impair the strength of the concrete.
   4. Shall not be embedded in structural concrete slabs less than 6 inches
   5. Only two conduits or pipes shall cross at any point. The sum of the outside diameter of the crossing pipes or conduits shall not exceed one-third (1/3) of the thickness of the concrete thickness.
   6. Conduit shall not be located between the bottom of reinforcement and bottom of concrete slab or beam.
   7. Aluminum conduit shall not be embedded in concrete.
   8. Conduit shall be installed such that there will be NO cutting, bending, and/or displacement of reinforcement from its proper location.
   9. Conduit and/or pipes shall not pass through a waterstop in slabs, beams, or walls.
   10. Conduit shall not be installed prior to review of conduit layout plan with no exceptions taken by the Engineer.
   11. Voids cast into concrete slabs and walls for pipes or conduit and subsequently filled with concrete or grout shall not be installed unless reviewed with no exceptions taken by the Engineer.
3.4 EXPANSION ANCHORS AND EPOXY ADHESIVE ANCHORS

A. Anchors shall be installed by qualified personnel trained to install expansion and adhesive anchors.

B. Anchors shall be installed in strict accordance with the Manufacturer’s Printed Installation Instructions (MPII).

C. Each installer shall at all times have in their possession the MPII.

D. Adhesive anchors shall be installed in concrete having a minimum age of 21 days at time of installation.

E. All adhesive anchor cartridges shall have the expiration date clearly visible. Material past its expiration date shall not be used and shall be immediately removed from the site.

F. Embedded reinforcement shall be located with proper equipment prior to drilling to ensure that each drilling location does not coincide with existing reinforcement. Drilling through reinforcement shall be prohibited.

G. If existing reinforcement is encountered while drilling, offset the drill hole by a maximum of 2-inches. The new relocated hole shall be in the same line as the line of drilled holes. All offset holes shall be a minimum of 4-inches from a free concrete edge. Maintain the original spacing locations of the remaining dowels as indicated on the Contract Drawings.

H. Diamond drill bits shall not be permitted. Hammer drills shall be used.

I. The initial material extruded from each adhesive anchor cartridge shall be discarded in accordance with the manufacturer’s instructions to ensure that all material is properly mixed.

J. Depth stop shall be used to ensure correct drilling depth. Drilled holes shall be blown out with air, thoroughly wire-brushed with a repeated back and forth movement, blown out, thoroughly wire-brushed, and blown out again. Adhesive shall be injected starting from the bottom of the hole, and slowly withdrawn as filling progresses to prevent air pockets.

K. Anchored reinforcement shall remain completely undisturbed between manufacturer’s specified gel time and the full cure time. Zero load shall be applied during this time.

3.5 PLACING CONCRETE

A. Notify Engineer and Independent Testing Laboratory 24 hours minimum prior to each placement.

B. All reinforcement within the area of one day’s concrete placement shall be tied in place, and observed by the Engineer, prior to commencing concrete placement.

C. All concrete delivery trucks at each placement shall be tested as specified in Section 03305.

D. Assure placement and proper location of all embedded items.

E. Provide concrete Delivery Slip prepared at batch plant with each truck load of concrete showing the information listed under Submittals in this Section.

F. Water: water added after batching shall be carefully monitored as follows:
   1. Residual, wash, and/or other water in drums: completely discharge prior to concrete batching (drums backed out).
2. Slump adjustment: not permitted at wash down, “slump rack”, or by any other means between the time of batching to the point of delivery at the Project site.

3. Water added after arrival at Project site: accurately metered and recorded on the delivery ticket. The Engineer’s Resident Project Representative shall be notified prior to the addition of water.

4. No additional water shall be added to the concrete on site that will increase the water to cementitious materials ratio above that specified. If additional water is to be added on site, it shall be held back during batching from the quantity specified in the mixture design. The amount of water held back shall be clearly indicated on the concrete delivery slip, and the addition of more water than indicated shall be cause for non-compliance and rejection of the concrete truck.

G. Place concrete from mixing truck to final location quickly and without segregation.

H. Place all concrete from the delivery truck within 90 minutes of addition of water to cement, or cement to aggregate, whichever occurs first. When air temperature is 90°F and above, this time shall be reduced to 60 minutes. These times may be exceeded only upon review with no exceptions taken by the Engineer, and only if all tests for air content, slump and temperature are also within specified limits.

I. Standing water shall be removed from all forms and excavations and the Work shall be kept dry during concrete placement. No water shall be thrown on, allowed to flow over, or rise upon the concrete until the concrete surface has reached its final set and is rigid.

J. Runways shall be provided for wheeled concrete handling equipment. Runways shall not be supported upon placed reinforcement.

K. Concrete truck chute shall conform to the following:
   1. Minimum slope: 3 horizontal to 1 vertical. Maximum slope: 2 horizontal to 1 vertical. Between these limits the chute slope shall be such to ensure continuous flow without segregation.
   2. Provide baffle at end of chute to prevent segregation. If the end of the chute is more than 3 feet above the surface of deposit, a spout is to be used. The spout is to be kept full of concrete with the end kept as near as practical to the surface of the deposit.
   3. The chute shall be steel or steel lined. Aluminum chutes are not permitted. Sections of the chute shall have the same slope throughout.
   4. The chute is to be thoroughly flushed with water before and after each use with the water discharged outside the forms.

L. Freefall from concrete truck discharge chute, pump hose and hopper hose: 4 feet maximum.

M. The accumulation of concrete on the forms and/or reinforcement above the level of placement shall be avoided. The splashing of concrete upon formwork that is set for a subsequent concrete placement shall be prevented due to the resulting marks on the finished concrete.

N. Concrete placements shall be carried out in a continuous operation until the placement of the entire section between construction joints is complete. Place against plastic concrete only.

O. Do not place partially hardened concrete. Re-tempering is not permitted.
P. Compacting and vibrating concrete:
1. Consolidate each layer by mechanical internal vibrating equipment supplemented by hand spading, rodding, and tamping as required. The depth of each layer shall not exceed the smaller of 20 inches and the depth that can be properly vibrated with the equipment used. When deposited in multiple layers, the vibrator shall penetrate the preceding layer approximately 6 inches to blend layers. Ensure that initial setting of the previous layer doesn't occur prior to placement of subsequent layer.
2. Do not use vibrator to move fresh concrete within the forms. Insert vibrator at approximately 18-inch intervals, and over-vibration resulting in segregation shall be prevented.
3. Concrete shall be thoroughly consolidated around reinforcement, embedded items and into corners of forms.
4. Ensure that vibrator is kept several inches clear of waterstops.
5. Where internal vibration is impractical, the use of form vibrators will be considered, and will be allowed only with the review with no exceptions taken by the Engineer. When allowed, the vibrator shall be placed so that motion is horizontal.
6. Vibratory screeds are acceptable for slabs up to 8 inches thick, however internal vibration is required in areas of load-transfer dowels and electrical conduit. Internal vibration is required for slabs thicker than 8 inches.

Q. Placing concrete in cold weather:
1. Conform to ACI 306.1 as modified herein for concrete placements in cold weather as defined in Section 03346. When freezing temperatures may occur during periods not defined as cold weather, concrete surfaces shall be protected against temperatures lower than 35°F, as measured by the Engineer, for at least the first 24 hours after placement.
2. Concrete shall conform to the following temperature limitations “as placed and maintained” and “as mixed”, respectively. The minimum temperature maintained shall be for a minimum of 6 days, or 4 days with use of an accelerator, and shall be as measured at the concrete surface by the Engineer:

<table>
<thead>
<tr>
<th>Concrete Thickness</th>
<th>Concrete Thickness as placed and maintained</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 in</td>
<td>Less than 12 in</td>
</tr>
<tr>
<td>Minimum concrete temperature as placed and maintained</td>
<td>Minimum concrete temperature as mixed for indicated air temperature</td>
</tr>
<tr>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>Minimum concrete temperature as mixed for indicated air temperature</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Above 30°F</td>
</tr>
<tr>
<td>3</td>
<td>0 to 30°F</td>
</tr>
<tr>
<td>4</td>
<td>Below 0°F</td>
</tr>
</tbody>
</table>

3. The concrete placement temperature shall not be higher than the minimum concrete placement temperature (in the table above) by more than 20°F.
4. An accelerator may be used in the mixture design when placing concrete in air temperatures below 50°F.
All material and equipment required for cold weather placement, protection and curing shall be available at the project site before commencing concrete placement.

Any enclosure for weather and climate protection shall be in place before depositing any concrete. Heating within the enclosure shall maintain the temperature specified with a reasonable degree of uniformity in all parts of the enclosure. All exposed concrete surfaces within the enclosure shall be kept sufficiently moist to prevent drying. Heating appliances shall not be placed in a manner so as to damage the enclosure, forms, supports, or expose any area of concrete to drying out or to excessive temperatures.

The use of direct fired heaters including salamanders and torpedoes is not permitted due to the potential damage to concrete surfaces exposed to elevated levels of carbon dioxide, which can result in soft, chalky surfaces and dusting throughout the life of the structure. Heaters shall be indirect fired heaters with combustion exhaust vented outside the enclosure, electric or hydronic.

All snow, ice and frost shall be removed from the surfaces against which the concrete is to be placed including subgrade and reinforcement.

Do not place concrete on frozen ground. Insulate or heat subgrade to ensure temperature of subgrade material is above 32°F when concrete is placed.

All embedded items having a cross sectional area of 1.00 square inches or greater, including #9 and larger steel reinforcement, shall be at a temperature not less than 10°F at time of concrete placement.

Cover, insulate and/or heat as required to protect concrete and provide frost protection beneath structure. Thermal protection shall be provided immediately after concrete placement. Except when supplemental heat is provided, the R-value of the insulation shall be per the recommendations of Chapter 9 of ACI 306R.

Placing concrete in hot weather:

1. Hot Weather: Job-site conditions that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80°F or higher, and an evaporation rate that exceeds 1 kg/m²/h.

2. Temperature of concrete when placed shall not exceed 90°F. When the air temperature is 90°F and above, procedures to cool mixture ingredients shall be employed. These include:
   a. Providing shaded storage for aggregate,
   b. Frequent sprinkling or fog spraying of coarse aggregate,
   c. Using chilled batch water and/or ice.

3. Forms and reinforcement shall be sprinkled with cold water just prior to concrete placement. When possible, placement of slabs should be scheduled accordingly in order to minimize problems associated with direct sunlight and/or drying winds.

Pumping: The inside diameter of pipes and hoses used to convey the concrete shall be a minimum of three times the maximum size aggregate of the mixture. In order to minimize altering the concrete properties, long vertical sections at the end of the pump line is prohibited. A horizontal hose run, a hose loop, or a slide gate at the end of the hose is to be used to reduce loss of entrained air.
T. Thoroughly moisten subgrade materials prior to placing slabs on grade.
U. Place one inch of Sand Cement Slurry prior to placing concrete at the bottom of all walls greater than or equal to 8 feet in height.
V. When placing new concrete directly against existing concrete, clean the surface of all contamination and debris, and roughen by steel shot-blasting, abrasive (sand) blasting, or water-jetting (hydrodemolition). Use of scabblers, scarifiers, bush hammers, or pneumatic hammers is not permitted. The prepared surface shall be water-saturated for a minimum of six hours, and the excess water shall be removed immediately prior to placement of concrete. Apply specified bonding agent to the prepared surface to bond to new concrete.
W. Provide concrete pads and foundations for all equipment as shown on Drawings or as required by the equipment manufacturer. Set anchor bolts for equipment with templates at correct elevations using manufacturer's shop drawings reviewed by the Engineer with no exceptions taken unless otherwise indicated. All equipment pads shall be sized by the Contractor and equipment supplier except as otherwise indicated on the Drawings.
X. Contractor shall coordinate concrete truck wash-out area with Owner.

3.6 TOLERANCES
   A. Tolerances shall conform to all requirements of ACI 117.

3.7 PROTECTION
   A. Protect concrete from damage from construction activity, traffic, equipment, and materials. During the curing period protect concrete from load-induced stresses, shock, and vibration. Setting of forms upon slabs on ground shall not commence until a minimum of 3-days after placement, and 5-days when gang forms are used. Placement of concrete walls upon slabs on ground shall not commence until after the 7-day curing period.

3.8 FAILURE TO MEET STRENGTH REQUIREMENTS
   A. The strength of the concrete in place will be considered substandard if any one of the following results occur (where a strength test is defined as the average of two 6"Ø x 12" cylinders or three 4"Ø x 8" cylinders):
      1. The average any three (3) consecutive strength tests at 28 days is less than the specified strength (f’c).
      2. A compressive strength test result falls below the specified strength (f’c) by more than 500 psi.
   B. Concrete which fails to meet the strength requirements as outlined above will be reviewed by the Engineer. The Engineer will determine whether the substandard concrete will be accepted, rejected or additional tests performed.
   C. When substandard concrete occurs as defined in Part A, the Engineer will require corrective measures to be taken immediately to increase the average of subsequent strength tests. In addition, the Engineer may require cores drilled in the area of question in accordance with Specification 03305. If the core tests are inconclusive or impractical to obtain, load tests may be required, and their results evaluated in accordance with ACI 318. If the average of the three cores is less than 85% of the specified strength or if one core is less than 75% of the specified 28-day strength,
then that portion of the structure shall be strengthened by a method proposed by the Contractor and no exceptions taken by the Engineer or replaced by the Contractor at no additional cost to the Owner.

3.9 DEFICIENT CONCRETE

A. Concrete work will be considered deficient if it does not conform to strength and material durability requirements (including water to cementitious materials ratio), location, elevation, dimension, shape, alignments, and/or appearance as required in the Contract Documents. Specific examples of deficient concrete include (but are not limited to):

1. Concrete containing reinforcement that does not meet the requirements of the Contract Documents for size, quantity, strength, position, or arrangement.
2. Concrete which differs from the required dimensions or locations in such a manner as to reduce the strength.
3. Concrete surfaces not finished or cured in accordance with Section 03346.
4. Concrete work in hot or cold weather that doesn't meet the requirements of the Contract Documents.
5. Formed surfaces larger or smaller than specified dimensional tolerances. If the Engineer permits the Contractor to correct the error, such correction shall be as directed and in such a manner as to maintain the strength, function and appearance of the structure.
6. Concrete members cast in the wrong location may be rejected and shall be removed at no additional cost to the Owner if the strength, appearance or function of the structure is adversely affected.
7. Concrete exposed to view with defects that adversely affect the appearance of the specified finish shall be repaired. If, in the opinion of the Engineer, the defects cannot be repaired, the concrete may be rejected by the Engineer. Examples include:
   a. Non-uniform appearance including texture and color
   b. Excessive visible repairs of structural defects
8. Concrete work damaged from accidents, poor construction practices or fire.

B. Any deficient concrete may be subject to rejection and replacement at no additional cost to the Owner if the Engineer deems necessary.
SECTION 03305
CONCRETE TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Concrete Testing performed by Independent Testing Agency
   B. Watertightness (Leak) Testing

1.2 RELATED SECTIONS
   A. Section 01340 - Submittals
   B. Section 01400 - Quality Control
   C. Section 03010 – Concrete Modifications and Repairs
   D. Section 03300 - Cast-In-Place Concrete
   E. Section 03346 - Concrete Finishing and Curing

1.3 REFERENCES
   A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
   B. ASTM C31/C31M- Standard Practice for Making and Curing Concrete Test Specimens in the Field
   D. ASTM C42/C42M- Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   E. ASTM C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
   F. ASTM C172- Practice for Sampling Freshly Mixed Concrete
   G. ASTM C231- Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
   I. ASTM E329- Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
   J. ACI 301- Standard Specifications for Structural Concrete
   K. ACI 350.1-10- Tightness Testing of Environmental Engineering Concrete Structures
1.4 QUALIFICATIONS
A. Independent Testing Laboratory shall conform to concrete testing requirements of ASTM E329 and ASTM C1077.
B. Key personnel must be qualified in concrete quality assurance.
C. Perform concrete field quality control testing with personnel certified as an ACI Concrete Field Testing Technician, Grade 1 according to the American Concrete Institute (ACI).

1.5 SUBMITTALS
A. The Contractor shall be responsible for the submittals for review and acceptance by the Engineer at no additional cost to the Owner. Submittals shall include Independent Testing Laboratory’s qualifications, all testing reports, etc.
B. Independent Testing Laboratory will submit one copy each of all test reports to each of the following: Engineer, Resident Project Representative, Contractor, and concrete supplier. Reports shall indicate the following information:
- Project
- Placement location
- Contractor
- Concrete supplier
- Technician
- Date cast
- Date picked up
- Design strength
- Air temp
- Concrete temp
- Initial slump
- Final slump
- Field density
- Air content
- Cure box min/max temps
- Cylinder Nos
- Cylinder weights
- Date of breaks
- Break type
- Break load
- Break strength
- Truck Arrival Time
- Truck Unload Time
- Lab/Field-cured
- Cylinder size
C. Independent Testing Laboratory will submit reports within 5 days of testing or inspection.
D. Independent Testing Laboratory will notify the Engineer within 24 hours if tests indicate deficiencies.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 CAST-IN-PLACE CONCRETE
A. An independent, accredited and certified testing laboratory (Independent Testing Laboratory), selected and paid for by the Owner and directed by the Engineer and/or Resident Project Representative, shall test and sample Class A concrete for strength, slump, air content and density as indicated herein.
B. The Contractor shall provide on the Project site space to accommodate and a source of electrical power to service facilities to be provided by the Owner’s testing agency for proper initial curing and storage of concrete test cylinders to be lab-cured as required by ASTM C31/C31M for 48 hours after casting. Contractor to coordinate the location of these facilities with the Resident Project Representative and
Independent Testing Laboratory. Facilities for initial curing and storage of cylinders shall be of suitable size, prevent the loss of moisture from the specimens, and be automatically heated/cooled to maintain a temperature of between 60°F and 80°F, which shall be recorded with a maximum-minimum thermometer, as manufactured by Engius, Thermocure, or similar.

C. The General Contractor shall notify the Resident Project Representative of proposed upcoming concrete placements as follows. (The Resident Project Representative will notify the Independent Testing Laboratory.)
   1. On a weekly basis.
   2. For specific placements a minimum of 24 hours in advance.

D. From a sample obtained from the middle of mixer load (not from first 10% or last 10%) prepare (4) standard test cylinders measuring 6"Ø x 12" or (7) test cylinders measuring 4"Ø x 8" for each class of concrete as specified in 3.1A placed in any one day at the following frequency:
   1. For each 100 cubic yards of placed concrete, or
   2. For each placement less than 100 cubic yards

E. Concrete cylinders shall be tested as follows:
   1. 6" Ø x 12” cylinders:
      a. Test (1) cylinder at 7 days; (2) cylinders at 28 days
      b. Hold one cylinder for later testing (if required)
   2. 4" Ø x 8” cylinders:
      a. Test (2) cylinders at 7 days; (3) cylinders at 28 days.
      b. Hold two cylinders for later testing (if required)

F. At the Project site, for each truck before start of concrete placement: measure concrete temperature and perform slump, air content and density tests from a sample taken from the beginning of the discharge.
   1. Perform tests after the addition of any water that was held back during batching.
   2. If concrete is not pumped, sample from the discharge end of the truck. If the concrete is pumped, sample from the discharge end of the pump hose.
   3. Before taking test sample, discharge ¼ cubic yard, minimum, of concrete into a container (which can be placed after successful testing). Then take test sample.
   4. Upon the Engineer’s approval, once slump loss and loss of entrained air due to pumping is established, correlated acceptance limits for sampling and testing at the truck may be permitted.
   5. When the pumpline configuration is changed significantly, sampling and testing shall again be performed at the discharge end of the pump hose until new acceptance limits at the truck are properly correlated.

G. No concrete shall be placed until this testing is successfully completed.
H. In addition, perform slump, air content and density tests for each sampling when cylinders are made.
I. All samples for casting of cylinders shall be taken from the middle of the mixer load (not from first 10% or last 10%), and at the discharge end of the pump hose when pumped.
J. Perform temperature, slump, air content and density tests and make cylinders at other times when directed by the Resident Project Representative.
K. Samples taken for concrete testing are to be disposed of, and not used in the work.
L. Additional testing and sampling required as a result of deficient results or improper curing shall be paid for by Owner. The cost of resampling and retesting will be determined by Engineer, and Owner will invoice Contractor for this cost. If unpaid after 60 days, this invoice amount will be deducted from the Contract Price.
M. Contractor shall provide access to the site at all times for the Independent Testing Laboratory Personnel.

3.2 ADDITIONAL TESTS

A. Independent Testing Laboratory shall provide additional testing of in-place concrete that does not comply with the requirements of the Contract Documents or is considered substandard as directed by Engineer. Additional tests may consist of non-destructive testing, cores drilled from the area in question or load tests. Costs of additional testing will be paid by Owner. The cost of the additional testing will be determined by Engineer and Owner will invoice Contractor for that cost. If unpaid after 60 days, the invoice amount will be deducted from the Contract Price.

B. When the concrete strength is substandard as defined in Section 03300, concrete core specimens shall be obtained and tested from the affected area. A minimum of three (3) cores shall be taken for each sample in which the strength requirements were not met. The drilled cores shall be obtained and tested in conformance with ASTM C42/C42M. Engineer will determine the size and location of the required core samples.

C. Field-cured cylinders may be cast and tested by the Independent Testing Laboratory as required in the Contract Documents, or at the request of the Contractor. The costs of these tests shall be borne by the Contractor unless required per the Contract Documents. If the field-cured cylinders are cast and tested prior to 28-days to determine the in-place concrete strength in order to facilitate an accelerated schedule for subsequent concrete placements, or backfilling or leakage testing, the following criteria must be met:

1. The Contractor shall notify the Engineer and Independent Testing Laboratory 48 hours in advance of the concrete placement. The Engineer will determine at that point if the results of the field-cured cylinders may be used to determine the in-place concrete strength. The Contractor shall notify the Engineer as to when the field-cured cylinders will be tested and for what purpose.

2. A minimum of two 6"Ø x 12" cylinders or three 4"Ø x 8" cylinders shall be cast for each separate test the Contractor requests.

3. The field-cured cylinders shall be left in the field and located such that they are exposed to the identical environmental conditions as the concrete structure.

4. The Engineer shall determine if the strengths indicated by the field-cured cylinder tests are adequate for their intended purpose.

END OF SECTION
SECTION 03346

CONCRETE FINISHING AND CURING

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Concrete Finishing and Curing

1.2 RELATED SECTION
A. Section 01340 – Submittals
B. Section 03010 – Concrete Modifications and Repairs
C. Section 03300 - Cast-in-Place Concrete
D. Section 03604 - Non-Shrink Grout
E. Section 03930 - Concrete Coatings
F. Section 07100 - Waterproofing
G. Section 07150 - Dampproofing
H. Section 07900 - Joint Sealers
I. Section 09900 - Painting

1.3 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. ACI 301 – Standard Specifications for Structural Concrete
C. ACI 302.1R - Guide for Concrete Floor and Slab Construction
D. ACI 306.1 – Standard Specification for Cold Weather Concreting
E. ACI 306R – Cold Weather Concreting
F. ACI 308.1 – Standard Specification for Curing Concrete
G. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete
H. ASTM C309 – Standard Specification for Liquid Membrane - Forming Compounds for Curing Concrete
I. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
K. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers
1.4 SUBMITTALS
A. Submit product data and material safety data sheets for curing compounds, sealers and hardeners. Indicate the intended use and location for all products.
B. Submit methods to be used to protect the concrete during cold weather. The Engineer’s review shall be for information only as the Contractor is responsible for the means and methods of protection of concrete placed during cold weather.
C. Submit methods to be used to protect the concrete during hot weather. The Engineer’s review shall be for information only as the Contractor is responsible for the means and methods of protection of concrete placed during hot weather.
D. Submit curing methods. Submittal shall be presented in a table format indicating each structure and how all of the individual components of each structure will be cured.
E. Submit qualifications of flatwork finishers.
F. Contractor shall submit all requested information prior to the pre-Concrete meeting described in Section 03300.

1.5 SAMPLE WALL FINISH
A. For each type of wall finish used on the project, the first 100 square feet of finished area shall be observed by the Engineer. Sample areas shall be provided until no exceptions are taken with the wall finish. The final sample area shall serve as a guide for the remainder of the project.

1.6 ENVIRONMENTAL CONDITIONS
A. Environmental Conditions are defined as follows:
   1. Cold Weather:
      a. Cold weather is defined as any and all periods when for more than three consecutive days the average daily outdoor temperature drops below 40°F. (The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight.) When temperatures higher than 50°F occur during more than half of any 24-hour duration, the period shall not be regarded as cold weather.
      b. When freezing temperatures may occur during periods not defined as cold weather, concrete surfaces shall be protected against temperatures lower than 35°F, as measured by the Engineer, for at least the first 24 hours after the concrete placement.
   2. Hot Weather - Job-site conditions that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80°F or higher, and an evaporation rate that exceeds 0.2 pounds per square-foot per hour.

1.7 QUALITY ASSURANCE
A. Perform work in accordance with ACI 301, ACI 306.1 and ACI 308.1, except as modified herein.
B. All curing and finishing materials shall meet all Federal and State regulations pertaining to Volatile Organic Compounds (VOC) Compliance.
C. Contractor performing flatwork finishing of concrete slabs shall provide at least one (1) flatwork finisher certified as an ACI Concrete Flatwork finisher.
PART 2 - PRODUCTS

2.1 CURING MATERIALS

A. Curing and Sealing Compound:
   1. Acrylic water-based compound
   2. Conform to ASTM C309 Type 1 and ASTM C1315 Type 1 Class A, minimum 25% solids.
   3. Acceptable products:
      a. Super Diamond Clear VOX by Euclid Chemical
      b. StarSeal 1315 by Vexcon
      c. Vocomp 25 by WR Meadows
      d. Dress & Seal WB 25 by L&M Construction Chemicals
      e. Or equivalent.

B. Dissipating Resin Curing Compound:
   1. Conform to ASTM C309 Type 1
   2. Film must break down in two to four weeks.
   3. Acceptable products:
      a. Kurez-DR by Euclid Chemical Company
      b. Certi-Vex Enviocure 100, by Vexcon
      c. Or equivalent.

C. Curing, Sealing and Hardening Compound:
   1. Acrylic water-based compound
   2. Conform to ASTM C309 Type 1, Class A&B
   3. Acceptable products:
      a. Starseal EF Medium Gloss by Vexcon
      b. Or equivalent.

D. Curing Water: Water shall be potable from a municipal water supply. The temperature of the curing water shall not be lower than 20°F cooler than the surface temperature of the concrete at the time the water and concrete come in contact.


F. Curing Paper: ASTM C171, regular or white waterproof paper.

2.2 FINISHING MATERIALS

A. Slab Sealer:
   1. Silane or Siloxane based 96% chloride ion screen.
   2. Do not apply to surfaces cured with curing compounds.
   3. Acceptable products:
      a. Baracade Silane 100 C by Euclid Chemical
      b. Certi-Vex Penseal 244 100% by Vexcon
      c. Or equivalent

B. Slab Hardener:
   1. Siliconate/silicate-based penetrating liquid hardener/densifier/sealer: clear, odorless, chemically reactive, waterborne solution of inorganic siliconate/silicate materials with minimum solids content of 20% of which not less than 50% is siliconate.
   2. Acceptable products:
CONCRETE FINISHING AND CURING

a. Euco Diamond Hard, Euclid Chemical
b. FGS Hardener Plus, L&M Construction Chemicals
c. Or equivalent

C. Evaporation Retardant:
   1. Water based polymer liquid evaporation retardant.
   2. Acceptable products:
      a. E-CON as manufactured by L&M Construction Chemicals
      b. Eucobar by Euclid Chemical
      c. SikaFilm by Sika Corporation
      d. MasterKure ER 50 by Master Builders/BASF
      e. Starseal Assist by Vexcon
      f. Or equivalent

2.3 JOINT FILLER
A. Joint filler is specified in this Section. Joint sealant is specified in Section 07900.
   Crack sealant is specified below.
B. Joint filler shall be 100% solids, fast-setting, semi-rigid, two-component, self-leveling polyurea, having a minimum Shore A hardness of 80 per ASTM D2240.
C. Joint filler shall be Euco Qwikjoint 200 by Euclid Chemical Company, Joint Tite 750 by L&M Construction Chemicals, Inc., or approved equal.

PART 3 - EXECUTION

3.1 FINISHES
A. Repair all defects in accordance with Section 03010 and allow repair material to properly cure prior to finishing concrete.
B. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
C. Finish concrete surfaces as scheduled.

3.2 VERTICAL SURFACE FINISHES
A. Surface tolerance classes indicated herein are specified in ACI 117, and include abrupt surface irregularities that are measured within 1-inch of the irregularity, and gradual surface irregularities measured as the maximum gap between the concrete and the near surface of a 5-foot straight-edge, measured between contact points. All repairs shall be in accordance with Section 03010.
B. Surface Finish-1.0 (SF-1.0):
   1. Patch voids larger than 1 ½ inches wide or ½ inch deep.
   2. Projections exceeding 1 inch in height shall be removed.
   3. Except when taper tie system specified in Section 03300 is used, form tie holes need not be patched.
   4. Repair surface and structural defects as indicated in Section 03010.
   5. Surface tolerance Class D with formed surface irregularities not more than 1 inch.
C. Environmental Surface Finish-1.0 (ESF-1.0):
   1. Patch voids larger than 1 ½ inches wide or ¼ inch deep.
   2. Projections exceeding ½ inch height shall be removed.
3. Patch form tie holes.
4. Repair surface and structural defects as indicated in Section 03010.
5. Surface tolerance Class C with formed surface irregularities not more than $\frac{1}{2}$ inch.

D. Environmental Surface Finish-2.0 (ESF-2.0):
1. Patch voids larger than $\frac{3}{4}$ inch wide or $\frac{1}{4}$ inch deep.
2. Projections exceeding $\frac{1}{4}$ inch in height to be removed.
3. Patch form tie holes.
4. Repair surface and structural defects as indicated in Section 03010.
5. Surface tolerance Class B with formed surface irregularities not more than $\frac{1}{4}$ inch.

E. Environmental Surface Finish-3.0 (ESF-3.0):
1. The concrete surface shall be of uniform color, texture.
2. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the minimum.
3. Surfaces that will receive a coating (Section 03930) or surface-applied waterproofing (Section 07100) shall receive an initial abrasive blast to fully expose air voids prior to finishing. Coordinate all work of this section with Sections 03930 and 07100.
4. Patch voids larger than $\frac{3}{4}$ inch wide or $\frac{1}{4}$ inch deep.
5. Projections exceeding $\frac{1}{8}$ inch in height to be removed.
6. Patch form tie holes.
7. Repair surface and structural defects as indicated in Section 03010.
8. Additional finishing and surface preparation will be required for surfaces to receive concrete coatings or waterproofing. Refer to Sections 03930 (Concrete Coatings) and 07100 (Waterproofing).
9. Surface tolerance Class A with formed surface irregularities not more than $\frac{1}{8}$ inch.

F. Grout-Cleaned Rubbed Finish (GCRF):
1. Provide an ESF-3.0 finish as specified above.
2. The wall surface shall have all loose dirt, scale, etc. removed.
3. The surface shall be wetted and allowed to soak the surface. The surface being worked on shall not be in the sun while finishing. Curing in the sun is acceptable.
4. The grout mixture shall be one part portland cement and $1 \frac{1}{2}$ parts sand (by volume) and enough water to produce the consistency of thick paint matching the color of the surrounding concrete. After the materials are mixed, let set for at least 15 minutes.
5. The sand and portland cement shall be obtained from the concrete plant where the concrete was obtained and shall be the same sand and the same cement as used in the concrete.
6. Scrub grout into voids and remove excess grout. This is not a parg coat. The entire surface shall be rubbed and all voids filled.

3.3 SLAB SEALER
A. Apply in strict conformance to manufacturers' recommendations. The requirements indicated below are minimum and more stringent requirements required by the
manufacturer shall be adhered to.

B. Cure concrete as specified. Let concrete age for a minimum of 30 days prior to application of sealer.

C. Clean surface of oil, grease, dirt, and foreign materials as recommended by the manufacturer.

D. Apply when slab temperature is between 40°F and 80°F.

3.4 JOINT FILLER

A. Joints shall be clean, dry, and free of oil and other foreign material that could adversely affect the bond between sealant and concrete. Joint preparation and filler installation shall be in accordance with the manufacturer’s instructions. Filler shall be installed the full joint depth. The top of the joint shall be overfilled, followed by trimming of excess such that joint filler is flush with the concrete slab.

3.5 CURING

A. Curing shall begin immediately following the initial set of concrete or after slab surface finishing has been completed when it will not mar, erode or stain the concrete surface and shall continue after form removal. All concrete shall be cured to attain strength and durability by one of the following methods for a minimum of 7 consecutive days immediately after placement. Moist cure is required for all tank and liquid containing walls and slabs – curing compounds are not allowed. See Schedule of Finishes and Curing Requirements in this Section:

1. Moist Cure
   a. Ponding or continuous sprinkling. Intermittent wetting and drying is not an acceptable curing method.
   b. Application of curing paper kept continuously wet. Use wet methods for the first 24 to 30 hours. Lap side joints of paper 4 inches minimum and end joints 6 inches minimum. Tape joints or weigh down paper to prevent displacement. Repair any and all tears during the curing period. Apply paper no earlier than 24 hours, and no later than 30 hours, after finishing. The slab surface shall be maintained in a wet condition beneath the paper at all times. During cold weather, as previously defined, when moist cure is called for in the Schedule of Finishes and Curing Requirements in this section, the application of water is not required except when a heated enclosure is provided.

2. Application of concrete curing compounds.
   a. When using dissipating resin curing compounds, allow curing compound to chemically break-down, and remove residuals and other foreign material, prior to applying sealers and other coatings.
   b. The use of curing compounds on surfaces to receive toppings, sealers, chemical hardeners, water repellents, waterproofing, dampproofing, coatings, or GCRF is not allowed. Utilize curing methods as indicated in the schedule.
   c. For slabs, apply immediately following the disappearance of the surface water sheen after the final finishing pass. For formed concrete, apply immediately after form removal.
B. Moisture loss from surfaces placed against wooden or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed.

C. After form removal of vertical elements, the concrete shall be cured as indicated in the schedule for the balance of time remaining as specified above. All exposed concrete (tops of walls) within vertical forms shall begin curing, such as with soaker hoses, within 24 hours of placement, regardless of the duration that the forms will remain in place.

D. Cold Weather:

1. Conform to ACI 306.1, except as modified herein, for placement of concrete in cold weather as defined in Part 1.6.

2. Thermal protection must be provided immediately after concrete placement. Procedures for covering, insulating, housing and/or heating concrete shall be prearranged. Except when supplemental heat is provided, the R-value of the insulation shall be in accordance with the recommendations of Chapter 9 of ACI 306R.

3. Concrete structures shall be covered, insulated and heated as required to protect the concrete and prevent frost penetration beneath the structures.

4. Maintain concrete at the following minimum temperature (measured at concrete surface) for a minimum protection period of 6 days (or 4 days with use of an accelerator):
   a. Sections of less than 12 inch minimum dimension: 55°F
   b. Sections of 12 to 36 inch minimum dimension: 50°F
   c. Sections of 36 to 72 inch minimum dimension: 45°F
   d. Sections greater than 72 in minimum dimension: 40°F

5. Protect concrete from damage due to concentrated heat sources to prevent drying and local carbonation of concrete surfaces. Combustion heaters shall be properly vented, and located so they do not apply heat directly to concrete surfaces. The use of direct fired heaters including salamanders and torpedoes is not permitted due to the potential damage to concrete surfaces exposed to elevated levels of carbon dioxide, which can result in soft, chalky surfaces and dusting throughout the life of the structure. The use of indirect fired heaters with combustion exhaust vented outside the enclosure is permitted.

6. For those surfaces requiring curing compounds, reapply curing compounds every two days during heating period or at greater frequencies as required by the manufacturer.

7. The temperature shall be monitored at the surface of the concrete, including corners and edges, which are more vulnerable to low temperature. The concrete surface temperature shall be recorded a minimum of twice per each 24-hour period.

8. Slabs, regardless of air content, shall not be exposed to freezing temperatures when exposed to rain, snow or other water sources, prior to reaching a compressive strength of 3500 psi.

9. Concrete shall be cooled gradually at the end of the protection period. When the surface temperature of the concrete is within 20°F of the ambient temperature, all protection may be removed. The maximum allowable temperature drop at the concrete surfaces shall not exceed 5°F in any 1 hour,
and during any 24 hours after the end of the curing period shall not exceed the following total temperature drop:

a. Sections of less than 12 inch minimum dimension: 50°F
b. Sections of 12 to 36 inch minimum dimension: 40°F
c. Sections of 36 to 72 inch minimum dimension: 30°F
d. Sections greater than 72 in minimum dimension: 20°F

E. Long-term protection against freezing:
1. The surface temperature of concrete shall be maintained above 35°F until the compressive strength, as verified by field-cured cylinders (or embedded thermocouples) reaches the 28-day design compressive strength specified.

F. Long-term cold weather protection of non-air-entrained hard troweled concrete slabs:
1. After the curing period (at which time they are protected), the surface temperature shall be maintained at a minimum of 35°F for a minimum of 8 weeks.
2. Thereafter, and for the duration of the Contract, if such slabs might be subjected to freezing temperatures they shall be fully sheltered from rain, snow, and all other water sources.
3. The surface temperature shall be as measured by the Engineer.

G. Hot Weather:
1. Unless otherwise superseded by more stringent requirements within this Specification, conform to ACI 308.1 for curing of concrete in hot weather as defined in Part 1.6.
2. Protect concrete from plastic shrinkage cracking and rapid evaporation of water.
3. Shade concrete from direct sun and protect from wind.

H. Curing of Concrete to Receive Architectural Finishes:
1. All concrete that will receive Architectural Finishes shall be moist cured. The use of curing compounds or sealers is prohibited.
2. All concrete that will receive Architectural Finishes shall be conditioned to provide the proper environmental conditions as required by the finish manufacturer. The moisture in the concrete shall be reduced to the point that the moisture content is within the recommended limits required by the finish manufacturer.
3. All concrete that will receive Architectural Finishes shall be prepared to provide the proper surface finish as required by the Finish manufacturer.

3.6 INSTALLATION OF CONCRETE FILL
A. Clean surface with brooms, water jets or air jets. Maintain wet for 6 hours immediately before placing fill concrete. Remove all standing water.
B. Immediately before placing concrete fill, broom in grout paint to the damp concrete surface. Do not allow grout paint to set prior to placement of concrete fill.
C. Clarifiers: Screed concrete fill to a true surface using the scrapers of the installed mechanical equipment to the depth shown on the Drawings.
D. Apply finish in accordance with Schedule. For tanks provide FF.
3.7 SCHEDULE OF FINISHES AND CURING REQUIREMENTS
A. Concrete surfaces "exposed to view" shall be defined as those exposed to view upon completion of the Work, whether or not a painted finish is specified. Surfaces which will be covered by fill, such as exterior faces of walls, shall not be considered exposed to view. Interior surfaces of tanks and channels to receive a cover (including grating), or that are more than one foot below the design water level, shall not be considered exposed to view.

B. Provide finishes on concrete surfaces according to the following schedule:

<table>
<thead>
<tr>
<th>Location</th>
<th>Finish</th>
<th>Curing Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WALLS AND VERTICAL SURFACES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid Retaining or Containment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior surfaces not exposed to view</td>
<td>ESF-2.0</td>
<td>Moist cure</td>
</tr>
<tr>
<td>Exterior and interior surfaces that will receive surface-applied waterproofing</td>
<td>GCRF</td>
<td>Moist cure</td>
</tr>
</tbody>
</table>

NOTES:
1. An Architectural Finish is paint, tile, carpeting or other finish specified in Section 9 of the Contract Documents.
2. All concrete to receive a coating, slab sealer, hardener, waterproofing, dampproofing, topping, GCRF or Architectural Finish shall be moist cured.
3. All curing, sealing and hardening materials shall be applied in a minimum of 2 coats or more if required by the manufacturer. Each successive coat shall be applied perpendicular to the previous coat.
4. Liquid retaining shall be defined as those slabs and walls which contain liquid or will be exposed to groundwater.
5. A tank is defined as any liquid retaining structure and includes tanks, channels, pits, chambers and any other structure that retains liquids.

3.8 PROTECTION
A. In addition to protecting concrete against hot and cold weather, provide the following protection:
1. Protect concrete against vibration until concrete has attained 33% of its 28-day strength. Do not compact soil, drive piles or blast ledge within 100 feet of freshly placed concrete until concrete has attained 33% of its 28-day strength.
2. Protect concrete from damage from construction activity, traffic, equipment, and materials. During the curing period protect concrete from load-induced stresses, shock, and vibration. Setting of forms upon slabs on ground shall not commence until a minimum of 3-days after placement, and 5-days when gang forms are used. Placement of concrete walls upon slabs on ground shall not commence until after the 7-day curing period.
3. Protect concrete against premature loads until the concrete has been in place for 14 days and the design strength has been attained (unless otherwise indicated). Premature loads include but are not limited to:
   a. Backfilling
   b. Loading elevated slabs
   c. Constructing CMU walls atop elevated slabs
   d. Installing equipment on elevated slabs

4. Tightness testing shall not be performed until the concrete being tightness tested has been in place for a minimum of 28 days and the design strength has been attained. Elevated slabs that are not tightness tested but that are required to be constructed prior to tightness testing (such as floor or roof slabs over tanks) shall be in place for a minimum of 14 days with the design strength attained prior to leakage testing. During cold weather, field-cured cylinders shall be required to determine in-place strength.

END OF SECTION
SECTION 03420

PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Precast concrete structures:
   1. All circular precast concrete structures with a size greater than or equal to 6’-0” interior diameter (sections assembled vertically). Smaller sections are specified in Division 2.
   2. All rectangular or square precast concrete structures of all sizes (monolithic or assembled vertically), except where specified in Division 2.
   3. All segmental box type tank structures assembled horizontally.
B. Joint sealants
C. Leak testing

1.2 RELATED SECTIONS
A. Section 01340 - Submittals

1.3 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
C. ACI 301 Specifications for Structural Concrete
D. ACI 318 Building Code Requirements for Structural Concrete
E. ACI ITG -7 – Specification for Tolerances for Precast Concrete
F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
I. ASTM A1064/A1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain or Deformed, for Concrete
J. ASTM C33/C33M – Standard Specification for Concrete Aggregates
K. ASTM C40/C40M – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
L. ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
M. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete
Q. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
U. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
V. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
X. ASTM C877 - Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
Y. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
Z. ASTM C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
AA. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
BB. ASTM C989/C989M – Standard Specification for Slag Cement for Use in Concrete and Mortars
CC. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
DD. ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures
FF. ASTM C1293– Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
II. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

JJ. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing

KK. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials


MM. AWS D1.4/D1.4M – Structural Welding Code – Reinforcing Steel

NN. Concrete Reinforcing Steel Institute - 10MSP, Manual of Standard Practice

OO. AASHTO HB-17, Standard Specifications for Highway Bridges (17th Edition)

PP. Precast/Prestressed Concrete Institute (PCI) – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products (MNL-116)


TT. ASTM E 74 - Practice for Calibration of Force Measuring Instruments for Verifying the Load Indication of Testing Machines.


WW. ASTM G 53 - Practice for Operating Light and Water Exposure Apparatus (Fluorescent UV - Condensation Type) for Exposure of Nonmetallic Materials.

1.4 DESIGN REQUIREMENTS

A. All precast units shall be constructed of the shapes and sizes as shown on the Drawings, with interlocking ship lap joints.

B. Base sections shall be designed and constructed with the floor slabs cast monolithically with the bottom riser section.

C. In addition to the requirements specified herein, all precast units shall meet the following:
   1. Circular units shall meet ASTM C478.

D. Structural design calculations shall be in accordance with ACI 318 “load and resistance factor design” and include the following loading conditions:
   1. For all load cases, the weight of soil shall be taken as 125 pounds per cubic foot.
   2. The following load cases shall be included for all structures, including those designed to the requirements of ASTM C857, ASTM C890, and ASTM C478:
      a. For liquid-containing structures: full of liquid with no backfill and no load applied to top slab (leak test condition).
      b. For all structures:
         i. Empty structure with cumulative maximum external vertical and horizontal loads including lateral earth pressure, maximum groundwater elevation, and lateral vehicle surcharge.
ii. Empty structure with cumulative maximum external vertical loads and half the maximum lateral earth pressure, no groundwater, and no lateral vehicle surcharge.

iii. The forces and distortions applied during curing, stripping, storage, transportation, lifting and erection so that precast members are not overstressed or otherwise damaged.

3. Unless otherwise indicated on the Drawings, the maximum groundwater level shall be assumed at finished grade or the flood elevation noted on the Drawings, whichever is higher.

E. Concrete admixture for microbiologically induced corrosion control shall be included.

F. Reinforcing Steel:
   1. For rectangular and square precast structures, including segmental box type tank structures, and for flat slab tops and bases of circular structures: the minimum steel reinforcement in each direction in slabs and walls shall not be less than 0.0025 times the gross area of the concrete section.

G. Concrete clear cover on reinforcing steel: 1½ inches minimum.

H. The interior dimensions of the precast concrete structures shall be as shown on the Drawings. Walls, top slabs and base slabs shall be a minimum of 8” thick.

I. The precast concrete structure shall be designed to resist flotation:
   1. A factor of safety of 1.15 shall be used against flotation based on weights of empty structure and soil directly over footing extensions and above the top slab (if any).
   2. Unless otherwise indicated on the Drawings, the maximum groundwater level shall be assumed at finished grade or flood elevation indicated on the Drawings.
   3. The base slab may be extended beyond the face of the wall to provide additional resistance to flotation.
   4. Unless otherwise indicated on the Drawings, additional cast-in-place concrete base slabs will not be permitted for flotation resistance.
   5. Frictional resistance shall not be permitted.
   6. 
   7. If the Engineer determines that the submitted buoyancy calculations are incorrect, the Engineer shall direct the Contractor to implement specific measures to counteract buoyancy to the Engineer’s satisfaction. Any and all costs associated with such measures shall be borne entirely by the Contractor and shall be at no additional cost to the Owner.

J. Segmental structure joints:
   1. Provide waterstop sealants and external sealing bands in all joints to create watertight joints.

1.5 SUBMITTALS

A. Manufacturer's Data:
   1. Submit manufacturer's specifications and instructions for all manufactured materials and products including hatches, sealants, sealing bands, dampproofing, pipe sleeves, flexible wall boots, anchorage hardware and other
items. Include manufacturer's certifications and laboratory test reports as required.

2. Submit the proposed erection procedure for precast units, sequence of erection, and required handling equipment.

B. Shop Drawings:

1. Submit shop drawings showing complete information for the fabrication and installation of precast concrete units.

2. Submit layout drawings prepared and stamped by a Professional Engineer registered in the Project state. Drawings shall include the following information:
   a. Overall layout drawings of the assembled precast concrete structure including overall dimensions. Provide identification of each precast unit corresponding to the sequence and procedure of installation.
   b. Drawings of individual members indicating plan and cross section dimensions, locations, sizes, types and details of reinforcement.
   c. Location and details of anchorage devices that are to be embedded in the precast concrete sections.
   d. Locations and details of joints including ship laps and details of mechanical connections.
   e. Locations of wall penetrations for pipes. All openings shall be cast-in-place at the manufacturing plant. Field coring of pipe penetrations shall not be allowed.

3. Submit structural design and buoyancy calculations. Calculations and Drawings shall be prepared and stamped by a Professional Engineer registered in the Project state. Calculations will be reviewed for consistency with the project intent only. The Professional Engineer stamping the shop drawings and calculations shall be responsible for the design.

4. Submit Concrete Mixture designs including test data that meets the criteria specified in ACI 301, Section 4. Mixture design shall include:
   a. Proportions for all ingredients, 28-day design compressive strength, water to cementitious materials ratio, admixture dosages, slump, and air content.
   b. Cement Manufacturer's Certificates of conformance with ASTM C150/C150M or C595/595M taken during the last 90 days.
   c. Supplementary Cementitious Materials: Source and test reports with certificates of conformance with ASTM C618 for fly ash and ASTM C989/C989M for slag cement for actual material to be used in the Work taken during the last 90 days
   d. Aggregate: data not older than 90 days, except test data for soundness, abrasion, alkali reactivity – not older than 12 months. Fine and coarse aggregate data shall include:
      i. Sources
      ii. Specific Gravity
      iii. Sieve analyses per ASTM C33/C33M, including fineness modulus of fine aggregate
iv. Organic impurities for fine aggregate per ASTM C40/C40M
v. Aggregate reactivity (fine and coarse aggregate), one of the following options:
   (1) Aggregate test data in accordance with ASTM C1293,
   (2) Concrete mixture tests in accordance with ASTM C1293,
   (3) Concrete mixture tests in accordance with ASTM C1567,
   (4) Categorized in accordance with ASTM C1778 with testing in accordance with ASTM C1293 at 1-year, or ASTM C1260 at 16-days if ASTM C1293 test data is not available. Also indicate the total alkali loading contributed by portland cement in the submitted mixture/s.

vi. Soundness per ASTM C88 tested with magnesium sulfate (fine and coarse aggregate).
vii. Abrasion for coarse aggregate per ASTM C131/C131M or ASTM C535 (coarse aggregate).
e. Product data and material safety data sheets for concrete admixtures.
i. Microbiologically induced corrosion control (MICC) admixture.
   (1) Product data, dosage, and instructions for use including storage, preparation prior to dosing, batching sequence, dosing process, and concrete mixing procedures.
   (2) Letter from MICC admixture manufacturer attached to concrete mixture design stating that the concrete mixture design is compatible for use with the admixture. (MICC admixtures may not be compatible with some commercially available concrete admixtures.)
   (3) Letter of certification from precaster stating that all requirements of the admixture manufacturer were followed.
   (4) Concrete batch tickets for each batch of concrete, indicating inclusion of MICC admixture.
f. Test reports by testing agencies meeting ASTM E329:
   i. Test data used to determine the standard deviation used for establishing the required average design strength, and test data documenting that the proposed concrete proportions will produce an average compressive strength equal or greater than the required average compressive strength, shall be from within the previous 12 months.
   ii. Laboratory trial batch data shall be from within the previous 24 months.

5. Submit past Project list with Owner contact information.
6. Submit letter from precast concrete manufacturer stating:
   a. That all segmental precast concrete structures have been shop assembled prior to shipment and all fabrication and construction and erection tolerances have been adhered to.
b. For segmental box type tank structures assembled horizontally include statement that adjacent sections have been marked at the plant with match points to facilitate field assembly and correct alignment, and have been dry fit assembled at the plant to confirm that the required fit is obtained at each joint.

c. For structures assembled vertically include statement that adjacent sections have been marked at the plant with match points to facilitate field assembly and correct alignment, and have been dry fit assembled at the plant to confirm that the required fit is obtained at each joint.

1.6 QUALITY ASSURANCE

A. The manufacturer shall exhibit satisfactory performance on projects of similar magnitude under similar or equal service conditions for a period not less than five (5) years.

B. For structures specified to meet ASTM C913 the concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute (PCI) Plant Certification Program for Group C1 products. For structures specified to meet ASTM C478 or ASTM C858, the concrete manufacturing plant shall be certified by the National Precast Concrete Association (NPCA).

C. The precast concrete manufacturing plant shall implement a Quality Control Plan and maintain a permanent Quality Control Manual outlining the quality control procedures used by the plant. The Quality Control Plan and Manual shall adhere to the requirements of MNL-116.

D. Engineer (or Independent Testing Laboratory) may perform a plant inspection at any time during casting of precast concrete components during the construction period. General Contractor shall notify the Engineer a minimum of 14 days prior to the availability of specific precast components for inspection. After notification, Engineer will notify the General Contractor a minimum of 72 hours prior to the inspection.

E. Segmental box type tank structures assembled horizontally: adjacent sections shall be marked at the plant with match points to facilitate assembly and achievement of correct alignment. Adjacent sections shall be dry fit assembled at the plant to confirm that the required fit is obtained at each joint prior to shipment to project site.

F. Structures assembled vertically: adjacent sections shall be marked at the plant with match points to facilitate assembly and achievement of correct alignment. Adjacent sections shall be dry fit assembled at the plant to confirm that the required fit is obtained at each joint prior to shipment to the project site.

1.7 WARRANTY

A. The Contractor shall provide a one (1) year warranty (from the Date of Substantial Completion) for the following:
   1. Cracking, spalling or other surface and structural defects.
   2. Separation of joints or misalignment of adjacent units due to faulty precast concrete sections.
3. Leakage through all joints between concrete sections due to faulty materials or improper installation.
4. Microbiologically induced corrosion.
B. The manufacturer shall repair or replace all defective work at no additional cost to the Owner within warranty period.

1.8 DELIVERY, STORAGE AND HANDLING
A. All materials shall be inspected at the project site by the General Contractor for surface and structural defects at the time of delivery. All damaged materials shall be replaced by the Contractor at no additional cost to the Owner.
B. Store precast concrete units at the project site to ensure against cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at the designated lift points only.
C. All precast concrete units shall be placed on supports such that they are stored off the ground.
D. Deliver fabricated assemblies as job progress requires in the largest sections permitted, properly labeled for field erection.
E. Store in original packaging on site under protective coverings and out of the way of normal construction activities. Provide special storage in accordance with the manufacturer's instructions and recommendations.

1.9 WARRANTIES
A. Floor Hatches (including fire rated): Manufacturer shall guarantee against defects in material or workmanship for a period of five years.
B. Insulated Scuttles: Manufacturer shall guarantee against defects in material or workmanship for a period of five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. American Concrete (Superior Concrete, LLC), Auburn, ME, PCI (B2, C1)
B. Unistress Corp, Pittsfield, MA, PCI (A1,B4,C4A)
C. George R. Roberts, Sanford, ME, NPCA
D. Shea Concrete Products, Nottingham, NH, NPCA
E. Or equivalent
F. Floor Hatches/Insulated Scuttles
   1. The Bilco Company
   2. Babcock-Davis Hatchways, Inc.
   3. Or equal.
G. Ladder Up Safety Post
   1. The Bilco Company
   2. Babcock-Davis Hatchways, Inc.
   3. Or equal.
H. Water-tight [Airtight Floor Hatches]
   1. Presray
   2. Or equal
I. Floor Hatch Safety Net
1. Safe Approach, Inc. Auburn, Maine
2. USF Fabrication
3. Or equal

J.

2.2 FLOOR HATCHES

105 lbs. hatch (for hatches indicated to be installed on curbs over process tanks): Door leaf shall be 1/8-inch aluminum diamond pattern plate to withstand a live load of 105 pounds per square foot with a maximum deflection of 1/150th of the span. Surface mount frame shall be 1/4-inch by 3-inch by 3-inch aluminum with internal mounting flange and 7/16" diameter anchor holes. Door(s) shall be equipped with Type 316 stainless steel hardware including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. Each leaf shall have at least one compression spring operator enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. The springs shall be of sufficient size to partially open the hatch when the latch is released. A Type 316 stainless steel snap lock with a gasketed cover plug and removable turn handle shall be provided. A heavy extruded EPDM rubber gasket shall be permanently adhered to the cover. Mount angle frames on a neoprene gasket seal and caulk around edge of frame at concrete curb.

300 lbs. hatch:
1. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot with a maximum deflection of 1/150th of the span. Channel frame shall be 1/4-inch aluminum with an anchor flange around the perimeter and have a minimum cross-section area of 7½ square inches to allow adequate water drainage. Door(s) shall be equipped with Type 316 stainless steel hardware including all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners. Each leaf shall have two (2) compression spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. The springs shall be of sufficient size to partially open the hatch when the latch is released. A Type 316 stainless steel snap lock with a gasketed cover plug and removable turn handle shall be provided. A 1-1/2" drainage coupling shall be located in the front right corner of the channel frame.

B. Hatch covers with grating shall be the manufacturer's standard aluminum grating framed with aluminum supports and plating.

C. H-20 Hatches for Off Street Locations:
Door shall be designed for occasional AASTHO H-20 (16,000# wheel load over 8"x20" area plus 30% impact factor) wheel loading and with a maximum deflection of 1/150th of the span. Door construction shall be similar to A, above.
D. 150 lbs Hatches:
   Door frame shall be 1/4-inch extruded aluminum with built-in neoprene cushion and
   with strap anchors bolted to exterior. Door leaf shall be 1/4-inch diamond plate to
   withstand a live load of 150 pounds per square foot with a maximum allowable
   deflection of 1/150th of the span. Door(s) shall be equipped with Type 316 stainless
   steel hardware including all parts of the latch and lifting mechanism assemblies, hold
   open arms and guides, and all brackets, hinges, pins and fasteners.

E. Watertight (Air-tight) Hatches:
   Door frame shall be aluminum with molded neoprene gasket. Hatch hardware shall
   include dogs with stainless steel rollers, gas shocks to facilitate opening/crossing and
   a hold-open arm. Hatch design shall be flush, water tight and designed for 150 PSF
   loading. Model D3HA as manufactured by Presray or equal.

F. H-20 Air-tight (Watertight) Hatches:
   Door and frame shall be steel with a molded neoprene gasket. Hatch hardware shall
   include dogs with stainless steel rollers, gas shocks sized to facilitate
   opening/crossing by hand and a hold-open arm. Hatch design shall be flush, water
   tight and designed for H-20 loading. Model D3HA as manufactured by Presray or
   equal.

G. Water tight hatches shall be designed to withstand feet of water without leaking.

2.3 LADDER SAFETY POST
   A. General - Provide ladder safety posts at each hatch where a ladder is indicated on the
      Drawings.
   B. Device shall be manufactured of stainless steel with a telescoping tubular section that
      locks automatically when fully extended. Upward and Downward movement shall
      be controlled by a stainless steel spring balancing mechanism. All materials shall be
      stainless steel.

2.4 SAFETY NET
   A. Slide Rails; 1½" diameter; Schedule 40 stainless steel pipe.
      Yield:  8 KSI
      Shear:  12 KSI
   B. Corner Brackets:  Aluminum.
      Ultimate Tensile Strength:  40 KSI
      Shear:  27.45 KSI
   C. Pear Shaped Rings:  316 stainless steel load tested to 13,500 pounds.
   D. Eye Corner Hooks:  316 stainless steel.
   E. Netting:  Dupont Type 728 high density nylon.
   F. System shall be Hatch Net 120S as manufactured by Safe Approach, Inc. and shall
      be designed to meet loadings required by law.

2.5 SAFETY GRATING
   A. Provide Hatch Safety grating, by Hatch Manufacturer at all new hatches. Grating shall
      be corrosion resistant fiberglass or aluminum and shall be rated for 300 PSF.
   C. Safety grating shall meet OSHA standard 1926.502 for fall protection.
D. Grate shall be lockable with maximum grate openings not exceeding 5 inch by 5 inch, and maximum side clearance of 4 inches.
E. Provide automatic hold open arm.
F. Install per manufacturers recommendation.

2.6 FINISHES
A. Mill finish aluminum, polyamide epoxy primer at steel hatches.
B. Polyamide epoxy (5 mils) or manufacturer's standard bituminous coating applied to exterior of the frame in contact with concrete.
C. All coatings shall comply with Local, State and Federal regulations.

2.7 MATERIALS
A. Concrete mixture design shall conform to the following:
   1. Minimum compressive strength of concrete at 28-days, (f'c) = 5000 psi.
   2. Maximum water/cement ratio = 0.42
   3. Cement for all units shall be:
      a. For wastewater structures: Type II or III portland cement conforming to ASTM C150/C150M or specified blended cements.
      b. For stormwater structures and for vault-type structures not containing wastewater: Type I, II, or III portland cement conforming to ASTM C150/C150M or specified blended cements.
      c. Blended cements: ASTM C595/595M (MS) types, excluding type IS (≥70). Do not use blended cements conforming to ASTM C595/595M if they contain cements conforming to ASTM C1157/C1157M.

4. Supplementary Cementitious Materials:
   a. Slag Cement: ASTM C989/C989M - Grade 100 or 120.
   b. Silica Fume: ASTM C1240
   c. Fly Ash: ASTM C618 - Type F

5. The proposed mixture shall contain cementitious materials in the following proportions:
   a. Portland Cement - No less than 65% of the total by weight.
   b. Slag Cement - No greater than 35% of the total by weight.
   c. Fly Ash - No greater than 25% of the total by weight.

6. Entrained air content of concrete: 6% ± 1.5%. Air entrainment admixture shall conform to ASTM C260/C260M.

7. Admixtures:
   a. Low Range Water Reducer (pending verification of compatibility with MICC admixture): MasterPozzolith 210 by Master Builders/BASF; WRDA with HYCOL by GCP Applied Technologies; or equivalent meeting ASTM C494/C494M Type A.
   b. High Range Water Reducer (superplasticiser) (pending verification of compatibility with MICC admixture): Rheobuild 1000 or Glenium 3000 NS by Master Builders/BASF; Daracem 100 or ADVA 140M by GCP Applied Technologies; or equivalent meeting ASTM C494/C494M Type F.
c. Air entraining agent (pending verification of compatibility with MICC admixture): MasterAir AE 200 by Master Builders, DAREX II AEA by GCP Applied Technologies; or equivalent meeting ASTM C260/C260M.

d. MICC: Con\textsuperscript{mic}Shield, as manufactured by ConShield Technologies, Inc. or Xypex Bio-San C500, as manufactured by Xypex Chemical Corporation.

8. Aggregates


b. Coarse aggregate shall consist of a well graded crushed stone or a washed gravel conforming to the requirements of ASTM C33/C33M as follows:

<table>
<thead>
<tr>
<th>SIEVE</th>
<th>NO. 8 (3/8&quot;)</th>
<th>NO. 67 (3/4&quot;)</th>
<th>NO. 57 (1&quot;)</th>
<th>NO. 467 (1 1/2&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-½ inch</td>
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<td>-</td>
<td>100</td>
<td>95-100</td>
</tr>
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<td>1 inch</td>
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<td>25-60</td>
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c. Fine aggregate shall meet FDOT requirements for structural concrete or consist of washed inert natural sand, free from mineral or other coatings, soft particles, clay, loam, organic and other deleterious materials, conforming to the requirements of ASTM C33/C33M as follows:

<table>
<thead>
<tr>
<th>SIEVE NO.</th>
<th>PERCENT PASSING</th>
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<tbody>
<tr>
<td>4</td>
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<td>0 to 10</td>
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<td>200</td>
<td>0 to 3.0</td>
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</table>

The Fineness Modulus shall be between 2.3 to 3.1. The percentage retained between any two consecutive sieves shall not exceed 45%.
d. Fine Aggregate testing: Perform the following tests on samples of the fine aggregate:

i. Organic Impurities (ASTM C40):
   (1) Color of supernatant liquid above test sample tested in accordance with ASTM C40 shall not be darker than standard (Organic Plate No. 3/Gardner Color Standard No. 11).
   (2) Use of a fine aggregate failing when tested in accordance with ASTM C40 is not prohibited, provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 days, calculated in accordance with ASTM C87, is not less than 95%.

ii. Soundness (ASTM C88):
   (1) Fine aggregate sample tested in accordance with ASTM C88 for five cycles using magnesium sulfate (not sodium sulfate) shall have a weighted average loss not greater than 18%.

iii. Alkali Reactivity:
   (1) Use one of the following four options:
      (a) Test aggregate in accordance with ASTM C1293. Aggregate having an expansion less than 0.04% at 1-year is acceptable for use.
      (b) Test concrete mixture with the aggregates and cementitious materials combination submitted, in accordance with ASTM C1293. Aggregates in mixtures having an expansion of less than 0.04% at 2-years are acceptable for use. (This option also satisfies coarse aggregate requirements.)
      (c) Test concrete mixture with aggregates and cementitious materials combination submitted in accordance with ASTM C1567. Aggregates in mixtures having an expansion less than 0.10% at 16 days are acceptable for use. (This option also satisfies coarse aggregate requirements.)
      (d) Aggregate reactivity shall be categorized in accordance with ASTM C1778 with testing in accordance with ASTM C1293 at 1-year, or ASTM C1260 at 16-days if ASTM C1293 test data is not available. If the coarse and fine aggregates are of different reactivity, the level of protection shall be based on the more reactive aggregate. The alkali content contributed by the portland cement shall not exceed 4.0 lbs per cubic yard of concrete for moderately reactive aggregate and 3.0 lbs per cubic yard of concrete for highly reactive aggregate. The use of very highly reactive aggregate shall not be permitted.
   (2) Evidence of a satisfactory service record in lieu of testing for alkali reactivity is not permitted.
e. Coarse Aggregate testing: Perform the following tests on samples of the coarse aggregate:

i. Abrasion (ASTM C131/C131M or ASTM C535):
   (1) Coarse aggregate shall be tested in accordance with either ASTM C131/C131M (aggregate smaller than 1 1/2”) or ASTM C535 (aggregate larger than ¾”).
   (2) Loss of the mass of the coarse aggregate by abrasion shall not exceed 50%.

ii. Soundness (ASTM C88):
   (1) Coarse aggregate sample tested in accordance with ASTM C88 for five cycles using magnesium sulfate (not sodium sulfate) shall have a weighted average loss not greater than 15%.

iii. Alkali Reactivity:
   (1) Use one of the following four options:
      (a) Test aggregate in accordance with ASTM C1293. Aggregate having an expansion less than 0.04% at 1-year is acceptable for use.
      (b) Test concrete mixture with the aggregates and cementitious materials combination submitted, in accordance with ASTM C1293. Aggregates in mixtures having an expansion of less than 0.04% at 2-years are acceptable for use. (This option also satisfies fine aggregate requirements.)
      (c) Test concrete mixture with aggregates and cementitious materials combination submitted in accordance with ASTM C1567. Aggregates in mixtures having an expansion less than 0.10% at 16 days are acceptable for use. (This option also satisfies fine aggregate requirements.)
      (d) Aggregate reactivity shall be categorized in accordance with ASTM C1778 with testing in accordance with ASTM C1293 at 1-year, or ASTM C1260 at 16-days if ASTM C1293 test data is not available. If the coarse and fine aggregates are of different reactivity, the level of protection shall be based on the more reactive aggregate. The alkali content contributed by the portland cement shall not exceed 4.0 lbs per cubic yard of concrete for moderately reactive aggregate and 3.0 lbs per cubic yard of concrete for highly reactive aggregate. The use of very highly reactive aggregate shall not be permitted.

(2) Evidence of a satisfactory service record in lieu of testing for alkali reactivity is not permitted.
9. Water:
   a. Potable, from a municipal water supply, or
   b. Nonpotable water that meets ASTM C1602/C1602M and the following requirements:
      i. Chlorides as Cl: 1000 ppm - tested by ASTM C114 or by #4500, Argentometric Method from “Standard Methods for the Examination of Water and Wastewater”.
      ii. Sulfate as SO4: 1500 ppm – tested by ASTM D516 or ASTM D4130.
      iii. Equivalent alkalies (Na2O + 0.658 K2O): 300 ppm total alkali – tested by ASTM C114.
      iv. Total inorganic solids by mass: 5000 ppm – tested by ASTM C1603.
      vi. pH: 4.0 to 9.0 – tested by AASHTO T 26.

B. Reinforcement:
   1. Bars: ASTM A615/A615M Grade 60; deformed new materials. Cold-bent in accordance with CRSI 10MSP.
   2. Welded wire fabric: ASTM A1064/A1064M. Flat sheets are required; rolls are not permitted.

C. Plates and inserts:
   1. Plates:
      a. Provide cast-in-place plates as shown on the Drawings. Plates shall be either:
         i. ASTM A36/A36M, hot-dip galvanized in accordance with ASTM A123/A123M, or
         ii. AISI Type 316 stainless steel.
   2. Inserts:
      a. Provide inserts as required for lifting, connections, etc.
         i. ASTM A123/A123M or A153/A153M hot-dip galvanized, or
         ii. AISI Type 316 stainless steel.

D. Manhole Steps:
   1. Provide manhole steps as shown on the Drawings.
   2. Steps shall be constructed of steel reinforced copolymer polypropylene. Steps shall conform to ASTM C478 and the polypropylene shall conform to ASTM D4101.
   3. The top surface shall have a molded non-slip surface
   4. Step widths shall be between 13.75 inches – 14 inches. Step projects from face of concrete shall be between 5 inches – 6 inches.
   5. Steps shall be able to support the following loads in accordance with ASTM C478:
      a. Minimum pullout load of 300 pounds
      b. Minimum vertical load of 800 pounds with a maximum permanent deflection of ½ inch
6. Thoroughly clean all surfaces to be embedded with a suitable cleaning agent to ensure that the surfaces are free from all foreign matter such as dirt, oil and grease.

7. All steps shall be cast into walls of the precast section to form a continuous ladder with a distance of 12-inches between steps. Step inserts may be cast into the walls if reviewed with No Exceptions Taken by the Engineer.

8. Acceptable products:
   b. Model P-14938 by Parson Environmental Products, Inc.
   c. Model PS2-PF by M. A. Industries, Inc.
   d. Or equal

E. Aluminum Ladders:
1. Material: Aluminum Alloy 6063-T6 (ASTM B221) or Aluminum Alloy 6061-T6 (ASTM B308).
2. Finish: Clear Anodized (AA M12C22A41)
3. Welding: filler alloy 5356
4. Rails: Minimum sizes L3x3x1/4 with 2'-0” clear opening unless indicated on the Drawings.
5. Rungs:
   a. 1-inch square or 1-inch diameter extruded aluminum bar with serrated, corrugated or knurled non-slip surface. Grit tape or grit paint shall not be permitted.
   b. Prefabricated aluminum rungs with serrated, corrugated or knurled non-slip surface:
      i. Type 950 Ladder Tread by Wooster Products, Inc.
      ii. Diamondback by McNichols
      iii. Traction Tread by McNichols
      iv. Or equal

6. Maximum rung spacing 1'-0”.

F. Pipe Openings:
1. Provide formed cast-in-place holes, cored holes, or cast-in sleeves.
   a. Flexible rubber watertight connectors shall conform to ASTM C923.
      i. Connectors shall either be cast into the concrete or fastened to the structure with stainless steel expansive sleeves.
      ii. Pipes shall be fastened to the connector with stainless steel bands.
      iii. Products:
          (1) Kor-N-Seal (106-406 Series) by Trelleborg Pipe Seals
          (2) PSX: Positive Seal by Press-Seal Corporation
          (3) Z-Lok Connector made by A-Loc Products Inc.
          (4) Or equal
   b. Hot-dipped galvanized steel sleeves with a welded waterstop ring centered in the wall.
   c. Expansive rubber and stainless steel ring to seal annular space between pipe and pipe opening.

G. Precast Section Joints:
1. Provide rubber sealant and sealing bands at all precast concrete section joints.
2. Rubber sealants:
   a. Install solid, continuous flexible butyl rubber sealants in all joints to achieve watertight joints. Install a double row of joint sealants for every manhole joint.
   b. Sealant shall conform to ASTM C990.
   c. Sealant shall be sized such that it compresses a minimum of 50% within the joint.
   d. Sealant shall maintain stability at all temperatures and not shrink or harden over time.
   e. Acceptable products:
      i. Kent Seal No. 2 by Hamilton Kent
      ii. RN 101 Ram-Nek Joint Sealant by Henry
      iii. EZ-STIK or PRO_STIK Butyl Sealant by Press-Seal Corporation
      iv. Conseal CS-102 (CS-202 when the temperature during installation is less than 30˚F) by Concrete Sealants, Inc.
      v. Or equal

3. Joint Sealing Bands:
   a. Shall be 12” wide
   b. Shall conform to ASTM C877 Type III
   c. Acceptable products:
      i. EZ-WRAP by Press-Seal Corporation
      ii. ConWrap CS-212 by ConSeal
      iii. MacWrap C877 Type III by MarMac Construction Products Co.
      iv. Or equal

H. Liquid Asphalt Dampproofing:
   1. Apply a two-coat waterborne emulsified-asphalt dampproofing system for all below grade exterior wall surfaces:
   2. First coat: Fiber free waterborne emulsified asphalt dampproofing conforming to ASTM D1187/D1187M (Type 1) and ASTM D1227/D1227M (Type 3, Class I). Hydrocide 600 by Sonneborn Building Products, Sealmastic Emulsion by W.R. Meadows, or equal.
   3. Second coat: Waterborne emulsified asphalt dampproofing reinforced by long fibers conforming to ASTM D1187/D1187M (Type 1) and ASTM D1227/D1227M (Type 2, Class I). Hydrocide 700 by Sonneborn Building Products, Sealmastic Emulsion by W.R. Meadows, or equal.

I. Manhole covers and frames: Provide manhole covers and frames as shown on the Drawings. Integral manholes covers and frames are furnished under this Section, and specified in Specification Section 02601 Manholes, Covers and Frames.

J. Concrete Repair Materials:
   1. Grout Paint: Mix 1-part Type II portland cement, 1-part fine sand, and enough water to the consistency of thick paint.
   2. Patching Mortar: 1-part of a mixture of white and grey Type II portland cement to 2.5 parts of damp loose sand. Cement type to match substrate.
   3. Epoxy Adhesive:
      a. Two or three-part water-based epoxy bonding agent with cementitious components
b. Acceptable products:
   i. Armatec 110 Epocem by Sika Corporation
   ii. Corr-Bond by Euclid Chemical Co.
   iii. MasterEmaco P 124 by Master Builders
   iv. Or equivalent
4. Repair of random cracks (dry – free of liquid or moisture):
   a. 2-component, 100% solids, moisture-tolerant, low-viscosity, high-strength, multipurpose, epoxy resin adhesive.
   b. Acceptable products:
      i. Sikadur 35 Hi-Mod LV by Sika Corporation
      ii. Eucopoxy Injection Resin by Euclid Chemical Co.
      iii. MasterInject 1500 by Master Builders
      iv. Or equivalent
5. Repair of random cracks (wet - presence of liquid or moisture):
   a. Low viscosity polyurethane resin that expands and forms a closed cell foam when it comes in contact with water.
   b. All cracks that are wet (either damp or leaking) at the time of repair shall be repaired with a material that is specifically intended for wet repair as recommended by the manufacturer.
   c. Acceptable products:
      i. SikaFix HH Hydrophilic by Sika Corporation
      ii. Dural Aqua-Fil by Euclid Chemical Co.
      iii. MasterInject 1210 IUG by Master Builders
6. Repair of minor spalls, honeycombs areas and air voids and cementitious overlays:
   a. Polymer modified, non-sag cementitious repair mortar with corrosion inhibitor.
   b. Repair material shall include peastone for repairs of greater depth as required by the manufacturer. For repair areas involving depths generally in excess of three (3) inches, utilize a repair material suitable for the depth of repair.
   c. Acceptable products:
      i. SikaTop 122 Plus or 123 Plus by Sika Corporation
      ii. Tamms Structural Mortar by Euclid Chemical Co.
      iii. MasterEmaco N 400 MasterEmaco N 400
      iv. Or equivalent

PART 3 - EXECUTION

3.1 FLOOR HATCH INSTALLATION
   A. Installation shall be in accordance with manufacturer's instructions.
   B. Coordinate the hatch installation with the drain piping.
   C. Install the ladder safety post in the middle of the top two rungs of the ladder.
   D. Cover and protect the installed hatches from splatter or debris and from damage or staining by adjacent work until accepted by the owner.
3.2 SAFETY NET INSTALLATION
A. Install factory prepared brackets to hatch drainage channel with stainless steel bolts. Each bracket has four factory installed reference points. Drill 9/16-inch diameter holes in bracket using opposite corners of the reference points. Do not drill holes directly above or below one another. Place and support safety net system in opening. Using the bracket as a guide, drill through hatch drainage channel and bolt with ½-inch diameter stainless steel bolt and nylon lock nut. Place silicone sealant on bolt threads before tightening nuts.

3.3 FORMWORK
A. Forms for manufacturing precast concrete products shall be of the type and design consistent with industry standards and practices.
B. Forms shall be capable of consistently providing uniform products and dimensions.
C. Forms shall be constructed so that the forces and vibrations to which the forms will be subjected can cause no product damage

3.4 FABRICATION AND PLACING REINFORCEMENT
A. Detailing and fabrication of reinforcement shall conform to the CRSI Code of Standard Practice unless otherwise indicated on the Drawings.
B. Reinforcing steel bars shall be clean and free from loose mill scale and rust and from coatings that reduce bond.
C. Place reinforcement of structural members on accessory bolsters and chairs. Accessories shall be stainless steel or have plastic tips.
D. All reinforcing shall have concrete cover specified.
E. Do not weld reinforcement unless the Engineer takes no exceptions in writing. When permitted, welding shall be in accordance with AWS D1.4/D1.4M.

3.5 PRODUCTION, CURING, FINISHING, REPAIRS AND STORAGE
A. Production, curing and storage of the precast units shall conform to the provisions of MNL 116.
B. Production:
   1. Each precast concrete unit shall be an integral placement without any construction or cold joints. Base slabs shall be an integral placement with the bottom wall section.
   2. Structures shall be fabricated from the minimum number of precast sections in order to minimize the number of joints. Joints shall be located such that penetrations do not intersect joints.
   3. Tolerances: Fabricate precast units without exceeding the tolerances specified below:
      a. Rectangular or square utility, water and wastewater units:
         i. Interior length, width, or height:
            (1) Less than 5'-0”: +/- 1/4”
            (2) 5’-0” to 10'-0”: +/- 3/8”
            (3) Greater than 10'-0”: +/- 1/2”
         ii. Wall and slab thickness: -3/16”, +1”
         iii. Variation in length of opposite surfaces:
(1) Per foot of internal span: +/- 1/8"
(2) Span = 7’ or less: +/- 5/8”
(3) Span > 7’: +/- ¾”

iv. Variation from End Squareness (difference in interior diagonal measurements):
(1) Measured length less than 10’-0”: ½”
(2) Measured length 10’-0” to 20’-0”: ¾”

v. The inside joint seam gap between two adjacent sections before joint sealant is applied shall not exceed 3/8”.

vi. Offsets in alignment of adjacent members at any joint +/- ¼”.

b. Circular structures meeting ASTM C478:
   i. Interior diameter: +/- 1.0%
   ii. Thickness of wall and slabs: -3/16”, +1”
   iii. Offsets in Alignment of Adjacent Members at Any Joint: +/- ¼”
   iv. The inside joint seam gap between two stacked sections before joint sealant is applied shall not exceed 3/8”

C. Curing:
   1. All exposed precast concrete shall be cured by either:
      a. Moist curing (steam, ponding or application of burlap kept continuously wet)
      b. Covering the exposed surface with polyethylene sheets
      c. Covering the exposed concrete with membrane curing compounds
      d. Application of steam. This method may only be used after the initial set of the concrete.
   2. Alternate wetting and drying shall not be permitted

D. Finishing:
   1. Unless otherwise indicated all surfaces shall be cast with an "As Cast" finish.
   2. All exposed surfaces shall be free of form defects, joint marks and shall be within the color variation as defined by the submitted samples and/or mock-up sample.
   3. Slight color variations, small surface holes (up to ¼ inch diameter) caused by air bubbles will be accepted but no major imperfections, excessive honeycombing, sand streaks or other major defects shall be permitted.

E. Repairs of Defects at the Plant:
   1. Minor defects:
      a. Surface defects not impairing the functional use or expected life of a precast concrete product as determined by the Engineer shall be considered minor defects.
      b. Minor defects shall be repaired by a method that does not impair the product and approved in writing by MICC admixture manufacturer.
      c. All repairs shall be made and identified prior to shipment to the Project site.
   2. Major defects:
      a. Structural defects in precast concrete products that impair the functional use or the expected life of products as determined by the Engineer shall be considered major defects.
b. All precast units with major defects shall be rejected and not delivered to the Project site.

F. Storage:
   1. Areas used for storage of products shall be firm enough and level enough to avoid causing damage to stored products.
   2. Products shall be stored on level surfaces in a manner that will minimize damage caused by uneven bearing, improperly located dunnage blocks, stacking products too high or difficulty in handling.

3.6 HANDLING, AND TRANSPORTATION
A. All precast concrete units shall be lifted using designated pick points and lifting inserts. Extreme caution shall be exercised so as not to damage the units during handling.

B. Prior to shipment:
   1. All precast products shall be inspected by plant personnel to assure design conformance, that all defects have been repaired, that all units have proper identification.
   2. For horizontally installed sections: that all units have proper match marks to facilitate assembly, and units have been dry fit assembled at the plant to ensure proper fit at each joint.
   3. For vertically assembled sections: that all units have proper match marks to facilitate assembly, and units have been dry fit assembled at the plant to ensure proper fit at each joint.
   4. Products not conforming to requirements shall be clearly labeled and the defects noted on the inspection report. Only products conforming to the requirements shall be shipped.

C. Transportation:
   1. Precast concrete units shall be properly supported during transportation to minimize potential for damage.
   2. Transport units in a position consistent with their shapes in order to avoid excessive stresses that may cause damage. Unique shipping instructions or special stacking may be required for irregularly shaped pieces.
   3. Do not transport units until they have been cured for a minimum of 5 days or have reached 75% of their 28-day design strength.

3.7 REPAIR OF UNITS AT PROJECT SITE
A. Minor defects, as determined by the Engineer, shall be repaired by a method that does not impair the product, and shall be at no additional cost to the Owner. Minor defects:
   1. Form tie holes
   2. Air voids (bugholes) larger than those specified for the required surface finish
   3. Honeycomb areas with a depth less than 1 inch
   4. Blisters
   5. Delaminations
   6. Crusting
   7. Visible construction joints, fins and burs
   8. Non-uniform concrete color and appearance
9. Floors that are not level

B. Major defects, as determined by the Engineer, shall not be repaired. Precast units with major defects shall be rejected and removed from the Project site and replaced at no additional cost to the Owner. Major defects:
   1. Random cracks
   2. Excessive cracking (crazing)
   3. Spalls
   4. Air voids (bugholes) and honeycombed areas with a depth greater than or equal to 1 inch

3.8 REPAIR OF SURFACE DEFECTS

A. Form Tie Holes: After cleaned and thoroughly dampened, apply grout paint and fill holes solid with patching mortar.

B. Air voids (bugholes): After cleaned and thoroughly dampened, apply grout paint and fill holes solid with patching mortar.

C. Honeycomb areas:
   1. All honeycombed areas shall be removed to sound concrete by means of hand chisels or pneumatic chipping hammers or hydrodemolition.
   2. Saw cut a 1-inch minimum square groove around the edges of the defective area perpendicular to the surfaces to serve as the boundary for concrete removal. Saw cut the edges perpendicular to the surface. No feather edges shall be allowed.
   3. Remove all loose aggregate paste and debris and scrub clean. Thoroughly wet area to be repaired. Brush and scrub grout paint into the substrate of the area to be repaired.
   4. Mix patching mortar using as little water as possible. Allow to stand with frequent manipulation of trowel to achieve stiffest consistency. Blend white and gray portland cement to achieve color match with surrounding concrete.
   5. Prior to the set of grout paint (but after it has cast its water sheen), apply a stiff consistency of patching mortar to the area with a trowel. Leave patched surface slightly higher than surrounding surface. Do not finish for 1 hour minimum. Cure in same manner as adjacent concrete.

D. Blisters, delaminations and crusting: Repairs shall be similar to those for honeycomb areas. Depth of saw cut shall match the depth of the defective concrete.

E. Visible construction joints, fins and burrs: Remove by grinding until a smooth uniform surface is attained.

F. Concrete with an overall non-uniform color or appearance as determined by the Engineer shall be repaired with a complete cementitious overlay. Application of the overlay shall be in strict accordance with the manufacturer’s written instructions and recommendations.

3.9 ERECTION OF PRECAST STRUCTURES

A. The General Contractor shall carefully inspect the precast units delivered to the project site prior to commencing installation, and immediately notify the fabricator of any and all deficiencies such as the absence of marked match points on adjacent sections, sections out of specified tolerances, and improperly fabricated sections so
that the fabricator can correct such deficiencies, including replacing sections as required.

B. Install all precast structures level, plumb and aligned to the elevations and in the locations shown on the Drawings. All precast concrete units shall be lifted using designated pick points and lifting inserts in accordance with the written instructions from the Precast Concrete supplier.

C. Installation Tolerances: Install precast units without exceeding the tolerances specified in Section 3.3.

D. Attach precast concrete units to concrete foundations as indicated on the Drawings or as required by the Precast Concrete manufacturer.

E. Connect adjacent precast concrete units as required by the manufacturer. All units shall fit tight to their adjacent units.

F. Joints: All joints shall be watertight and shall be sealed as indicated below:
   1. Install butyl rubber sealants in all joints. A minimum of 2 rows of sealants shall be applied at each joint.
   2. Install butyl sealing bands around the exterior face of all horizontal and vertical joints to achieve watertight joints. For segmental box type tank structures, install sealing band on the interior face of joints in the base slab.
   3. All sealants and sealing bands shall be installed in accordance with the manufacturer’s recommendations.
   4. Install primer as required by the sealing band manufacturer. Primer and sealing band shall be installed within the temperature range recommended by the manufacturer.
   5. Sealing bands shall be installed directly over the joints prior to installation of any other straps or anchors and prior to application of field-applied dampproofing.
   6. Apply concrete repair material to all offsets of 1/8” to 1/4” between adjacent precast sections to provide a smooth transition from one precast section to the next prior to applying the joint sealing band.
   7. Joints shall be clear of dirt, snow, ice and other debris prior to installing sealing bands.

G. After erection is complete, all surface damages to the precast concrete units shall be properly repaired in accordance with this Section. All lifting inserts and holes shall be patched after final installation.

3.10 LIQUID ASPHALT DAMPPROOFING APPLICATION

A. Apply dampproofing to the exterior surfaces all below grade precast concrete walls and on the top surface of below grade top slabs.

B. Apply two coats in strict accordance with manufacturer’s printed instructions and as specified herein. Clean and prepare surfaces as required.

C. Do not apply dampproofing at temperatures below 40° F or when temperature is expected to fall below 40° F within 12 hours.

D. Do not place backfill for at least 48 hours after application.

E. All dampproofing materials spilled on adjacent structures shall be cleaned with a material recommended by the dampproofing manufacturer.
3.11 TESTING
A. General:
   1. Perform leakage tests on all precast concrete structures indicated below prior to application of damp proofing and installing backfill around the structures. Installing backfill at the ends of box type tank structures prior to the leak test will not be permitted.
   2. All testing must be performed in the presence of the Engineer.
   3. Suitably plug all pipes entering precast concrete tank and brace plugs to prevent blow out.
B. Leakage Tests:
   1. Fill precast concrete tank with potable water to within one foot below the underside of the top slab. Contractor shall be responsible for providing potable water for the tests.
   2. A period of up to 12 hours may be permitted, if the Contractor so wishes, to allow for absorption.
   3. At the end of the absorption period, refill precast concrete tank with water to to within one foot below the underside of the top slab and begin the 4-hour test period.
   4. At the end of the 4-hour test period, refill precast concrete tank to the top of the precast concrete tank cover and measure the volume of water added. The test shall be considered passing if the following conditions are met:
      a. The drop in the liquid level does not exceed 1/8 inch
      b. There are no visible leaks on exterior surfaces of the tank or through joints.
   5. Contractor shall repair all leaks at no additional cost to the Owner. All repair materials shall be reviewed for information only by the Engineer.
   6. Precast concrete structures shall be retested subsequent to repairs.
   7. Additional tests and repairs will be performed until such time as the structures can demonstrate compliance with the testing requirements.
   8. Contractor shall dispose of water in accordance with all applicable local, State and Federal Regulations.
C. Test Schedule:
   1. The following structures shall be leak tested:

END OF SECTION
SECTION 03604

NON-SHRINK GROUT

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Cementitious non-shrink grout
B. Epoxy non-shrink grout

1.2 RELATED SECTIONS
A. Section 01340 - Submittals
B. Section 03010 – Concrete Modifications and Repairs
C. Section 03300 - Cast-in-Place Concrete
D. Section 03346 - Concrete Finishing and Curing
E. Section 05500 - Metal Fabrications

1.3 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. ASTM C33/C33M - Specification for Concrete Aggregates
D. ASTM C827 - Test Method for Changes in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
E. ASTM C1107/C1107M - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
F. CRD-C611 - Test Method for Flow of Grout Mixtures
G. CRD-C621 - Specification for Non-Shrink Grout

1.4 SUBMITTALS
A. Submit product data and material safety data sheets for products to be used.
B. Submit test data when required.
C. Submit manufacturers installation instructions for products used.
D. Submit a list of at least five (5) similar installations of the product during the last 5 years.

1.5 QUALITY ASSURANCE
A. The grout manufacturer shall be ISO 9001 certified and have been in business of
manufacturing similar products for over ten (10) years. The manufacturer shall maintain a strict quality assurance program, offer technical services and provide a representative at the jobsite for product training, prior to product installation, upon written request.

B. Conform to Army Corps of Engineers Specification CRD-C621 and ASTM C1107/C1107M (Grades B or C).

C. Grouts shall exhibit non-shrink characteristics when tested according to ASTM C827.

1.6 DELIVERY, STORAGE AND HANDLING
A. Deliver in original sealed packages or containers, labeled with the manufacturer’s identification, printed instructions and batch code.
B. Store in dry conditions above freezing and below 90°F.
C. Keep unused portions of opened containers dry and warm.
D. Store aggregate covered and protected from the elements.

1.7 ENVIRONMENTAL CONDITIONS
A. Do not place grout when exposed to precipitation.
B. Place grout when temperature of substrate and ambient air are above 40°F and below 90°F.
C. Place grout outside these limits when approved by heating substrates, enclosing work, shading, cooling or other measure to mitigate adverse weather conditions.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Cementitious grout: consists of premeasured, prepacked flowable cement based grouting material with aggregate requiring only the addition of water.
B. Epoxy grout: consists of premeasured, prepacked epoxy based grouting material consisting of an epoxy resin, hardener and specially blended aggregates. The ratio of the weight of aggregate to the weights of the combined resin and hardener (fill ratio) shall be maintained.
C. Aggregates: ASTM C33/C33M fine aggregate, washed.
D. Pea Stone: ASTM C33/C33M coarse aggregate, size number 8 (max. size 0.375 inches), washed.
E. Water: Potable, from municipal water supply.
F. Epoxy resins shall not contain non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other volatile and hazardous diluents are not permitted.
G. Utilize proper grout for the intended application as recommended by the manufacturer.

2.2 TESTS
A. All grouts shall achieve a minimum 28 day strength of 6,000 psi according to ASTM C109/C109M.
B. Grouts when tested by flow cone according to CRD-C 611 shall take more than 20 seconds to flow as a maximum limit on fluidity.
C. Test grout when requested.
2.3 ACCEPTABLE PRODUCTS
A. Cementitious Grout
   1. Five Star Grout - Five Star Products, Inc
   2. Masterflow 928 - BASF / Master Builders
   3. NS Grout - Euclid Chemical Company
   5. Harris Construction Grout – A.H. Harris & Sons, Inc.
   6. Or equal
B. Epoxy Grout
   1. HP Epoxy Grout - Five Star Products, Inc.
   2. Masterflow 648 CP Plus - BASF / Master Builders
   3. E3-HP - Euclid Chemical Company
   4. Epogrout 758 - L&M Construction Chemicals, Inc.
   5. Or equal

PART 3 - EXECUTION

3.1 SURFACE PREPARATION
A. Unless otherwise indicated, Follow manufacturer's written instructions.
B. Concrete surfaces shall be a minimum 28 days old.
C. Completely remove all loose concrete, aggregate, dust, laitance, dirt, oil, grease and other contaminants by bush-hammering, chipping, brushing, concrete cleaners or degreasers.
D. Use acceptable mechanical means to obtain clean, sound and rough concrete surfaces, exposing coarse aggregate. Blow surfaces clean of dust and debris using oil-free compressed air.
E. Surface moisture:
   1. Cementitious grout: Soak concrete surfaces thoroughly for a minimum of 8 hours with potable water. Concrete shall be saturated and free of standing water at time of grout placement.
   2. Epoxy grout: Do not pre-soak concrete surfaces prior to grout placement. Surfaces shall be visibly dry.
F. Follow manufacturer’s cold and hot weather grouting procedures to maintain all materials and surfaces that contact grout within acceptable temperature ranges. Heat the substrate and surrounding environment to a minimum of 40° F.

3.2 FORMS
A. Formwork shall be constructed of rigid nonabsorbent materials, securely anchored, watertight and strong enough to resist forces developed during grout placement.
B. Formwork shall be constructed so that the grout is placed across the shortest distance whenever possible. The clearance between formwork and baseplate shall be sufficient to allow for headbox. The clearance for remaining sides shall be one to three inches.
C. Height of formwork shall extend a minimum of one inch above the highest point to be grouted.
D. All formwork shall be coated with a form release agent or plastic sheeting for easy removal. Care should be taken not to contaminate grouting surfaces where bond is required.
3.3 MIXING
A. Provide an adequate number of mortar mixers in good operating condition for uninterrupted placement. Do not exceed one-half the maximum capacity of the mortar mixer.
B. Cementitious grout:
   1. Pre-wet mortar mixer directly prior to mixing. Empty excess water.
   2. Start by adding the minimum amount of premeasured potable water to mixer. While mixing, slowly add grout and mix to a uniform consistency.
   3. Mix thoroughly for approximately four to five minutes. To achieve desired consistency, add remaining water as necessary. Do not exceed maximum water content as stated on product packaging or add an amount that will cause segregation.
   4. For pours requiring aggregate extension, add clean, damp coarse aggregate before final water adjustment.
   5. Do not mix more material than can be placed within the working time of the grout. Do not retemper the mix by adding additional water.
C. Epoxy grout:
   1. Combine resin and hardener into pail containing resin. Mix thoroughly by hand with a paddle or by slow speed mixer until a uniform color (no streaks) is obtained. Avoid air entrapment while mixing. Immediately pour all mixed liquids into mortar mixer. While mixing at a slow speed, slowly add aggregate and mix only until aggregate is completely wet.
   2. Do not mix more material than can be placed within the working time of the grout.

3.4 PLACING
A. Pouring (Cementitious and Epoxy Grout):
   1. A headbox or similar device is required for a continuous pour to avoid air pockets under baseplate. All grouting shall take place from one side to the other, maintaining contact with the bottom of the plate at all times.
   2. When pouring through grout holes, placement shall proceed continuously with a headbox until the grout has risen in the next hole. Maintain head pressure at initial hole so that grout stays in contact with the bottom of the baseplate at all times.
   3. Commence grouting at the next hole with an additional headbox. Continue process, alternating headboxes until grouting is complete.
   4. When pouring into the headbox, grout shall be introduced in a manner to avoid air entrapment. Care must be taken during grouting to keep the headbox at least half full of material to ensure even grout flow. If necessary to assist the flow, a plunger may be used. This procedure shall continue until the grout rises above the bottom edge of the baseplate on the opposite side.
   5. Throughout the pour, forms shall be constantly checked for leaks. All leaks shall be sealed immediately.
B. Pumping (Cementitious Grout):
   1. The type and size of pump and discharge line used are dependent on the parameters of each installation. Contact the pump and grout manufacturers for recommendations.
2. Pumping raises the grout temperature and shortens the working time while reducing its consistency. Keep mix temperature as cool as necessary, except in cold weather.
3. The grout shall be mixed to a consistency that will not segregate while pumping.
4. The grout shall be passed through a #4 screen prior to placement into the pump hopper.
5. Before pumping, determine the working time under jobsite conditions. Pumpability shall be determined by field testing.
6. The pump shall be positioned to minimize the pumping distance. Keep the discharge line as close to horizontal as possible. All hose connections must be watertight.
7. Immediately prior to pumping, the pump and lines shall be primed with a priming slurry leaving hopper empty to prevent overwatering.
8. Once the pumping has begun, it is important not to use any of the priming slurry from the discharge lines. Grout shall not be used until a uniform consistency is obtained at the discharge nozzle.
9. Provide an adequate volume of mixed grout to keep the pump hopper at least half full. The grout shall be placed into pump hopper in a manner to prevent air entrapment.
10. The discharge nozzle shall be withdrawn only while pumping, keeping it submerged within the grout at all times.
11. When a pump is needed to transport grout and the nozzle cannot be inserted into the cavity being grouted, a headbox is required. The headbox will allow the pour to be continuous, avoiding air pockets under the plate. The grout shall be discharged from the nozzle into the headbox in a manner to avoid air entrapment. The headbox shall be kept at least half full at all times.
12. All grouting shall take place from one side of the plate to the other. Maintain contact with the bottom of the plate at all times to maximize the effective bearing area (EBA).
13. When pouring through grout holes, placement shall proceed continuously until the grout has risen in the next hole. Maintain head pressure at initial hole so that grout stays in contact with the bottom of the baseplate at all times. Commence grouting at the next hole with an additional headbox. Continue process, alternating head boxes until grouting is complete.

C. Dry pack (Cementitious Grout):
1. A dry-pack consistency is achieved when the mixed grout can be squeezed into a ball by hand without crumbling. Only enough water should come to the surface to moisten the hands.
2. Use a ram with a square cut end and hammer to evenly compact the grout against solidly braced backing boards, combining each layer (approximately 1/2 inch thick) to the previously placed layer over its entire surface.
3. Each placed layer shall be visually inspected for placement uniformity.
4. Striking force should be sufficient for compaction of the grout without affecting plate alignment.
5. Placement shall be continuous until grouting is complete.
3.5 FINISHING AND CURING

A. Finishing:
1. Cut grout back from bottom of baseplate to the foundation at approximately a 45° angle. Formwork can be removed for cutback when grout offers stiff resistance, or when cut with a steel trowel, stands up without support. Epoxy grout may be finished flush with the edge of the base plate.
2. Provide smooth finish to exposed grout surfaces.
3. Grout shall not be allowed to remain above the bottom edge of the baseplate.

B. Curing:
1. Cementitious grout shall be moist cured for a minimum of three days. Epoxy grout does not require curing agents.
2. Cementitious Grout shall be protected from excessive evaporation with wet rags prior to set.
3. Grout shall be protected from wind, rain, freezing and vibration until a minimum compressive strength of 1000 psi is achieved.
4. Maintain temperature above 45° F until a minimum compressive strength of 1000 psi is achieved.

END OF SECTION
SECTION 03930
CONCRETE COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Materials, surface preparation and application of specified coatings to all indicated concrete surfaces. The specified coating systems are intended to serve the following functions:
   1. Type 1 - Protect the concrete surfaces from hydrogen sulfide gas and sulfuric acid within the indicated areas. Note that this work is identified as part of the Base Bid
   2. Type 2 - Provide a complete cementitious resurfacing. Note that this work is identified as a Bid Alternate.
B. List of Applicators who are approved to install the specified coatings.

1.2 RELATED SECTIONS
A. Section 01340 - Submittals
B. Section 03300 - Cast-In-Place Concrete
C. Section 03010 - Concrete Modifications and Repairs

1.3 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. ASTM C1583 - Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)
C. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity
F. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating
G. ASTM D4259 - Standard Practice for Abrading Concrete
H. ASTM D4260 - Standard Practice for Acid Etching Concrete
I. ASTM D4262 - Standard Test Method for pH of Chemically Cleaned or Etched
Concrete Surfaces

K. ASTM D4285 - Test Method for Indicating Oil or Water in Compressed Air
L. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notch Gages
M. ASTM D4417 - Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
O. ASTM D4787 - Standard Practice for Continuity Verification of Liquids or Sheet Linings Applied to Concrete Substrates.
P. ASTM D5162 - Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
T. ASTM D7682 - Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
V. ASTM E337 - Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
W. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
X. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes
Y. ASTM G210 - Standard Test Method for Operating the Severe Wastewater Analysis Testing Apparatus
AA. ICRI - International Concrete Repair Institute
BB. ICRI Technical Guideline 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair
CC. NACE SP0188 (Item No. 21038) – Standard Practice for Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
DD. SSPC - Steel Structures Painting Council.
EE. SSPC QP 1 - Field Application To Complex Industrial And Marine Structures
FF. SSPC QP 2 - Field Removal Of Hazardous Coatings
GG. SSPC QP 3 - Shop Painting Certification Program
HH. SSPC C7 - Abrasive Blasting Program
II. SSPC C12 - Spray Application Certification
JJ. SSPC Coating Application Specialist (CAS) Certification Program
KK. SSPC PCAC - Plural Component Application For Polyureas And High Solid Coatings- Certification Program
LL. SSPC Basics Of Concrete Surface Preparation
MM. SSPC CCB - Concrete Coating Basics
NN. SSPC-SP13/NACE No. 6 "Surface Preparation of Concrete".
OO. SSPC-PA-2 – Procedures for Determining Compliance to Required Dry Film Thickness
PP. SSPC-PA-9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages
QQ. VOC Standards - All coatings shall be in accordance with all applicable State and Federal VOC Standards.
2. Ozone Transportation Commission (OTC) 2005 VOC Regulation.

1.4 RESPONSIBILITIES
A. Following are the responsibilities of each of the listed parties as they relate to the installation of the Type 1 coatings:
   1. General Contractor:
      a. Attend the Pre-Coating Meeting.
      b. Provide oversight of the surface preparation, application, testing and any subsequent repairs of the coating system.
      c. Provide repairs to concrete substrate prior to application of parge coat (or coordinate the work if the Applicator will provide the repairs). Ensure that the repair materials are compatible with the coating materials.
      d. Install and ensure that all embedded and drilled items are in place prior to application of parge coat.
      e. Provide environmental controls.
      f. Coordinate and schedule the required site visits by the Manufacturer.
      g. Obtain daily field reports from Applicator and Inspection reports from the Manufacturer and submit to the Engineer within 24 hours of work or inspections, respectively.
      h. Coordinate and facilitate communication, coordination, and procedures in accordance with the Contract Documents.
   2. Engineer:
      a. Attend the Pre-Coating Meeting.
      b. Review field reports.
      c. Perform final inspection of coatings.
   3. Engineer’s Resident Project Representative (herein referred to as “RPR”)
      a. Attend the Pre-Coating Meeting.
      b. Provide daily review of the work
      c. Inspect concrete substrate and identify areas requiring repair prior to installation of parge coat.
      d. Coordinate with the Applicator and General Contractor on scheduling of work.
      e. Coordinate inspections and testing by the Independent Coatings Inspector.
      f. Perform final inspection of coatings.
4. Coating Manufacturer (herein referred to as “Manufacturer”)
   a. Attend the Pre-Coating Meeting.
   b. Provide periodic site visits as required.
   c. Recommend repairs of deficient coating applications.
   d. Provide field reports to General Contractor for all site visits.
5. Coating Applicator (herein referred to as “Applicator”)
   a. Attend the Pre-Coating Meeting.
   b. Provide repairs to concrete substrate prior to application of parge coat (if the repairs are not provided by the General Contractor).
   c. Perform surface preparation of substrates.
   d. Install the coating systems, including primer, parge coat and top coats.
   e. Measure and document the temperature and relative humidity of the atmosphere prior to and every 2 hours during installation of the coating. The relative humidity shall be measured in accordance with ASTM E337.
   f. Measure wet film thickness of coatings in accordance with ASTM D4414.
   g. Provide daily field reports to the General Contractor at the end of each day the work is performed.
6. Independent Coatings Inspector (herein referred to as “Inspector”)
   a. Attend the Pre-Coating Meeting.
   b. Provide periodic inspection when requested by the RPR.
   c. Ensure general conformance with the Contract Documents. Inspector will not approve or accept work.
   d. Test the concrete surfaces to be coated to determine if they are conductive and the holiday testing can be performed.
   e. Measure, test and document the following conditions:
      i. pH of the concrete substrate
      ii. Moisture content of the concrete substrate
      iii. Surface profile of the concrete substrate
      iv. Temperature of the concrete substrate
      v. Soundness of the concrete substrate
      vi. Coating thicknesses (in accordance with ASTM D6132)
      vii. Pull-off strength (in accordance with ASTM D4541)
      viii. Holiday test (in accordance with NACE SP0188 or ASTM D5162)
   f. Notify the Engineer and General Contractor of any failed test results at the end of each day the work is performed.
   g. Submit inspection and test reports to the Engineer within 48 hours of the inspections and tests

1.5 SUBMITTALS
A. Submit product data under provisions of Section 01340 for all coating materials.
B. Submit Safety Data Sheets (SDS) for all coating products.
C. Submit schedule with list of items to be coated, type and manufacturer of all coating materials, dry mil thickness of all materials, details of surface preparation methods and application procedures.
D. Storage requirements including temperature, humidity, and ventilation for resurfacing system materials.
E. Submit details of how the coating will terminate at embedded items (such as pipes, stop gate frames and anchors) and at tops/faces of walls, and details at substrate contraction and construction joints and cracks.

F. Submit Manufacturer’s proposed schedule for reviewing the work in progress.

G. Submit Applicator’s proposed schedule for application of the coatings listing dates for each phase of each type of coating at each structure.

H. If an alternate coating system (than those specified) is proposed, submit Manufacturer's certification stating that the proposed coating system is a proper system and meets the performance criteria specified in Part 1.6.

I. Submit Manufacturer’s certification that the proposed coatings meet all applicable State and Federal VOC regulations.

J. Applicator:
   1. Submit name and qualifications of the Applicator.
   2. Submit letter from Manufacturer stating that the Applicator is experienced with the submitted coating system and is an approved installer of the Manufacturer’s products.
   3. Submit a list of five similar installations from the past five years using the Manufacturer’s products.

K. Submit report and results from the evaluation of the coating in accordance with ASTM G210 from an Independent Testing Laboratory.

L. Submit warranty.

M. Submit Applicator’s Daily Field Reports and Manufacturer’s Inspection Reports within 24 hours of the daily work. The reports shall include the following:
   1. Date of work
   2. Area of work. Copies of appropriate Drawings from the Contract Documents may be used to highlight the area of work
   3. Environmental conditions during work
   4. Summary of products installed, including locations, thicknesses and quantities.
   5. Summary of all tests performed (by Manufacturer and Inspector)
   6. Summary of surface preparations and installations approved by the Manufacturer.

1.6 QUALITY ASSURANCE

A. Coating systems:
   1. The coating systems specified are intended to serve the following functions as indicated:
      a. Type 1 - Protect the concrete surfaces from hydrogen sulfide gas at an average concentration of 50 parts per million (ppm) over a one-year period, and sulfuric acid concentration of up to 7.5%
      b. Type 2 - Provide a complete permanent cementitious surface overlay of the concrete surfaces.
   2. The intent of the specifications is to establish minimum performance requirements for each type of coating system. The specified systems represent the minimum required to achieve the required protection. The coating manufacturer shall be responsible for providing a coating system that will serve the required function. Alternate systems may be proposed if they meet the
requirements of this specification and provide the total specified coating thickness, including that of the parge coat.

3. Lab Testing:
   a. All Type 1 Coatings shall have been subjected to laboratory testing and evaluations performed in strict accordance with ASTM G210 to demonstrate the applicability of the coating to the anticipated chemical exposures. The testing and evaluation requirements outlined in this Section serve only as highlights of ASTM G210 and do not replace the full requirements of ASTM G210.
   b. Laboratory testing and evaluations shall have been conducted by an independent testing laboratory.
   c. The Engineer shall reserve final judgment as to whether a coating will be applicable based on the submitted test results.
   d. The testing procedure shall include the following:
      i. Testing shall be performed on steel coupons within an airtight chamber maintained at 65° ± 3°C.
      ii. All test coupons shall be subjected to intermittent immersions in the aqueous solution and purges of sewer gases for a total of 28 days. The coupons shall be subjected to a total of 60 aqueous solution immersions and 20 sewer gas purges.
      iii. The aqueous solution shall consist of a mixture of following solutions:
         - 10% sulfuric acid (H₂SO₄)
         - 0.4% sodium chloride (NaCl).
      iv. The sewer gas shall consist of a mixture of the following gases:
         - 500 ± 50 ppm analyzed hydrogen sulfide (H₂S) gas
         - 10,000 ± 200 ppm analyzed carbon dioxide (CO₂) gas
         - 5,000 ± 100 ppm analyzed methane (CH₄) gas
         - Balanced dry air
   e. The following properties of the coating shall be assessed both prior to and after the test:
      i. Impedance using Electrochemical Impedance Spectroscopy (EIS) Analysis’
         - The initial EIS value shall be no less than 10.
         - The final EIS value shall be no less than 8.
         - The difference between the initial and final EIS values shall be no greater than 3.
      ii. Tensile adhesion strength.
         - The initial tensile strength shall be no less than 850 psi.
         - The final tensile strength shall be no less than 90% of the initial tensile strength.

4. Materials selected for each of the different coating systems for each type of surface shall be supplied by of a single manufacturer.

B. Applicator shall have the following qualifications:
   1. Applicator has been approved by the Manufacturer to apply the submitted product.
2. Applicator shall employ personnel who will be on the Project site that have the following SSPC Qualifications and Certifications:
   a. SSPC QP 1
   b. SSPC QP 2
   c. SSPC QP 3
   d. SSPC C7
   e. SSPC C12
   f. SSPC CAS
   g. SSPC PCAC
   h. SSPC Basics Of Concrete Surface Preparation
   i. SSPC CCB
3. Applicator has the appropriate equipment to apply the coatings, including plural-component spray equipment (if required for the product).
4. Have a minimum of five years of experience performing work of similar size and complexity as the work indicated in the Contract Documents

C. Field Quality Control (Type 1 Coatings):
1. An Inspector, hired and paid for by the Owner and working under the direction of the Engineer, shall provide periodic inspections and perform the duties identified in Part 1.4.
2. A qualified technical field representative from the Manufacturer shall be present during the milestones indicated herein and at appropriate intervals deemed necessary to ensure the work is done in strict accordance with the Manufacturer's recommendations and requirements of the Contract Documents.
3. Each layer of the coating system shall not be applied until the Inspector has reviewed and approved the completed work up to that point. If deficiencies are discovered, the Inspector shall consult with the Manufacturer and submit a written statement documenting all deficiencies and make recommendations for repair.
4. After the Applicator has repaired the noted deficiencies, the Inspector shall inspect the repaired work until all deficiencies are repaired.
5. Recoating of materials failing to meet the requirements of the Contract Documents, shall be performed by the coating applicator, at no additional cost to the Owner.
6. The number of coats and total mil thickness specified in the coating schedule are minimums. If the specified minimum film thickness is not achieved, additional coats shall be applied to achieve the total film thickness specified.

1.7 DELIVERY AND STORAGE
A. Deliver coating materials in sealed containers with labels legible and intact. Materials exceeding the storage life recommended by the Manufacturer shall be rejected. Include on label of all containers:
   1. Name or title of product
   2. Federal Specification Number if applicable
   3. Manufacturer's batch number and date of manufacture
   4. Manufacturer's name
   5. Generic type of material
   6. Application and mixing instructions
7. Hazardous material identification label
8. Shelf life date
9. Storage requirements
B. All containers shall be clearly marked indicating any personnel safety hazards associated with the use of or exposure to the materials.
C. Store only acceptable project materials on the project site. General Contractor shall provide a suitable storage area for coating materials delivered to the site. Coating materials shall not be stored in existing facilities.
D. Environmental conditions of the storage area shall comply with Manufacturer's recommendations.
E. Confine mixing, thinning, clean-up and associated operations, and storage of materials-related debris before authorized disposal, to these areas. All materials are to be stored on pallets or similar storage/handling skids off the ground in sheltered areas in which the temperature is maintained between 70°F and 90°F.
F. Do not use floor drains, dikes or storm drains for disposal of materials.
G. Comply with all applicable health and fire codes and regulations including safety precautions recommended by the manufacturer. Storage space shall be provided with a suitable fire extinguisher fully charged at all times.

1.8 SEQUENCING
A. Refer to Section 01010 "Summary of Work" for sequence of work requirements. The facility shall remain online at all times and the work will be sequenced accordingly to accommodate this requirement.
B. The General Contractor shall coordinate the schedule and sequencing of coatings. The surfaces indicated on the structural drawings to receive a coating system will be out of service and available for coating at various stages throughout the duration of the construction project.
C. Due to the nature of this project and the sequencing required to maintain treatment during the project, a significant amount of construction sequencing will be required. Manufacturer and Applicator shall include all costs as needed to accommodate the Contractor's construction schedule, include multiple mobilization and demobilizations.

1.10 PRE-COATING MEETING
A. Engineer shall hold meeting more than 14 days prior to commencement of surface preparation to review coating products and procedures.
B. Meeting Minutes: Engineer shall record minutes of meeting and distribute to attending parties within 10 business days of meeting.
C. Attendance: General Contractor shall coordinate the attendance of the following parties: General Contractor, Applicator and technical representative from the Manufacturer. Engineer shall coordinate the attendance of the following parties: Engineer, RPR and Inspector.

1.11 WARRANTY
A. Manufacturer shall provide a warranty for defects of the supplied coating materials. Defects shall be defined as when the coating either cracks, delaminates or otherwise fails and does not perform as a protective coating for the concrete surface. All
warranties shall be effective for a period from the Date of Substantial Completion as indicated in the Contract Documents. Warranty periods are as follows:
1. Type 1 coating - five (5) years.
2. Type 2 coating - one (1) year.

PART 2 - PRODUCTS

2.1 COATING SYSTEMS

A. General:
1. The systems shown are meant to show a representative system of each specified manufacturer. Equivalent systems that meet the requirements of this specification may be proposed.
2. All indicated coating thicknesses shall be measured as follows:
   a. All thicknesses are dry film thicknesses (DFT)
   b. Minimum thicknesses shall be as measured from the peak of the surface profile.
   c. Coating thicknesses that exceed the Manufacturers recommended maximum thickness per lift will require application in multiple lifts.
3. All indicated coats shall be applied over the entire concrete surface to be coated.

B. All Type 2 Coating systems shall be NSF/ANSI Standard 61 potable water approved.

C. Type 1 Coatings:
1. Tnemec Company, Inc:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. Parge Coat: Series 218 Mortarclad (epoxy modified cementitious repair mortar) (1/8"-1/4" thick) or Series 217 Mortarcrete (cementitious repair mortar) (greater than 1/4" thick)
   c. Top Coat: Series G436 Perma-Shield FR (80 mils) followed by Series G435 Perma-Glaze (15-20 mils)

2. Sauereisen:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. Parge Coat: RestoKrete No. 208 (epoxy modified cementitious repair mortar) (1/8" minimum) or RestoKrete No F-120 (cementitious repair mortar) (1/8" minimum)
   c. Top Coat: Sewergard No. 210X (100 mils)

3. Sherwin-Williams:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. Parge Coat: A.W. Cook CEMTEC Thin Patch (microsilica cementitious repair mortar) (1/8"-1/2" thick) or A.W. Cook CEMTEC Silatec MSM (microsilica cementitious repair mortar) (greater than 1/2" thick)
   c. Top Coat: Dura-Plate 6000 (100 mils)

4. Sealant - All joints within the Type 1 coating system shall be sealed with a sealant that will provide resistance to the hydrogen sulfide and sulfuric acid concentrations specified and is compatible with the coating system. Thiokol 2235 by PolySpec, Duoflex by Sika Corporation or equal.
D. Type 2 Coatings:

1. Tnemec Company, Inc.:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. First Coat: Series 217 MortarCrete (cementitious repair mortar) (1/4" - 1/2")
   c. Top Coat: Series N69 Hi-Build Epoxoline II (6-8 mils)

2. Sika Corporation:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. First Coat: SikaTop 122 Plus or 123 Plus (cementitious repair mortar) (1/8" - 1/2")
   c. Top Coat: Sikagard 62 (6-8 mils)

3. Sauereisen:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. First Coat: RestoKrete Substrate Resurfacer No. F-121 (cementitious repair mortar) (1/8" - 1/2")
   c. Top Coat: No. 210 GL Glaze (6-8 mils)

4. Sherwin-Williams:
   a. Surface Preparation: Abrasive Blast (SSPC-SP13/NACE No. 6) to achieve a minimum ICRI profile CSP 5
   b. First Coat: A.W. Cook CEMTEC Thin Patch (microsilica cementitious repair mortar) (1/8" - 1/2")
   c. Top Coat: Macropoxy 5500 (6-8 mils)

2.2 APPLICATORS

A. The following is a list of Applicators who are authorized by the specified Manufacturers to install their respective Type 1 coatings. Equal or alternate applicators will not be considered.

1. Knowles Industrial Services Corporation, Gorham, ME
2. Van De Graff Painting Co., Portland, ME
3. Copia Specialty Contractors, Inc., Bangor, ME
4. Venture Construction, Concord, NH
5. R.J. Forbes Painting Contractor, Inc., Attleboro, MA
6. John W. Egan Company, Newtonville, MA
7. Soep Painting, Lawrence, MA

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment and procedures used for the coating system application shall be as recommended by the Manufacturer. Unless specified elsewhere herein, the Applicator shall comply with the Manufacturer's most recent written instructions with respect to the following:

1. Mixing of all materials
2. Protection and handling of all materials
3. Recoat limitation and cure times
4. Application procedures
5. Final curing
6. Use of proper application equipment

B. The environmental conditions under which the coatings and coating systems are applied shall be in strict accordance with the Manufacturer's recommendations. Environmental conditions that shall be controlled include:
   1. Temperature of the surrounding air and substrate
   2. Relative humidity and dew point of the surrounding air
   3. Moisture content of the concrete substrate
   4. pH of the concrete substrate
   5. Presence of dust and other external conditions that affect the proper installation and curing of the coating
   6. Presence of wind or direct sunlight
   7. Presence of rain, snow, dew or fog

Provide additional heat, shelter, dehumidification and other means as required to bring the environmental conditions to those required by the Manufacturer.

C. Protection:
   1. Cover or otherwise protect finish work or other surfaces not being resurfaced.
   2. Erect and maintain protective tarps, enclosures and/or masking to contain debris (such as dust or airborne particles resulting from surface preparation) generated during any and all work activities. This includes, but is not limited to, the use of dust/debris collection apparatus as required.
   3. Furnish and lay protective coverings or drop cloths in all areas where the coating is being applied to adequately protect concrete slabs, embedded metals in the concrete, existing piping and other work from damage during the execution of the coating work.
   4. Protect adjacent structures not to receive coatings from coating spray.

D. Cleaning and resurfacing shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly resurfaced areas.

E. Do not apply successive layers until previous layer has cured for the minimum time as recommended by the manufacturer. If a lift has cured beyond the maximum time allowed, prepare the surface as recommended by the Manufacturer prior to applying additional layers.

F. Do not use or retain contaminated, outdated, prematurely opened, diluted materials, or materials which have exceeded their shelf life.

G. General Contractor shall establish a storage area for all coating materials and equipment. The environmental conditions of the storage area shall comply with the Manufacturers recommendations.
   1. Remove all soiled and used rags, waste and trash from the storage area at the end of each work day.
   2. Clean all coating spills and stains in the storage area caused by painting materials and equipment at no additional cost to the Owner.

3.2 SURFACE PREPARATION FOR TYPE 1 COATINGS
A. All surface preparation procedures specified within are meant to serve as minimum requirements. If the specific coating manufacturer has more stringent requirements
for surface preparation, they shall be adhered to.

B. Remove all existing mounted items prior to surface preparation.

C. Oil and grease shall be removed before mechanical cleaning is started via an alkaline-based emulsifying detergent as recommended by the resurfacing material manufacturer. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded and free of contaminants that might interfere with the adhesion of the resurfacing materials.

D. Initial Cleaning/Decontamination: All existing areas to be resurfaced shall be pressure washed with a 2500-5000 PSI spray containing an alkaline-based detergent to remove all loose materials, acid constituents, grease, oil, and other contaminants (use potable water only, not plant water). All washing shall be in accordance with SSPC-SP13/NACE 6

E. All concrete surfaces shall be prepared in accordance with Part 2.1 to remove contaminants, laitance and weak concrete, expose subsurface voids and produce a sound concrete surface with the required ICRI profile.

F. Applicator shall select the appropriate method for surface preparation and removal of existing coatings based on existing conditions. Methods of surface preparation and removal of existing coatings shall include the following:
   1. Mechanical methods (ASTM D4259):
      a. Abrasive blasting: Dry, wet, vacuum assisted or centrifugal shot blasting.
      b. High pressure water cleaning or waterjetting with potable water
      c. Impact tool methods.
      d. Power tool methods.
   2. Chemical methods (acid etching on horizontal surfaces) (ASTM D4260).

G. Abrasive Blasting:
   1. Air used for blast cleaning shall be free of oil and moisture to not cause contamination of the surfaces to be resurfaced. Blast equipment shall be tested in accordance with ASTM D4285.
   2. Abrasive used in dry blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused.
   3. The compressed air used for blast cleaning will be filtered free of condensed water or oil. Moisture traps will be cleaned at least once every four hours or more frequently as is appropriate.
   4. Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. Oil separators shall be cleaned at least once every four hours or more frequently as is appropriate.
   5. An air dryer or drying unit shall be installed which dries the compressed air prior to blast connections.
   6. The Contractor shall keep the area of work in a clean condition and shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the execution of the work or the operation of the existing Treatment Facility.

H. After concrete surfaces have been blast cleaned, surfaces shall be cleaned of dust and loose particles with compressed air.

I. Repair all surface and structural defects as indicated in Section 03010 and the Contract Drawings.
J. Install all drilled anchors prior to application of parge coat. Cover or otherwise protect anchor threads from coating.

K. After surface preparation is complete, the following conditions shall be verified by the appropriate parties to ensure suitability of the surface for the parge coat:
   1. Surface profile
   2. Surface cleanliness
   3. pH of surface
   4. Moisture content of surface
   5. Soundness of surface
   If the surface conditions do not meet the Manufacturer’s required criteria, they shall be modified by a means acceptable to the Manufacturer until the required conditions are met.

L. Surface profile shall be determined by one of the following methods:
   1. Visually compare the surface to ICRI CSP Visual Comparators.
   2. Use of replica tape in accordance with ASTM D4417 (Method C):
      a. Obtain the surface profile by pressing replica tape against the prepared concrete surface.
      b. Measure the profile of the replica tape using a micrometric thickness gage
   3. Determine surface profile at a minimum of three 6” x 6” locations for each work shift or area

M. The pH of the substrate surface profile shall be determined in accordance with ASTM D4262.

N. Moisture content of surface shall be measured by the use of plastic sheets in accordance with ASTM D4263.

3.3 APPLICATION OF TYPE 1 COATING

A. All work indicated herein and as shown on the Contract Drawings are based on specific manufacturer's requirements. Provide all work, including items not specifically addressed herein, in strict accordance with the supplied coating manufacturer's recommendations.

B. Materials shall be applied only by craftsmen experienced in the use of the specific products involved.

C. Install coating prior to installing all mounted items.

D. Initial parge coat shall be applied over the entire surface to receive a topcoat. The parge coat shall be applied to fill surface voids and establish a continuous uniform surface for the topcoat.

E. The coatings shall be prepared and terminated at all discontinuities, joints and corners in strict accordance with the Contract Drawings and Manufacturers recommendations.

F. After installation of parge coat, prepare surfaces as follows:
   1. Epoxy modified cementitious repair mortars: Provide brushed finish to provide a surface profile
   2. All other cementitious repair mortars – Prepare surface in accordance with SSPC-SP13/NACE No. 6 to expose subsurface voids and produce a sound concrete surface with an ICRI profile of CSP 3 or CSP 4.
G. Comply with the recommendation of the Manufacturer for drying and curing time between subsequent coats at the given temperature. The topcoat shall be properly cured and tested prior to immersion in liquid.

H. Finish coats shall be monolithic and free of pockmarks, trowel marks, depressions, unconsolidated areas, waviness, ridges, pinholes or holidays.

3.4 CLEANING
A. Upon completion of the work, all staging, scaffolding, containers and other used materials shall be removed from the coating area and Project site. Coating spots on adjacent surfaces shall be removed and the job site cleaned.

B. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the Engineer at no additional cost to the Owner.

3.5 INSPECTIONS AND TESTS FOR TYPE 1 COATINGS
A. All coatings shall be inspected at various stages of installation by the responsible parties as indicated below. In addition, the Manufacturer's technical field representative shall be required to visit the jobsite on a regular basis to inspect the work in progress and be available for any jobsite consultation and problem resolution involving the coating application. The required inspections and tests and parties responsible for them shall include the following:

1. Concrete surface to be coated (prior to installation of parge coat):
   a. Surface profile (Inspector)
   b. Surface cleanliness (Manufacturer/Applicator/Inspector)
   c. pH of surface (Inspector/Applicator)
   d. Moisture content of surface (Inspector/Applicator)
   e. Temperature of surface (Inspector/Applicator)

2. Parge coat (prior to installation of top coat)
   a. Surface profile (Inspector/Applicator)
   b. Surface cleanliness (Manufacturer/Applicator/Inspector)
   c. pH of surface (Inspector/Applicator)
   d. Moisture content of surface (Inspector/Applicator)
   e. Temperature of surface (Inspector/Applicator)
   f. Verification of coating thickness (wet film) (Applicator)
   g. Verification of coating thickness (dry film) (Inspector)

3. Top coat
   a. Verification of coating thickness (wet film) (Applicator)
   b. Verification of coating thickness (dry film) (Inspector)
   c. Discontinuity (Holiday) testing (Inspector)
   d. Visual inspection (Engineer)

B. Do not apply additional coats until the completed coat has been inspected as indicated above. Only inspected and reviewed coats will be considered in determining the number of and total thickness of coats applied.

C. Verification of Coating Thickness:

1. The wet film dry film thicknesses of each required coating layer shall be verified.
2. The method of verification shall consist of one of the following:
   a. The use of notch gages to measure wet film thicknesses (in accordance with ASTM D4414)
   b. The use of electronic gages using ultrasonic measurement techniques to measure dry film thicknesses (in accordance with ASTM D6132).
   c. Destructive testing (in accordance with ASTM D4138). This method shall be used only after review with no exceptions taken by the Engineer. All damaged areas shall be repaired by a method approved by the coating manufacturer.

3. Frequency of thickness readings:
   a. The minimum frequency of coating thickness readings shall be in accordance with SSPC PA-9. Engineer reserves the right to increase the frequency of testing and direct the Inspector to test additional areas as necessary.
   b. Definitions:
      i. Gage reading: Single instrument reading.
      ii. Spot measurement: Average of three gage readings within a 6 inch diameter area.
      iii. Area measurement: Average of five spot measurements within a 10 ft x 10 ft (100 SF) area.
   c. Coating area ≤ 300 square feet (SF): One area measurement for each 100 SF of coated area.
   d. 300 SF < coating area ≤ 1000 SF: One area measurement at each of 3 random 100 SF areas.
   e. Coating area > 1000 SF:
      i. One area measurement at each of 3 random 100 SF areas (first 1000 SF).
      ii. One area measurement at each random 100 SF areas (each remaining 1000 SF or portion thereof).

4. Acceptance criteria:
   a. Gage reading: none
   b. Spot measurement: Each spot measurement shall be within 80% of the specified range (not less than 80% of the minimum value and not greater than 120% of the maximum value)
   c. Area measurement: The average of each area measurement shall fall within the specified range

5. Additional testing of non-conforming area measurements:
   a. Obtain additional spot measurements at 5 foot intervals in 8 equally spaced directions radiating out from the nonconforming area up to the limit of area coated during the work shift.
   b. Each spot measurement shall conform to specified requirements
   c. When 2 consecutive spots measurements conform to requirements, measuring can stop in that direction.
   d. Area within 5 feet of any nonconforming measurement will be considered non-conforming and shall be repaired and retested until all areas are within the specified thickness limit.
D. Holiday Testing:
1. Holiday testing will be performed by the Inspector with a high voltage spark tester in accordance with NACE SP0188 or ASTM D4787.
2. Prior to the application of the coatings on each surface, the concrete surface shall be tested to determine if it is conductive and the holiday testing can be performed.
   a. The conductivity shall be tested by attaching a ground wire to exposed reinforcing steel or another metallic ground installed in the concrete and touching the electrode to the bare concrete.
   b. If a metallic ground is not available, the ground wire shall be placed directly against the bare concrete surface and weighed with a damp cloth or wet sand filled paper bag.
   c. If the surface is not conductive, a conductive prime coat shall be applied.
3. The voltages used for the holiday test will be determined by the Inspector and confirmed by the coating manufacturer. The manufacturers maximum test voltage shall not be exceeded.
4. Coating shall be fully cured and the surface completely dry to the touch prior to performing the holiday test.
5. All detected holidays in the coating shall be marked and repaired with a material and procedure recommended by the Manufacturer.
6. All repaired areas shall be retested.

E. Pull-off Strength Testing: Pull-off strength will be performed on the mock-up wall section by one of the following methods:
1. Pull-off Strength of Coatings Using Portable Adhesion Testers in accordance with ASTM D7234:
   a. Testing equipment shall be one of the following types:
      i. Type I Fixed Alignment Adhesion Tester
      ii. Type II Fixed Alignment Adhesion Tester
      iii. Type III Self-Aligning Adhesion Tester
      iv. Type IV Self-Aligning Adhesion Tester
   b. The tests shall be conducted as follows:
      i. Clean the coating surface.
      ii. Select surface areas to perform the tests. Test area shall have enough perpendicular and radial clearance to accommodate the testing apparatus, be flat enough to permit proper alignment and rigid enough to support the counter force of the apparatus.
      iii. Score around the loading fixture (2-inch diameter or square dolly or stud) to the concrete surface to ensure that the pulling force is applied only to the area beneath the dolly. Use a water-lubricated diamond-tipped core bit. When using a round dolly, score before the dolly is attached to the coating. When using a square dolly, score after the dolly is attached to the coating.
      iv. Scoring shall be performed in a manner that ensures the cut is made normal to the coating surface and in a manner that does not twist or torque the test area and minimizes heat generated and edge damage or microcracks to the coating and the concrete substrate.
v. Attach loading fixture to the coating surface with an appropriate adhesive. Ensure adhesive does not flow into groove.
vi. Remove excessive adhesive around the fixture.

vii. Apply testing apparatus to loading fixture.

viii. Select maximum test force based on Manufacturer’s product literature. Test force shall be no less than 100 psi and no more than 250 psi.

ix. Apply a tension force normal to surface.
x. Gradually increase load (no more than 30 psi/sec) until a plug of material detaches or the required value is reached in 30 seconds or less.

xi. Record mode of failure and pulloff force. Convert the indicated force to the actual force using the loading fixture manufacturer’s calibration chart. Calculate pulloff stress based on the applied force and surface area that was stressed.

xii. For all tests to failure, designate the failures by one of the following failure mechanisms:

1. Concrete substrate cohesive failure – This failure mode is defined as failure within the concrete, below the concrete/coating interface.

2. Coating adhesive failure: This failure mode is defined as failure directly at the concrete/coating interface.

3. Coating cohesive failure or coating intercoat adhesion failure: This failure mode is defined as failure within the coating system, above the concrete/coating interface.

4. Fixture adhesive failure: This failure mode is defined as failure within the fixture adhesive or at the fixture adhesive/coating interface. When this failure mode is encountered, the test should be repeated.

c. Number of tests:

i. The minimum number of strength tests conducted shall be three tests per area.

ii. If test results are deficient, more tests shall be performed at the direction of the Engineer.

d. Report the following:

i. Substrate type

ii. Coating or coating systems and the thickness, type and test surface orientation

iii. Whether the testing was performed in the field or in a laboratory environment

iv. Air temperature and the relative humidity during testing

v. Test apparatus type (include manufacturer and model number), along with the loading fixture type and size

vi. Adhesive type used

vii. Number of tests performed

viii. Magnitude of applied load
ix. Average and range of pull-off values
x. Failure mechanism

2. Knife Test in accordance with ASTM D6677:
   a. Perform 3 three tests per area.
   b. Select an area free of blemishes and minor surface imperfections. For tests in the field, ensure that the surface is clean and dry.
   c. Make two cuts in the film each about 1.5” long that intersect near their middle with a smaller angle of between 30 and 45°.
   d. Starting at the intersection of the “X,” use the tip of the knife blade and attempt to lift the coating from the substrate or the underlying coating layer(s).
   e. The adhesion of the coating shall be rated in accordance with the following scale:
      i. 10 - Coating is extremely difficult to remove. Fragments no larger than 1/32” x 1/32” removed with great difficulty
      ii. 8 - Coating is difficult to remove. Coating chips from 1/16” x 1/16” to 1/8” x 1/8” removed with difficulty
      iii. 6 - Coating is somewhat difficult to remove. Coating chips from 1/8” x 1/8” to 1/4” x 1/4” removed with slight difficulty
      iv. 4 - Coating is somewhat difficult to remove. Coating chips in excess of 1/4” x 1/4” removed using light pressure with knife blade
      v. 2 - Coating is easy to remove. Once started with the knife blade, the coating can be grasped with fingers and easily peeled to a length of at least 1/4”
      vi. 0 - Coating is easy to remove. Once started with the knife blade, the coating can be grasped with fingers and easily peeled to a length greater than 1/4”

F. Additional site visits by the Inspector to retest areas that were shown to be deficient shall be paid for by Owner. The cost of retesting will be determined by Engineer, and Owner will invoice Contractor for this cost. If unpaid after 60 days, this invoice amount will be deducted from the Contract Price.

G. Post-Construction Inspection:
   1. All tanks with the Type 1 coating shall be inspected once per year during the warranty period. All tanks with this coating will be taken out of service at various intervals during each year of the warranty. The exact inspection time for each tank will be determined by the Owner. The Owner may waive any annual inspection during the warranty period if the tank is unable to be taken out of service. This will not relieve the Contractor of subsequent annual warranty inspections.
   2. The Owner will be responsible for removal and disposal of the liquid contents of the tanks that were coated and will be inspected. The Owner shall also clean the walls and floors of the tanks as necessary to expose the coating systems to be inspected.
   3. The inspection will be in the presence of the Owner, Engineer, Applicator and Manufacturer.
4. All coatings will be inspected for cracks, coating delaminations, and other potential defects. All defects shall be repaired by the General Contractor at no additional cost to the Owner. All repairs shall be submitted to the Engineer for review with no exceptions taken.

3.6 COATING SCHEDULE
A. The structures that shall be coated are as indicated on the Contract Drawings.
B. Following is a summary of the structures that shall be coated:
   1. Type 1 (Base Bid):
      a. Wet well
   2. Type 2: (Bid Alternate)
      a. Wet Well

END OF SECTION
SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Structural Steel Shapes
B. Fasteners
C. Anchor Rods
D. Welding
E. Bolt and Weld Inspections
F. Galvanizing

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. All structural steel items embedded in concrete - Section 03300 Cast-in-Place Concrete
B. All structural steel items embedded in concrete masonry - Section 04200 Unit Masonry

1.3 RELATED SECTIONS

A. Section 01340 – Submittals
B. Section 01400 - Quality Control
C. Section 03604 - Non-Shrink Grout
D. Section 05500 - Metal Fabrications
E. Section 09900 – Painting

1.4 REFERENCES

A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. ASTM A6/A6M - Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
C. ASTM A36/A36M - Specification for Carbon Structural Steel
D. ASTM A53/A53M - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
E. ASTM A108 - Specification for Steel Bar, Carbon and Alloy, Cold-Finished
F. ASTM A123/A123M - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
G. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
H. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
I. ASTM A500/A500M - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
J. ASTM A572/A572M - Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
K. ASTM A588/A588M - Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
L. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
M. ASTM A847/A847M - Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
N. ASTM A992/A992M - Specification for Steel for Structural Shapes for Use in Building Framing
O. ASTM B6 - Specification for Zinc
P. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus
Q. ASTM B244 - Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
T. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
W. ASTM D3359 - Standard Test Methods for Measuring Adhesion by Tape Test
X. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test
Z. ASTM F436 - Specification for Hardened Steel Washers
AA. ASTM F844 - Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
BB. ASTM F959 - Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
DD. ASTM F3125/F3125M - Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
1.5 SUBMITTALS

A. Submit complete shop and erection drawings showing all fabrication, welding, connections, anchor rod placement, finishes, materials and dimensions. Copies of Contract Drawings in whole or in part, will not be accepted as shop drawings. Mark numbers on the fabricated pieces of steel shall be the same mark numbers used on the detailed shop and erection drawings. All welds shall be indicated using standard AWS weld symbols.

B. Submit product data where required.

C. Submit calculations for all structural steel beam connections not specifically detailed on the Contract Drawings. All bolted connections not detailed on the Drawings shall be sized to support one-half the total uniform load capacity as shown in Table 3-6, of the AISC Steel Construction Manual. If standard connections from Tables 10-1, 10-2 or 10-10b from the AISC Manual of Steel Construction are used, references may be made to these tables for each beam with the appropriate connection load in lieu of design calculations.

D. Submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificates shall be accompanied by a current certificate by the welder attesting to the fact that they have been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

E. Submit the following qualifications:
   1. Steel Fabricator: AISC Certification
   2. Steel Erector: AISC Certification
F. Submit qualifications of galvanizing plant.
G. Submit Certificate of Compliance from the galvanizer stating that the galvanizing is in accordance with specification.
H. Submit mill test reports for structural steel shapes, bolts, nuts, washers and studs.
I. Statement stating that all connections and welds have been inspected and are in compliance with the requirements of this Specification.

1.6 QUALITY ASSURANCE
A. The fabricator shall participate in the AISC Quality Certification Program and shall be certified as an AISC-Certified Plant, Standard for Steel Building Structures (STD).
B. The erector shall participate in the AISC Quality Certification Program and shall be certified as an AISC-Certified Steel Erector.
C. All work shall conform to ANSI/AISC 303 and ANSI/AISC 360
D. Mill materials shall meet the tolerances specified in ASTM A6/A6M.
E. All welding shall conform to AWS D1.1/D1.1M.
F. Galvanizer Qualifications: Galvanizer shall have demonstrated a minimum of ten years’ experience in the successful application of galvanized coatings specified in this specification in the facility where the work is to be performed and who will apply the coatings within the same facility. All galvanizing shall be performed by a single plant that is a member of the American Galvanizers Association.
G. All welders shall be certified in accordance with the requirements of the AWS D1.1/D1.1M with the following information:
   1. Type of welding for which the welder is qualified
   2. Welding position for which the welder is qualified
   3. Code and procedure for which the welder is qualified
   4. Date qualified
   5. Name of the firm and person certifying the qualification tests

1.7 DELIVERY, STORAGE AND HANDLING
A. Coordinate delivery of products.
B. Unload material as soon as it is delivered and carefully handle and stack to prevent corrosion, deformation and damage. Structural steel shapes shall be carefully stored on substantial pallets, dunnage, or other supports and spacers. Supports shall be free from earth and properly drained, preventing splatter from dirt and other foreign matter.
C. Protect products from damage prior to, during and after installation.
D. All ASTM F3125 Grade F1852 and galvanized Grade A325 bolt assemblies shall be assembled and shipped in the same container.
E. Provide protective storage for all fastener components. Fastener components removed from protective storage shall be protected from dirt and moisture in closed containers at the site of installation. Fastener components shall not be cleaned or modified from as-delivered condition, and if they accumulate rust or dirt shall not be incorporated into the work, and shall be removed from the site. Grade F1852 tension-control bolt assemblies shall not be relubricated.
F. Remove damaged materials from the site.
PART 2 - PRODUCTS

2.1 MATERIALS Structural steel shapes and plates:
  1. Wide flange beams ("W" shapes) - ASTM A992
  2. Standard beams ("S" shapes):
     a. ASTM A992/A992M – all S12 sizes
     b. ASTM A36/A36M – all other sizes
  3. Channels ("C" and "MC" shapes) - ASTM A36/A36M [A572/A572M Grade 50 or A992/A992M]
  4. Angles ("L" shapes) – ASTM A36/A36M [A572/A572M Grade 50 or A992/A992M]
  5. Plates - ASTM A572/A572M
  6. Weathering Steel:
     a. Wide flange beams, channels and angles - ASTM A588/A588M
     b. Hollow structural shapes – ASTM A847/A847M

B. Hollow Structural Shapes ("HSS" Shapes):
  1. Rectangular: ASTM A500/A500M, Grade C (50 ksi yield strength)
  2. Round: ASTM A500/A500M, Grade C (46 ksi yield strength)

C. Pipe: ASTM A53/A53M, Grade B

D. Anchor Rods: ASTM F1554, Grade 55, S1. Provide color coded grade marking at threaded end of rod

E. Fasteners
  1. High Strength Bolts: ASTM F3125 Grade A325 [Grade A490] Type 1, Style Heavy Hex Head [ASTM F3125 Grade F1852, Type 1 (twist-off tension control assemblies)] [ASTM F3125 Grade F2280, Type 1 (twist-off tension control assemblies)] Unfinished Bolts: ASTM A307
  2. Nuts: ASTM A563 Heavy Hex
  3. Washers: ASTM F436 (ASTM F3125 Bolts); ASTM F844 (ASTM A307 Bolts)
  4. Plate Washers: ASTM A572/A572M, Grade 50
  5. Direct Tension Indicators: ASTM F959, Type 325-1 [325-3, 490-1, 490-3], compressible washer type

F. Threaded Rods: ASTM A36/A36M

G. Headed Shear Studs:
  1. Material: Low Carbon Steel, ASTM A108: Grades 1010 - 1020 (chemical properties) and AWS D1.1/D1.1M (physical properties)
  2. Strength: Minimum yield strength: 49 ksi
  3. Finish: Hot Dipped Galvanized ASTM A153
  4. Manufacturer: Nelson Stud Welding (Type 4HL or 3SL) or equal

H. Welding Rods: AWS D1.1/D1.1M (E70XX Electrodes)

I. Finish:
  1. Shapes: Hot-Dipped Galvanized: ASTM A123/A123M
  2. Fasteners: ASTM A153/A153M

J. Primer: Refer to Section 09905 "Surface Preparation and Shop Coatings". 
PART 3 - EXECUTION

3.1 FABRICATION
A. Unless otherwise specified, structural steel shall be fabricated in accordance with the requirements of AISC 303 and AISC 360. All members shall fit closely together and shall be straight and true, and the finished work shall be free from burrs, bends, twists, and open joints.
B. All bolt holes shall be provided as required and shall be punched, sub punched and reamed, or drilled in accordance with AISC 360. Holes shall not be made or modified by thermal cutting.
C. Holes shall be 1/16 inch larger than the nominal bolt diameter, except holes for cast-in-place anchor bolts which shall be 5/16 inch larger than the nominal bolt diameter and as otherwise shown on the Drawings.
D. The use of oversize or slotted holes not shown on the Drawings shall be subject to prior review by the Engineer.
E. Holes shall be made in steel members for attachment of wood blocking, nailers, etc. Holes shall be sized to suit the fasteners indicated on the architectural drawings: where size and spacing are not indicated, holes shall be 9/16 inch diameter, at 3 feet O.C.
F. Except as otherwise indicated on the drawings, gusset plates shall have a minimum thickness of 3/8 inch.
G. Sheared and thermal cut edges shall be true to line and free from rough corners and projections.
H. Re-entrant cuts/corners shall be filleted to a radius of not less than ½ inch.
I. Bent plates shall be in accordance with AISC "Minimum Radius for Bending."
J. Column ends bearing upon base and cap plates and beam ends with end plates shall be saw-cut or milled to true surfaces and correct bevels.
K. Welding shall be done in a sequence which minimizes distortion and shrinkage.
L. Fabrication holes, notches, etc. not required by nor shown on the Drawings shall be subject to prior review by the Engineer.

3.2 CONNECTIONS (GENERAL)
A. All steel framing connections not detailed on the Drawings shall be either shop-welded, field-bolted or all field-bolted connections designed by the fabricator subject to the provisions of the design drawings, specifications and AISC 360. All connections shall be designed to support [one-half the total uniform load capacity of the framing member as shown in Table 3-6 of the AISC Manual of Steel Construction.] [the reactions indicated on the Drawings]. Fabricator shall use the ASD (Allowable Stress Design) in the connection designs. Connections shall be one of the following:
1. All-bolted double angle connections (Table 10-1)
2. Bolted/welded double-angle connections (Table 10-2)
3. Bolted/welded shear end-plate connections (Table 10-4)
4. Single-plate connections (Table 10-9)
B. The axes of axially loaded members which meet at a point shall intersect at the point (unless otherwise indicated).
C. Except as otherwise shown, where three or more members are joined, their centroidal lines of action shall meet at a common point, and there shall be no eccentricity.

D. Accessory material not indicated on the design drawings, intended to be left in place on the completed structure by the erector, shall be indicated on the shop drawings. Where so indicated by the Engineer on the shop drawings, such items shall be removed before acceptance of the completed work.

E. At the time of connecting, all contact surfaces shall be free from loose or non-adherent rust, loose mill scale, oil, grease, dirt, mud, and any foreign matter, coating, or defect that may adversely affect the connection.

F. At the time of connecting, all faying surfaces at Slip-Critical bolted connections shall be prepared in accordance with the requirements of Section 3.2.2. of the RCSC Specification.

3.3 CONNECTIONS (BOLTED)

A. All high strength bolted connections shall conform to the RCSC Specification.

B. All connections shall have a minimum of two bolts and the minimum bolt size shall be 3/8 inch (unless otherwise indicated).

C. Bolts shall be of proper length, and the end of the bolt shall be at least flush with the outer face of the nut. Bolts projecting more than 5/8-inch beyond the face of the nut in exposed work shall be cut off close to the nut as directed by the Engineer. If tension control (twist-off) bolts are used in exposed work in other than Pretensioned and Slip-Critical connections (where the splined bolt extensions are twisted off during installation), the splined bolt extensions shall be removed.

D. All bolts shall have washers between the tightened element and the structural member. Beveled washers shall be used where flange slope exceeds 1:20.

E. High strength bolts or nuts once tightened shall not be loosened then re-used. Care shall be taken not to damage the threads of high strength bolts during installation. Joints shall be properly aligned and drifted, and holes reamed, if required, to permit bolts to be slipped into place by hand. No burning is allowed for hole adjustment.

F. Snug-Tightened Connections:

1. Snug-Tightened condition shall be defined as that tightness attained with a few impacts from an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected elements into firm contact.

2. All bolts identified as Snug-Tightened shall be tightened to a Snug-Tight condition with either spud wrenches or pneumatic impact wrenches.

3. All bolted connections shall be Snug-Tightened N-type bearing connections unless otherwise indicated on the Drawings.

G. Pretensioned and Slip-Critical Connections: Slip-Critical connections shall be provided as follows:

a. Where indicated on the Drawings.
b. Where oversized holes are used.
c. Where slotted holes are used, except where the direction of the applied load is normal to the slot.

2. Pretensioned connections shall be provided as follows:

a. Where indicated on the Drawings.
b. Column splices in buildings with high height to width ratios.
c. Connections of members that provide bracing to columns in tall buildings.
d. In structures carrying cranes of over 5-ton capacity at: column splices, column bracing, knee braces, and crane supports.
e. Connections for the support of machinery and other live loads that produce impact or reversal of load.

3. All bolts in Pretensioned and Slip-Critical connections shall be tightened (pretensioned) with one of the methods specified in Sections 8.2.1 through 8.2.4 in the RCSC Specification. The minimum bolt pretension shall be in accordance with Table 1 in the RCSC Specification. Pre-Installation Verification: The fastener assemblies and pre-tensioned installation procedures shall be tested in accordance with Section 7 in the RCSC Specification to verify the minimum bolt pretension forces can be achieved: Where bolts are specified to be installed “loose” or “finger tight”, the connection must first be snugged-up to ensure that all plies are in contact. The nuts shall then be backed off between one-half and one turn to permit the intended movement of the connection. The bolts shall be provided with double nuts to prevent loosening.

I. The entire high strength bolting operation, including all materials and equipment used and personnel employed, shall be under the direct supervision of and shall be the direct responsibility of the steel erector, but subject to the review of the Engineer.

J. All nuts, protruding ends of the bolts and base metal shall be match-marked after tightened using white ink or non-water soluble paint.

K. An Independent Testing Firm (hereafter referred to as “Inspector”), selected and paid for by the Owner, will inspect the bolted connections in accordance with Section 9 of the RCSC Specification as follows:

1. Snug-Tightened Connections: The Inspector will visually inspect the Snug-Tightened bolted connections. The visual inspections shall consist of the following (in accordance with Section 9.1 in the RCSC Specification):
   a. Verification that the proper components were used in the connection.
   b. Verification that the plies of connecting elements have been brought into firm contact.
   c. Additional non-destructive tests as required by the Engineer.

2. Pretensioned Connections: The Inspector will inspect Pretensioned bolted connections in accordance with Section 9.2 in the RCSC Specification.


4. After inspection, if the joint is satisfactory it shall be marked by the Independent Testing Firm with a symbol which indicates that the work is completed and is satisfactory. If the joint is unsatisfactory, it shall be repaired or removed and replaced with a new bolted connection to the Engineer’s satisfaction.

5. If it is discovered that bolts marked as approved by the Inspector are not in compliance with the requirements of this section and the referenced specification, codes, or authorities, the erector's bolting and inspecting procedures shall be revised as required by the Engineer before any of the remaining bolts are installed.

6. The Engineer reserves the right to inspect and test all bolted connections. The costs for this additional testing will be borne by the Owner.
3.4 CONNECTIONS (SHOP AND FIELD WELDING)

A. Welding shall be only for the connections and assemblages shown on the drawings or specified herein, and shall be performed in the shop, except where specifically noted to be performed in the field.

B. All welding shall be done only by certified welders using welding procedures and welding equipment in accordance with AWS D1.1/D1.1M. Welders employed on the work shall be experienced structural welders, previously qualified by tests and prescribed in AWS D1.1/D1.1M, using the base metals and electrodes specified herein.

C. Welding materials and workmanship shall conform to AWS D1.1/D1.1M. All welds shall be considered Prequalified if they conform to the Prequalified joints specified in Chapter 3 of AWS D1.1/D1.1M.

D. Welding electrodes shall conform to the requirements of AWS D1.1/D1.1M and shall be the E70XX series.

E. Welding shall be by the manual shielded metal arc process. If the fabricator wishes to use other processes, full details of materials, equipment, and procedures shall be submitted to and approved by the Engineer before any welding, other than as specified herein, is performed. All welds shall be free of undercut, unfilled craters, and cracks, and shall have smoothly faired contours. Flux and loose scale shall be removed from previous weld bead before succeeding bead is laid. Exposed welds shall be ground smooth.

F. All temporary (tack) welds shall meet all the specified requirements as the final welds. Tack welds that will be incorporated into the final weld shall be cleaned and thoroughly fused with final weld. Defective, cracked or broken tack welds shall be removed before final welding. Tack welds not incorporated into the final weld shall be removed.

G. No welding shall be performed during the following weather conditions:

1. Ambient temperature in the immediate vicinity of the weld is below 0°F,
2. If the welded surfaces are wet or are exposed to rain or snow,
3. High wind velocity. A temporary wind shelter may be used in order to reduce the wind directly exposed to the weld to a maximum of 5 mph,
4. Other inclement conditions that will hamper good workmanship.

H. Welds other than those indicated on the design drawings may be used only if reviewed and no exceptions are taken by the Engineer.

I. Welding of shear studs shall be in accordance with Section 7 of AWS D1.1/D1.1M.

J. When welding is unsatisfactory or indicates inferior workmanship, the welds shall either be repaired or removed and rewelded. Where requirements prescribe the removal of part of the weld or a portion of the base metal, such removal shall be by machining, grinding, chipping or machining. All weld repairs shall be proposed by the General Contractor and reviewed by the Engineer with No Exceptions Taken. Defective or unsound welds shall be corrected as follows:

1. Dimensional repairs:
   a. Fillet weld too small – Remove the weld and reweld to the proper size
   b. Crown height too low (groove weld) – Add more weld to the proper height using stringer beads
c. Surfacing or overlay weld height too low – Add more weld to the proper height using stringer beads

2. Excessive welds: Overlap, excessive convexity or excessive reinforcement: Reduce to size by removal of excess weld metal with a cutting or grinding machine.

3. Cracks in weld or base metal (Centerline, Heat affected zone (HAZ) or Transverse cracking): The extent of the crack shall be verified by acid etching, Magnetic Particle (MT) or Liquid Penetrant (PT) methods. Remove only the amount of weld to eliminate the crack with a cutting or grinding machine. Remove weld to 2 inches beyond each end of the crack. Add more weld to the proper height using stringer beads

4. Incomplete penetration (root side of butt welds) – Remove weld with a cutting or grinding machine. Add more weld to the proper height using stringer beads

5. Porosity – Remove individual pores with a rotary tool. Remove multiple and linear pores by grinding. Inspect weld by RT or UT to ensure that the porosity has been completely removed. Add new weld

6. Lack of fusion/Cold lap – Areas of weld (fillet or butt welds) that have not fused with base metal. Remove weld by grinding or routing. Inspect weld by PT to determine if weld is removed.

7. Undercut – Small cavity that is melted into the base metal adjacent to the toe of a weld that is not subsequently filled by weld metal. Remove by grinding or routing. Add additional weld into the base metal to match the adjacent weld.

8. Spatter – Particles of molten weld metal that solidify on the base metal outside the welded joint. Remove by grinding or routing.

9. Base metals distorted from welding: Straighten by mechanical means or by application of a limited amount of localized heat.

L. Where work performed subsequent to the making of a deficient weld has rendered the weld inaccessible or has caused new conditions which would make the correction of the deficiency dangerous or ineffectual, the original conditions shall be restored by removal of welds or members or both before making the necessary corrections, or else the deficiency shall be compensated by additional work according to a revised design approved by the Engineer.

M. In the event that faulty welding or its removal for rewelding, shall so damage the base metal that in the judgment of the Engineer its retention is not in accordance with the intent of the Drawings and Specifications, the Contractor shall remove and replace the damaged material at no additional cost to the Owner.

N. An Independent Testing Firm (hereafter referred to as “Inspector”), selected and paid for by the Owner, will perform inspection of the welding operation and welds. The inspector shall be an AWS Certified Welding Inspector in accordance with the provisions of AWS QC1. The following weld inspections will be performed by the Inspector:

1. Verification inspection of the welding materials and procedures and the welder's qualifications,

2. Visual inspection of all shop and field welds at the jobsite,

3. Ultrasonic Testing (UT) of all complete penetration welds
4. Magnetic Particle (MT) of 10% of all fillet welds. The number and locations of fillet welds to be tested will be determined by the Engineer.

5. Additional testing, such as Liquid Penetrant Testing (PT), Dye Penetrant Testing (DP), MT or UT may be performed at the discretion of the Independent Testing Firm.

6. Acceptance of welds shall be based on Chapter 6 of the AWS D1.1/D1.1M.

3.5 STEEL ERECTION AND INSTALLATION

A. Erection of structural steel shall be in accordance with AISC 303, AISC 360, and the requirements of all other applicable regulatory agencies and industry standards.

B. General Contractor shall verify elevations of concrete, masonry or steel bearing surfaces and locations of anchor rods, bearing plates, and other embedded items. Notify the steel erector that the anchor rods are ready for the start of steel erection.

C. Columns and base plates shall be set and accurately plumbed and leveled.

D. Column base plates may bear on pre-grouted leveling plates, leveling nuts and washers or shims. Leveling plates larger than 22 inch x 22 inch will be prohibited. The use of temporary column supports is not shown on the Drawings and will be permitted by the Engineer as required by the erector.

E. Leveling plates and loose base and bearing plates shall be promptly grouted after they are set and checked for line and grade. Columns with attached base plates that are temporarily supported on leveling nuts and washers or shims shall be promptly grouted after the structural steel frame or portion thereof has been plumbed.

F. Installation of grout for the column setting plates and base plates shall be performed in accordance with Specification Section 03604. No load shall be applied to grout until five days after the plate has been grouted. All column base plates shall bear on grout with a minimum thickness of 1-inch.

G. All unmatched holes in shop assembly of field connections shall be reamed and the pieces match marked before disassembly. Drift pins shall be used only for bringing members into position and not to enlarge or distort holes. Any piece weakened by reaming to compensate for eccentricity to a point where the strength of the joint is impaired shall be rejected and a new and satisfactory piece shall be provided by the Contractor at their own expense. Slotted holes and washers shall be provided for truing up steel requiring accurate alignment.

H. Camber of beams and girders shall be that indicated on the design drawings. Where no camber is indicated, any minor camber resulting from rolling or shop assembly shall be upward.

I. The use of a gas cutting torch in the field for correcting fabrication errors will not be permitted upon any primary member of the structural framing. The use of a gas cutting torch will be permitted only on secondary members, and then only after the review and no exceptions taken by the Engineer.

J. Steel work shall be adequately and safely supported and braced as required to prevent distortion or damage to the frame work due to wind, erection or other forces until the permanent supports and braces as shown on the Drawings are installed. All temporary material and all traces thereof shall be completely removed before acceptance of the work.
3.6 **GALVANIZING**

A. Acceptable manufacturers:
   1. Duncan Galvanizing, Everett, MA
   2. Connecticut Galvanizing, Glastonbury, CT
   3. V&S Taunton Galvanizing, LLC, Taunton, MA

B. All galvanizing processes, materials and systems described herein are based on Duncan Galvanizing, Everett, MA. Equivalent systems by other galvanizing plants will be permitted provided they meet the requirements of the Specification.

C. Provide hot-dipped galvanizing coatings to all structural steel and hardware as indicated on the Drawings and herein. Galvanizing coating shall consist of one of the four following products:
   1. Duragalv
   2. Primergalv
   3. Colorgalv
   4. Thermoset

D. Duragalv
   2. Duragalv coating shall consist of a zinc rich galvanized coating surface without additional finishes.
   3. Hot-dip galvanize all fabricated items in accordance with ASTM A123 and hardware items in accordance with ASTM A153.
   4. Prior to galvanizing, drill vent and drain holes in hollow steel shapes as required by the galvanizer.
   5. Galvanizing process shall consist of the following steps:
      a. Degreasing - Immersed the steel in an acid degreasing bath or caustic solution in order to remove the dirt, oil, and grease from the surface of the steel. After degreasing the steel is rinsed with water.
      b. Pickling – Immerse the steel in an acid tank filled with either hydrochloric or sulfuric acid, which removes oxides and mill scale. Once all oxidation has been removed from the steel, it is again rinsed with water.
      c. Fluxing - Immerse the steel in an acid tank filled with a combination of zinc chloride and ammonium chloride. The flux shall clean the steel of all oxidation developed since the pickling of the steel and to create a protective coating to prevent the steel from any oxidizing before entering the galvanizing kettle.
      d. After being immersed in the Degreasing, Pickling, and Fluxing tanks, the surface of the steel shall be completely free of any oxides or any other contaminants that might inhibit the reaction of the iron and liquid zinc in the galvanizing kettle.
      e. Galvanizing – The galvanizing process shall include the following steps:
         i. Immerse the steel in a galvanizing kettle containing liquid zinc.
         ii. The zinc shall be at least 98% pure and shall be heated to a temperature ranging from 820°F - 860°F, at which point the zinc is in its liquid state.
         iii. The steel products shall be immersed into the galvanizing kettle and remain in the kettle until the temperature of the steel has reached the temperature required to form a hot-dip galvanized coating.
iv. Once the inter-diffusion reaction of iron and zinc is completed, the steel product is withdrawn from the zinc kettle.

v. Excess zinc shall be removed by draining or vibrating.

vi. The finished product shall be inspected by using a variety of simple physical and laboratory tests may be performed to determine thickness, uniformity, adherence and appearance.

6. Fill vent holes after galvanizing, if applicable, and grind smooth.

7. Galvanize items after assembly when possible.

8. Galvanizing shall provide a visually acceptable coating and shall be free of lumps, globules, sharp edges or heavy deposits which will interfere with intended use or aesthetic appearance of materials. The Galvanized surface shall exhibit a rugosity (smoothness) of 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1-micron increments.

9. Warranty: Provide galvanizer's standard warranty stating that finished galvanized surfaces will be free from 10 percent or more visible rust for 20 years.

E. Primergalv

1. Primergalv coating shall consist of a zinc rich galvanized coating surface with an additional factory applied primer finish.

2. Apply Duragalv coating to the steel as specified above.

3. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommend by the primer coating manufacturer. Primer shall have a two year re-coat window for application of finish coat.

4. Primer shall be certified to have a VOC limit less than 2.8 lbs./gal and conform to EPA and local requirements. Primer shall meet or exceed the following performance criteria:
   a. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load) 1 kg load, 200 mg loss.
   c. Corrosion Weathering: ASTM D 5894, 13 cycles, 4,368 hours, 10 per ASTM D 714 for blistering; 7 per ASTM D 610 for rusting.
   e. Flexibility: ASTM D 522, 180 degrees’ bend, 1-inch mandrel, Passes.
   f. Pencil Hardness: ASTM D 3363, 3H.
   g. Moisture Condensation Resistance: ASTM D 4585, 100 degrees F, 2000 hours, Passes no cracking or delamination.
   h. Dry Heat Resistance: ASTM D 2485, 250 degrees F.
   j. Salt Fog Resistance: ASTM B 117, 5,600 hours No cracking or blisters.

5. Primer shall exhibit a rugosity (smoothness) of 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1-micron increments.
6. Warranty: Provide galvanizer's standard warranty stating that finished galvanized and primed surfaces will be free from 10 percent or more visible rust for 20 years.

F. ColorGalv

1. ColorGalv coating shall consist of a zinc rich galvanized coating surface with an additional factory applied architectural coating.
2. Apply Duragalv coating to the steel as specified above.
3. Apply polyamide epoxy primer within 12 hours after galvanizing at the same galvanizer’s plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
4. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer’s plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer.
5. Coatings shall be certified VOC compliant and conform to applicable regulations and EPA standards.
6. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
7. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing at the galvanizer’s plant. If blasted, galvanizer shall certify that rugosity standards are met.
8. Primer shall meet or exceed the following performance criteria:
   a. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load) 1 kg load, 200 mg loss.
   c. Corrosion Weathering: ASTM D 5894, 13 cycles, 4,368 hours, 10 per ASTM D 714 for blistering; 7 per ASTM D 610 for rusting.
   e. Flexibility: ASTM D 522, 180 degrees’ bend, 1-inch mandrel, Passes.
   f. Pencil Hardness: ASTM D 3363, 3H.
   g. Moisture Condensation Resistance: ASTM D 4585, 100 degrees F, 2000 hours, Passes no cracking or delamination.
   h. Dry Heat Resistance: ASTM D 2485, 200 degrees F.
   j. Salt Fog Resistance: ASTM B 117, 5,600 hours No cracking or blisters.
9. Topcoat shall meet or exceed the following performance criteria:
   a. Abrasion Resistance: ASTM D 4060, CS17 Wheel, 1,000 cycles 1 kg load, 87.1 mg loss.
e. Salt Fog Resistance: ASTM B 117 9,000 hours, Rating 10 per ASTM D 714 for blistering, Rating 9 per ASTM D 610 for rusting.


g. Pencil Hardness: ASTM D 3363, F.

h. Moisture Condensation Resistance: ASTM D 4585, 100 degrees F, 1000 hours, No blistering or delamination.

i. Xenon Arc Test: ASTM D 4798, Pass 200 hours.


10. Topcoat shall exhibit a rugosity (smoothness) of 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

11. Warranty: Provide galvanizer’s standard warranty stating that finished galvanized and coated surfaces will be free from 10 percent or more visible rust for 20 years.

G. Colorgalv Thermoset

1. Colorgalv Thermoset coating shall consist of a zinc rich galvanized coating surface with an additional factory applied heat cured architectural coating.

2. Apply Duragalv coating to the steel as specified above.

3. Apply High-Performance Thermosetting Based Coating. Factory-applied metal coatings shall be applied in a facility acceptable to the coating manufacturer. Factory applied coating shall include an architectural grade primer. Full cure of the coating system shall be verified by the coating manufacturer’s recommended test methods.

4. Thermoset coating shall meet or exceed the following criteria as established by the coating manufacturer.


b. Hardness: ASTM D 3363 (pencil), H min.


e. Humidity: ASTM D 2247, 3000 hours, few #8 blisters.


g. Color Retention: ASTM D 2244, 5 year less than or equal to 5 delta E.

h. Chalk Resistance: ASTM D 4214, #8 rating.

i. Gloss Retention: ASTM D 523, greater than or equal to 30 percent retention.

j. Erosion Resistance: ASTM B 244, less than 10 percent film loss.

k. Compliance: AAMA 2604.

5. Warranty: Provide galvanizer’s standard warranty stating that finished galvanized and coated surfaces will be free from 10 percent or more visible rust for 20 years.

H. Galvanizing Thickness

1. The minimum thickness of zinc coating (in ounces/square foot) on steel shapes shall conform to Table 1 below:
### Table 1 - Zinc Coating Thickness (oz/sf)

<table>
<thead>
<tr>
<th>Steel Shape</th>
<th>1/16-1/8</th>
<th>1/8-3/16</th>
<th>3/16-1/4</th>
<th>&gt;1/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shapes and Plates</td>
<td>1.0</td>
<td>1.7</td>
<td>2.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Strips and Bars</td>
<td>1.0</td>
<td>1.7</td>
<td>2.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Pipe and Tube</td>
<td>1.0</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

2. The minimum thickness of zinc coating (in ounces/square foot) on steel fasteners shall conform to Table 2 below:

### Table 2 - Zinc Coating Thickness (oz/sf)

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Average of Specimen</th>
<th>Individual Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A – Castings: Malleable Iron and Steel</td>
<td>2.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Class B – Rolled, pressed and forged articles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1 - 3/16 inch and over in thickness and over 15 inches in length</td>
<td>2.0</td>
<td>1.8</td>
</tr>
<tr>
<td>B2 - Under 3/16 inch in thickness and over 15 inches in length</td>
<td>1.5</td>
<td>1.25</td>
</tr>
<tr>
<td>B3 – Any thickness and 15 inches and under in length</td>
<td>1.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Class C - Fasteners over 3/8 inch diameter. Washers 3/16 inch and ¼ inch thick</td>
<td>1.25</td>
<td>1.0</td>
</tr>
<tr>
<td>Class D - Fasteners 3/8 inch and under in diameter, rivets and nails. Washers under 3/16 inch in thickness</td>
<td>1.0</td>
<td>0.85</td>
</tr>
</tbody>
</table>

I. Touch up and repair: After erection, touch-up all damaged galvanized and coated surfaces and field welds as follows:

1. Unless otherwise indicated, all touch up and repairs to galvanized surfaces shall be in strict accordance with the manufacturer’s recommendations.
2. Surfaces to be reconditioned with zinc-rich paint shall be clean, dry, and free of oil, grease and corrosion.
3. Areas to be repaired shall be power disc sanded to bright metal. To ensure that a smooth reconditioned coating can be effected, surface preparation shall extend into the undamaged galvanized coating.
4. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A780. Galvanizing repair paint shall have 95 percent zinc by weight.
5. The paint shall be spray applied in multiple coats until a dry film thickness of 4-6 mils minimum has been achieved. Coating thickness shall be verified by measurements with a magnetic or electromagnetic gauge.
6. Repair Paint:
   a. ZIRP by Duncan Galvanizing
   b. Or equivalent
3.7 SURFACE PREPARATION AND SHOP COATINGS

A. Provide Surface Preparation and Shop Coatings in accordance with specification Section 09905 for all structural steel that will not receive a hot-dipped galvanized coating, except for the following:
   1. Weathering steel
   2. Steel surfaces embedded in concrete or masonry
   3. Surfaces that will receive fireproofing material

B. Shop coats shall be compatible with and made by the same manufacturer as the field top coats as specified in Section 09900. Contractor shall coordinate the installation of the top coats with the shop coats.

C. After erection touch-up all abrasions and field welds with same material used on shop coating.

END OF SECTION
SECTION 05400
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Load and non-load bearing metal framing.
B. Metal tracks and accessories.

1.2 RELATED SECTION
A. Section 01340 - Submittals
B. Section 03300 - Cast in Place Concrete
C. Section 05120 - Structural Steel
D. Section 05500 - Miscellaneous Metals
E. Section 06100 - Rough Carpentry
F. Section 06190 - Prefabricated Wood Trusses
G. Section 09250 - Gypsum Wallboard

1.3 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
B. AISI S100 - North American Specification For The Design Of Cold-Formed Steel Structural Members
C. AISI S110 - Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames
D. AISI S200 - North American Standard For Cold-Formed Steel Framing – General Provisions
E. AISI S201 - North American Standard For Cold-Formed Steel Framing – Product Data
F. AISI S202 - Code of Standard Practice for Cold-Formed Steel Structural Framing
G. AISI S211 - North American Standard for Cold-Formed Steel Framing - Wall Stud Design
H. AISI S212 - North American Standard for Cold-Formed Steel Framing – Header Design
I. AISI S213 - North American Standard for Cold-Formed Steel Framing – Lateral Design
J. ASTM A123/A123M - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron
& Steel Products

K. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

L. ASTM A370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products

M. ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

N. ASTM A792/A792M - Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

O. ASTM A875/A875M - Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process

P. ASTM A924 / A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

Q. ASTM A1003 / A1003M - Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members


S. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

T. ASTM C955 - Specification for Cold-Formed Steel Structural Framing Members

U. ASTM C1007 - Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories

V. ASTM C1513 - Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections


X. ASTM E329 - Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

Y. ASTM F1941/F1941M - Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric

Z. ASTM F2329/2329M - Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

AA. AWS D1.1/D1.1M Structural Welding Code – Steel - American Welding Society

BB. AWS D1.3/D1.3M Structural Welding Code – Sheet Steel - American Welding Society


EE. Maine Uniform Building Code

FF. New Hampshire State Building Code


HH. State of Rhode Island Building Code SBC-1 [2013]

II. Connecticut State Building Code with 2005 CT Supplement and 2013 Amendment
1.4 DESIGN REQUIREMENTS
A. The cold-formed metal framing manufacturer (herein referred to as “Manufacturer”) shall be responsible for designing the following systems (as identified on the Contract Drawings):
   1. Exterior load bearing wall systems
   2. Non-load bearing stud wall systems
   3. Floor and ceiling framing systems
B. Load bearing walls include walls subjected to vertical axial loads and horizontal loads.
C. The system designs shall include all components of the design, including, but not limited to:
   1. Steel studs and tracks
   2. Steel headers and jambs
   3. Steel rafter
   4. Lateral bracing
D. Cold form metal framing systems shall be designed for the following loads:
   1. Exterior Load Bearing studs:
      a. Dead load = weight of materials
      b. Roof dead and live loads as indicated in the Drawings
      c. Floor dead and live loads as indicated in the Drawings
      d. Wind load as indicated in the Drawings
      e. Seismic loads (perpendicular to the studs) utilizing the seismic design parameters indicated on Drawing S-1.
   2. Ceiling framing:
      a. Dead load = weight of materials
      b. Ceiling live loads as indicated in the Drawings
      c. Seismic loads utilizing the seismic design parameters indicated on Drawing S-1.
   3. Deflection Limits: Design framing systems to withstand the design live loads without deflections greater than the following:
      a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
      b. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

1.5 SUBMITTALS
A. Submit complete shop drawings stamped by a Professional Engineer registered in the State of in accordance with the provisions of Specification Section 01340. The shop drawings shall include the following: Shop Drawings: Submit drawings for review which shall include:
   1. Fabrication drawings including cross sections, plans and/or elevations depicting component types and locations for each unique framing application;
   2. Connection details depicting fastener type, quantity, location and other information to assure proper installation;
3. Contractors electing to install prefabricated/pre-finished frames, shall submit drawings depicting panel configurations, dimensions, components, locations and construction sequence.


5. Layout drawings including member spacings, sizes, thicknesses, and types of cold-formed steel framing;

6. Fastening and anchorage details including fastener type quantity and locations.

7. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Structural Design Calculations: Submit calculations for all framing members which shall include, but not limited to:
   1. Design Criteria, including materials, loads, etc.
   2. Structural analysis for each framing system for all vertical and lateral loads.
   3. Selection of framing components and accessories and verification of connections.
   4. All calculations shall be stamped and sealed by a Professional Structural Engineer Registered in the State of Maine.
   5. Computer generated calculations and manufacturer standard load tables will be acceptable.

D. Literature: Submit technical literature prepared by the framing manufacturer.

E. Certification: Submit certification from manufacturer that all cold formed metal framing members meet or exceed the requirement of the Contract Specifications.

1.6 QUALITY ASSURANCE

A. Design Standards – Unless otherwise indicated, products and installation shall meet the requirements of the following standards.
   1. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
   2. Cold-Formed Steel Framing Design Standards:
      b. Wall Studs: AISI S211.
      c. Lateral Design: AISI S213.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site, and store in adequately ventilated, dry locations.

B. Storage area shall permit easy access for inspection and handling.

C. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

D. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather.

E. Replace damaged materials with new materials as directed by the Engineer.
PART 2 - PRODUCTS

2.1 MANUFACTURER
A. ClarkDietrich
B. MarinoWARE
C. Or equal

2.2 MATERIALS
A. Recycled content of steel products: postconsumer recycled content plus one-half of preconsumer recycled content not less than 25%.
B. Materials:
1. All finished cold formed structural framing members shall comply with ASTM C955.
2. Steel Sheet (structural framing members): ASTM A1003/A1003M. Grade and coating as follows:
   a. Grade: ST33H (33 ksi Grade 33 Type H) or ST50H (50 ksi Grade 50 Type H).
   b. Coating:
      i. Unless otherwise noted, all applications shall be considered dry areas:
      ii. Dry areas: Minimum CP 60 coating, which shall consist of one of the following:
           (1) G60 (Hot-dipped Galvanized coated) (ASTM A653/A653M)
           (2) A60 (Hot-dipped Galvannealed coated) (ASTM A653/A653M)
           (3) AZ50 (55% Aluminum - zinc alloy coated) (ASTM A792/A792M)
           (4) GF30 (Zinc - 5% Aluminum alloy coated) (ASTM A875/A875M)
      iii. Weather exposed: G90 (Hot-dipped Galvanized coated) (ASTM A653/A653M)
3. Steel Sheet (Vertical Deflection and Drift Clips): ASTM A 1003/A 1003M, ASTM A 653/A 653M. Grade and coating as follows:
   a. Grade: 50 Class 1 SS
   b. Coating: G90 (Hot-dipped Galvanized coated) (ASTM A653/A653M)
4. Unless otherwise indicated, all cold formed steel members shall be supplied in one of the following thicknesses:
   a. 15 mil = 20 gauge = minimum 0.0329” (design 0.0346”)
   b. 19 mil = 20 gauge = minimum 0.0329” (design 0.0346”)
   c. 30 mil = 20 gauge = minimum 0.0329” (design 0.0346”)
   d. 33 mil = 20 gauge = minimum 0.0329” (design 0.0346”)
   e. 43 mil = 18 gauge = minimum 0.0428” (design 0.0451”)
   f. 54 mil = 16 gauge = minimum 0.0538” (design 0.0566”)
   g. 68 mil = 14 gauge = minimum 0.0677” (design 0.0713”)
   h. 97 mil = 12 gauge = minimum 0.0966” (design 0.1017”)
5. Material yield strengths shall be as follows:
   a. Members made with 18 and 20 gauge metal – 33 ksi minimum
   b. Members made with 12, 14 and 16 gauge metal – 33 or 50 ksi

2.3 LOAD BEARING STUDS WALLS

A. Steel Studs:
   1. Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
   2. ClarkDietrich:
      a. Structural Studs (S):
         i. Available channel depths: 2 ½”, 3 ½”, 3-5/8”, 4”, 5 ½”, 6”, 8”, 10”, 12” and 14”.
         ii. Available flange widths: 1-3/8”, 1-5/8”, 2”, 2 ½” and 3”.
         iii. Knockouts: 1 ½” x 4” at 24” o.c. in studs 3-5/8” and deeper.
   b. ProSTUD:
      i. Available channel depths: 1-5/8”, 2 ½”, 3 ½”, 3-5/8”, 4”, 5 ½” and 6”.
      ii. Flange width: 1-1/4”
   3. MarinoWare:
      a. Structural Studs (CW, SW, J, JE, JX and JXW):
         i. Available channel depths: 2 ½”, 3-5/8”, 4”, 6”, 8”, 10”, 12”, 14” and 16”.
         ii. Available flange widths: 1-3/8” (CW), 1-5/8” (SW), 2” (J), 2 ½” (JE), 3” (JX) and 3 ½” (JXW).
         iii. Knockouts: 1 ½” x 4” at 24” o.c. (¾” x 4” at 24” o.c. for studs with 2 ½” channel depth).
   b. StudRite:
      i. Available channel depths: 3-5/8”, 4” and 6”.
      ii. Available flange widths: 1-5/8”, 2”, 2 ½” and 3”.

B. Bridging and Lateral Bracing:
   1. U-Channel for lateral bracing for exterior curtain wall framing, loadbearing walls, or high interior partitions constructed of structural studs.
   2. ClarkDietrich (CRC):
      a. Available channel depths: ¾”, 1 ½” or 2” depth.
      b. Leg lengths: ½”.
   3. MarinoWare (CR):
      a. Available channel depths: ¾”, 1 ½” or 2”.
      b. Leg lengths: ½”.
   4. Manufacturers standard clip used for rigid connections of studs and bridging.
   5. ClarkDietrich:
      a. Uni-Clip End Clip (UCEC)
         i. Universal framing clip angle used to attach and support numerous rigid framing conditions
         ii. 3 ½” x 1 ½” legs x 4 ½” long angle
b. SwiftClip:
   i. Universal framing clip angle used to attach and support numerous rigid framing conditions
   ii. LS series – 1 ½” x 1 ½” legs. 3 ¼”, 5 1/2”, 7 1/4”, 9 ¼”, 11 ¼” and 13 ¼” lengths.
   iii. LE Series – 3” x 1 ½” legs. 3 ¼”, 5 1/2” and 7 ½” lengths.
   iv. LA Series – 3” x 3” legs. 3 ¼”, 5 1/2” and 7 ¾” lengths.

c. EasyClip:
   i. A series – 3” x 3” angle. 3” and 6” lengths. Reinforce jamb-stud connections at the primary frame.
   ii. D series – 2” x 2” angle. 3 1/2” and 5 1/2” lengths. Stud wall to foundation connections.
   iii. E series – 1 ½” x 4” angle. 3”, 5”, 7”, 9” and 11” lengths. Rigid standoff connections.
   iv. S series – 1 ½” x 1 ½” angle. 3”, 5”, 7”, 9” and 11” lengths. Bridging connections.
   v. D series – 2” x 4” angle. 3 1/2” and 5 1/2” lengths. Stud wall to foundation connections.
   vi. U series – 1 ½” x 1 ½” angle. 3 3/8”, 5 ¾”, 7 ¾” and 9 ¾” lengths. Bridging connections.
   vii. X series – 2” x 2” angle. 3 3/8”, 5 ¾”, 7 ¾” and 9 ¾” lengths. 12, 14 and 16 gauge. Bridging connections.

d. Skewable Angle
   i. 2” x 2” 18 gauge angle
   ii. 3”, 4 7/8”, 5”, 6 3/8”, 7 and 9” lengths

e. Holdown (CD):
   i. CD8 – 2 5/8” wide base x 11” vertical leg
   ii. CD10 - 2 5/8” wide base x 13 1/2” vertical leg
   iii. CD15 - 2 5/8” wide base x 19” vertical leg
   iv. Used to connect the bottom of studs to foundations

f. FastBridge (FB):
   i. FB33 – 33 mil (20 gauge) clip
   ii. FB43 - 43 mil (18 gauge) clip
   iii. FB68 – 68 mil (14 gauge) clip

6. MarinoWare:
   a. Utility Clip (UA):
      i. Available angle leg lengths: 1 ½”, 2”, 3” and 4”
      ii. Available angle lengths: 3 ¼”, 5 ¼”, 7 ¼”, 9”, 11 ¼”, 13 ¼” and 15 ¾”
      iii. Used for various framing applications.
   b. Large Utility Clip (LA):
      i. Available angle sizes: 3” x 3” x 3 ¼”, 5 ¼” or 7 ¾” long
      ii. Used for various framing applications.
   c. Rigid Clip Connector (RCC):
      i. Available angle sizes: 4” x 1 1/2” x 3 ¼”, 5 ¼” or 7 ¾” long
      ii. Used to connect the bottom of studs to support structures
d. Rigid Clip (WRC):
   i. Rigid connection clip with no allowable vertical movement
   ii. WRC362 – 1 ½” x 4” x 3 ½” long
   iii. WRC600 – 1 1/2” x 4” x 5 1/2” long
   iv. WRC800 – 1 1/2” x 4” x 7 1/2” long
   v. WRC1000 – 1 1/2” x 4” x 9 1/2” long
   vi. WRSC1200 – 1 1/2” x 4” x 11 1/2” long

vii. Used to connect the bottom of studs to foundations

e. Holdown (S/HD and S/HDS)
   i. S/HD8 – 2 1/2” wide base x 13 7/8” vertical leg
   ii. S/HD10 – 2 1/2” wide base x 16 1/8” vertical leg
   iii. S/HD15 – 2 3/4” wide base x 21 1/2” vertical leg
   iv. S/HD8S – 2 5/16” wide base x 11” vertical leg
   v. S/HD10S – 2 5/16” wide base x 13 1/2” vertical leg
   vi. S/HD15S – 2 7/16” wide base x 17” vertical leg

f. Tension Tie (S/LTT and S/Htt)
   i. S/LTT20 – 2” wide base x 20” vertical leg
   ii. S/HTT14 – 2 1/2” wide base x 15” vertical leg
   iii. Used to connect the bottom of studs to foundations

g. BridgeRite Clip (BR)
   i. BRC3: 1 ½” x 1 ½” angle; available lengths: 3 1/4” and 4”
   ii. BRC6: 1 ½” x 1 ½” angle; available lengths: 6” and 8”

2.4 FLOOR AND CEILING FRAMING (JOISTS)
   A. Manufacturer's standard C and U-shaped steel framing members.
   B. ClarkDietrich (Ceiling):
      1. ProSTUD C-Sections:
         a. Available channel depths: 1-5/8”, 2-1/2”, 3-1/2”, 3-5/8”, 4”, 5-1/2” and 6”
         b. Flange widths: 1-1/4”
      2. U-Sections:
         a. Available channel depths: 3/4”, 1-1/2”, 2” and 2-1/2”
         b. Flange width: ½”
   C. ClarkDietrich (Floor Joists):
      1. C Sections:
         a. Available channel depths: 8”, 10”, 12” and 14”
         b. Available flange widths: 1-5/8”, 2” 2-1/2” and 3”
      2. S Sections (CSJ, CSW, CSE and CSS):
         a. Available channel depths: 6”, 8”, 10”, 12” and 14”
         b. Available flange widths: 1-5/8”, 2”, 2-1/2” and 3”
         c. End tracks: T and DT
      3. TradeReady (TDJ3, TDJ5, TDW3 and TDW5) Sections:
         a. Available channel depths: 7-1/4”, 8”, 9-1/4”, 10”, 11-1/4”, 12” and 14”
         b. Available flange widths: 1-3/4” and 2”
c. Hole sizes in webs:
   i. 7-1/4” and 8” deep channels: 4-1/4” x 7” oval holes @ 48” on center
   ii. 9-1/4”, 10” and 11-1/4” deep channels: 6-1/4” x 9” oval holes @ 48” on center
   iii. 12” deep channel: 8” diameter holes @ 48” on center
   iv. 14” deep channel: 10” diameter holes @ 48” on center

d. End tracks: JoistRite rim track

4. Joist Hanger (CDBV and CDMB):
   a. Prefabricated saddle type top flange bearing hangers
   b. Available flange widths: 1-5/8””, 2” and 4”
   c. Available depths: 6”, 8”, 10” and 12”

5. TradeReady Solid Blocking (JB):
   a. Fabricated channels that fit between joists (spaced 12”, 16” and 24” apart) to prevent rotation.
   b. Available depths: 7-1/4”, 8”, 9-1/4”, 10”, 11-1/4”, 12” and 14”
   c. Hole sizes in webs:
      i. 7-1/4” and 8” deep channels: 4-1/4” x 7” oval holes
      ii. 9-1/4”, 10”, 11-1/4”, 12” and 14” deep channels: 6-1/4” x 9” oval holes

6. EasyClip QuickTwist Web Stiffeners (QTWS):
   a. Fabricated channels that provide reinforcement of joist webs to prevent crippling
   b. Available depths: 3-1/2” and 6”
   c. Available lengths: Sized to fit within 7-1/4”, 8”, 9-1/4”, 10”, 11-1/4”, 12” and 14” joists

D. MarinoWARE (Ceiling):
   1. C-Sections:
      a. Available channel depths: 2-1/2”, 3-5/8”, 4”, 6” and 8”
      b. Available flange widths: 1-3/8” and 1-5/8”
   2. U-Sections:
      a. Available channel depths: 3/4”, 1-1/2”, 2” and 2-1/2”
      b. Flange width: ½”

E. MarinoWARE (Floor Joists):
   1. S Sections:
      a. Available channel depths: 6”, 8”, 10”, 12”, 14” and 16”
      b. Available flange widths: 2-1/2”, 3” and 3-1/2”
   2. SW, J, JE, JX and JXW Sections:
      a. Available channel depths: 6”, 8”, 10”, 12” and 14”
      b. Available flange widths: 1-5/8”, 2”, 2-1/2”, 3” and 3-1/2”
      c. End tracks: T and DT
   3. JoistRite (JR) Sections:
      a. Available channel depths: 8”, 10”, 12” and 14”
      b. Available flange widths: 2”, 2-1/2” and 3”
      c. Hole sizes:
         i. 8” deep channel: 5-1/2” diameter holes @ 14” on center
         ii. 10” deep channel: 7” diameter holes @ 28” on center
COLD-FORMED METAL FRAMING

iii. 12” deep channel: 9” diameter holes @ 35” on center
iv. 14” deep channel: 9” diameter holes @ 35” on center
d. End tracks: JoistRite rim track

4. Joist Hanger (BH):
   a. Prefabricated saddle type top flange bearing hangers
   b. Available flange widths: 2-1/8”, 4-1/4” and 6-3/8”
   c. Available depths: 8”, 10”, 12”, 14” and 16”

5. Solid Blocking (JB):
   a. Fabricated channels that fit between joists (spaced 12”, 16” and 24” apart) to prevent rotation
   b. Available depths: 6”, 8”, 9-1/4”, 10”, 11-1/4”, 12” and 14”

6. Web Stiffeners (JS):
   a. Fabricated channels that provide reinforcement of joist webs to prevent crippling.
   b. Available depth: 3-5/8”
   c. Available lengths: Sized to fit within 8”, 9-1/4”, 10”, 11-1/4”, 12” and 14” joists

PART 3 - EXECUTION

3.1 INSTALLATION: GENERAL

A. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

B. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled. Cutting of steel framing shall be by saw, shear or plasma cutting equipment. Oxyacetylene torch cutting is not permitted.

C. Temporary bracing:
   1. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed.
   2. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

D. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

E. Splicing:
   1. Install framing members in one-piece lengths. Splicing of framing components, other than track, is not permitted.
   2. Where splicing of track is necessary between stud spacings, a piece of stud shall be placed between adjacent tracks and fastened by welds or screws to each side of the track, each end.

F. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
H. Gypsum wall board shall be attached to steel studs in accordance with ASTM C840 except that the steel screws used shall be spaced no more than 8” oc at the edges and ends and not more than 12” oc in the field of the board.

I. Connections
   1. Connections shall be designed by the stud manufacturer unless indicated otherwise.
   2. Connections shall be accomplished by using screws or welding.
   3. Welds:
      a. Welds shall of the type, size and location shown in the shop drawings.
      b. Welders, welding operations and welding procedures shall be qualified in accordance with AWS D1.3.
      c. Welds shall be cleaned and coated with a zinc rich paint. Acceptable manufacturers:
         i. ZIRP by Duncan Galvanizing
         ii. Series 90-97 Tneme-Zinc by Tnemec
         iii. Or equal
   4. Screws:
      a. Screws shall be of the type, size, and location shown in the shop drawings.
      b. Screw penetration through joined materials shall not be less than three exposed screw threads.
      c. Contractor shall refer to installation instructions published by the screw manufacturer and ASTM C954 for minimum spacing and edge distance requirements and torque requirements.
      d. Screws shall have a zinc plated protective coating.
      e. Fastening of plywood shear walls to metal studs shall be as indicated on the Drawings. Alternate connections may be used provided they develop resistance to the shear specified in Part 1.4.

5. Concrete Anchors:
   a. Adhesive anchors:
      i. Anchor: AISC Type 316 Stainless Steel threaded rod with washer and nut.
      ii. Adhesive: Epoxy adhesive for anchoring reinforcement to concrete shall be a two-component solid epoxy-based system supplied in manufacturer's standard side-by-side cartridge and dispensed through manufacturer's standard static-mixing nozzle. Except for gel times, epoxy adhesive shall conform to ASTM C881. The Grade, Class and Type of epoxy shall be that which is appropriate for the intended use.
      iii. Epoxy adhesive shall pass the creep test requirements of ICC-ES AC308.
      iv. Acceptable manufacturers: SET-XP or ET-HP by Simpson Strong Tie Co., Inc., HIT-RE 500-SD by Hilti, Inc., or equal.
   b. Expansion anchors:
      i. Stainless steel AISI Type 316 for galvanized and aluminum fabrications; cadmium plated for painted steel fabrications.

c. Anchor Rods: ASTM F1554, Grade 55, S1. Provide color coded grade marking at threaded end of rod
d. Concrete anchors shall not be installed until the 28-day compressive strength of the concrete is obtained.
e. Contractor shall refer to instructions published by the anchor manufacturer for minimum spacing, edge distance and concrete embedment and additional installation requirements.

3.2 INSTALLATION: LOAD BEARING AND NON-LOAD BEARING WALLS

A. General:
1. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as shown on the Shop Drawings.
2. Studs shall be plumbed, aligned and secured to the continuous runner tracks at each end and each side, unless the stud end terminates at a deflection track.
3. Studs shall be spaced at a maximum 24 inches o.c.
4. Track shall rest on a continuous bearing surface. If not provided, install full size shims below track at stud locations or set bottom track in high strength non-shrink grout to ensure a uniform bearing surface.
5. Where splicing of tracks is necessary between studs, a piece of stud shall be placed in the track fastened with two screws or welds per flange to each piece of track.
6. Anchor studs to abutting structural columns or walls, including masonry walls, to provide lateral support of the wall.
7. Horizontal bridging:
   a. Install horizontal bridging in wall studs, spaced vertically in rows indicated on shop drawings but not more than 48 inches apart.
   b. The first rows at the top and bottom shall be within 12 inches of the top and bottom of the wall.
   c. Fasten bridging at each stud intersection.
   d. Install solid blocking between studs at a maximum spacing of 96 inches o.c.
8. 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.
9. 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.
10. Holes shall not be field cut into steel framing members unless specifically permitted by the manufacturer. All cut holes shall be reinforced in accordance with the manufacturer’s recommendations.
B. Load Bearing Walls:
   1. Studs shall be installed seated squarely against the web (within 1/16") of the top and bottom track to assure transfer of axial load. Studs shall be plumbed, aligned and fastened to the continuous top and bottom tracks at each flange before the installation of components which induce axial load.
   
   2. Align floor and roof framing members over the studs such that the offset between the centerline of the floor or roof framing member is no greater than 3/4” from the centerline of the stud. Where framing cannot be aligned as indicated, continuously reinforce track to transfer loads.
   
   3. Vertical alignment of studs shall be maintained at floor/wall intersections to ensure transfer of vertical load.
   
   4. Framed wall openings:
      a. Install headers over wall openings wider than the stud spacing. Fabricate headers of compound shapes indicated or required to transfer load to supporting jambs, complete with clip-angle connectors, web stiffeners, or gusset plates.
      b. Jambs shall be fabricated from studs fastened together using a minimum of two studs per jamb. Jambs shall extend the full height of the wall.
   
   5. Panel Wall assemblies:
      a. All connections shall be complete before hoisting of panel walls.
      b. Installation of panel wall assemblies, as shown in the shop drawings, shall be completed before the attachment of facing materials and the erection of ascending levels.
      c. Vertical alignment of panel walls shall be maintained at floor/wall intersections to ensure transfer of vertical load.
      d. Complete bearing shall be maintained below the panel wall tracks to provide for load transfer of axial loaded panel walls.
   
   6. 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.

C. Non-Load Bearing Walls:
   1. Provisions for Primary Framing Movements: Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support. Unless indicated otherwise, construction shall accommodate a vertical displacement of 1/2 inch.
      a. Install single deep-leg deflection tracks and anchor to building structure.
      b. Install double deep-leg deflection tracks and anchor outer track to building structure.
      c. Connect vertical deflection clips to [bypassing] [infill] studs and anchor to building structure.
      d. Connect drift clips to cold-formed metal framing and anchor to building structure.
   
   2. Provide stud jambs and headers at all wall openings. Individual studs forming the jamb and headers shall be attached together as indicated in the shop drawings.
3.3 INSTALLATION: FLOOR AND CEILING FRAMING (JOISTS)

A. Joists shall be located directly over bearing studs. If joists can’t be located directly over a stud, a load distribution member shall be provided to transfer loads to the studs.

B. 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.

C. 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.

D. Provide web stiffeners at the following locations:
   1. High reaction points such as where the joists frame into other members and where other members frame into the joists.
   2. Where walls bear directly on the joists. Web stiffeners shall be designed to fully transfer the axial loads from the wall above.
   3. Interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement

E. Provide bridging as required and as shown on the Shop Drawing. Fasten bridging at each joist intersection by one of the following methods:
   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.

F. Provide additional framing around all openings.

G. Provide end blocking where joist ends are not otherwise restrained from rotation.

H. All joists shall be completely installed with required web stiffeners, bridging and end blocking prior to applying any load on the joists.

I. Contractor shall not apply construction loads on the joists or the floor or ceiling system that exceeds the rated capacity. Additional structural supports shall be provided directly below heavy construction loads.

3.4 TOLERANCES

A. Fabrication tolerances:
   1. Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

B. Erection tolerances:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Plates and runners: 1/8-inch in 10 feet from a straight line.
   3. Studs: 1/8-inch in 10 feet out of plumb, not cumulative.
      Face of Framing members: 1/8-inch in 10 feet from a true plane.

END OF SECTION
SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Aluminum structural shapes
B. Aluminum nosings
C. Aluminum ladders
D. Aluminum safety gate
E. Steel shapes (that are not included under Section 05120)
F. Anchor rods for steel that is included in this section
G. Steel edge angles
H. Steel bollards
I. Embedded plates
J. Stainless steel pipe railing
K. Miscellaneous fabrications
L. Concrete anchors (post installed)
M. Fasteners
N. Surface preparation, shop coatings and galvanizing

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
A. Embedded edge angles
B. Grating and floor plate embedded support angles
C. Embedded plates

1.3 RELATED SECTIONS
A. Section 01340 - Submittals
B. Section 03300 - Cast-in-Place Concrete
C. Section 03604 - Non-Shrink Grout
D. Section 05120 - Structural Steel
E. Section 05400 - Cold-Formed Metal Framing
F. Section 09900 – Painting
G. Section 09905 – Surface Preparation and Shop Coatings

1.4 REFERENCES
A. This section contains references that are applicable to this Specification Section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel
D. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless
E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
J. ASTM A500/A500M – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
L. ASTM A572/A572M – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
M. ASTM A588/A588M – Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance
N. ASTM A780/A780M – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
O. ASTM A847/A847M – Standard Specification for Cold-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
P. ASTM A992/A992M – Standard Specification for Structural Steel Shapes
R. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus
W. ASTM D523 - Standard Test Method for Specular Gloss
X. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test
Y. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test
AA. ASTM F436/F436M – Standard Specification for Hardened Steel Washers  
BB. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs  
DD. ASTM F1554 – Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength  
EE. ASTM F3125/F3125M – Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 Mpa Minimum Tensile Strength  
FF. Research Council on Structural Connections - Specification for Structural Joints Using High-Strength Bolts  
GG. SSPC Steel Structures Painting Council  
HH. SSPC-SP1 Solvent Cleaning  
II. SSPC-SP2 Hand Tool Cleaning  
JJ. SSPC-SP3 Power Tool Cleaning  
KK. SSPC-SP4 Flame Cleaning of New Steel  
LL. SSPC-SP5 White Metal Blast Cleaning  
MM. SSPC-SP6 Commercial Blast Cleaning  
NN. SSPC-SP7 Brush Off Blast Cleaning  
OO. SSPC-SP8 Pickling  
PP. SSPC-SP9 Weathering and Cleaning  
QQ. SSPC-SP10 Near-White Blast Cleaning  
RR. Aluminum Association Near-White Blast Cleaning  
TT. Aluminum Association Aluminum Standards and Data (2009)  
UU. AWS D1.1/D1.1M Structural Welding Code – Steel - American Welding Society  
VV. AWS D1.2/D1.2M Structural Welding Code – Aluminum -American Welding Society  
WW. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel  
YY. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges  
ZZ. AISC 360 - Specification for Structural Steel Buildings  
AAA. AISC Design Guide 27: Structural Stainless Steel  

1.5 DESIGN REQUIREMENTS  
A. Steel Beam Connections: All bolted connections not detailed on the Drawings shall be sized to support one-half the total uniform load capacity as shown in Table 3-6, of the AISC Steel Construction Manual. If standard connections from Tables 10-1, 10-2 or 10-10b from the AISC Manual of Steel Construction are used, references may be made to these tables for each beam with the appropriate connection load in lieu of design calculations.
1.6 **SUBMITTALS**
A. Submit complete shop drawings showing fabrication, welding, connections, erection, finishes, materials and dimensions including plans, elevations, sections and details of all metal fabrications and connections and location of item in structure. Photocopies of Contract Drawings, in whole or part, will not be accepted as shop drawings.
B. Submit product data in accordance with the provisions of Section 01340.
C. Submit railing samples indicating surface quality, welding and finish when requested by the Engineer.
D. Submit certification from galvanizer stating that galvanizing is in accordance with Specifications.
E. Submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificates shall be accompanied by a current certificate by the welder attesting to the fact that they have been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

1.7 **QUALITY ASSURANCE**
A. Conform to AISC Manual of Steel Construction for the design, fabrication and erection of steel.
B. Conform to AWS D1.1/D1.1M for welding of steel.
C. Conform to the Aluminum Design Manual for the design, fabrication and erection of structural aluminum shapes.
D. Conform to AWS D1.2/D1.2M for welding of structural aluminum shapes.
E. Conform to AWS D1.6/D1.6M for welding of structural stainless steel shapes.

1.8 **COORDINATION**
A. The Contractor shall coordinate with the work of other Sections. Verify at the site both the dimensions and the work of other trades adjoining items before fabrication and installation of items herein specified.
B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.9 **FIELD MEASUREMENTS**
A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and conditions and to ensure proper fitting of all items.
B. Templates of channel and tank configuration shall be made for the installation of grating or checkered plate for the areas to be covered.

1.10 **DELIVERY, STORAGE, HANDLING**
A. Coordinate delivery of products.
B. Protect products from damage prior to and after installation.
C. Remove damaged material from the site.
PART 2 - PRODUCTS

2.1 WELDED ALUMINUM GUARDS AND HANDRAIL

A. Material
1. Miscellaneous Plates: Aluminum Alloy 6061-T6
2. Hinges: AISI Type 316 Stainless Steel. Provide a minimum of 2 hinges per plate section.

B. Fabrication
1. Provide for thermal expansion and contraction.
2. Cuts shall be squared and free of burrs.
3. Post spacing not to exceed 4'-0" on center.

C. Welding
1. Miter and cope intersections of posts and rails and weld all around. All corners at end loops shall be fabricated with a radius (mitered corners shall not be permitted)
2. Fuse without undercutting or overlap.
3. Weld corners and seams continuously in accordance with AWS. Welds to be smooth.
4. Remove splatter, grind exposed welds where necessary and contour and blend surfaces to match those adjacent.
5. Discoloration of finished surfaces will not be acceptable.
6. Welding electrode; filler alloy 5356.

D. Finish:
1. Clear anodized (AA M12C22A41) in accordance with the Aluminum Association, after fabrication and welding.

2.2 ALUMINUM STRUCTURAL SHAPES

A. Material: Aluminum Alloy 6061-T6: ASTM B308/B308M.
B. Welding: filler alloy 5356.
C. Finish: Mill.

2.3 ALUMINUM LADDERS

A. Material: Aluminum Alloy 6063-T6 (ASTM B221) or Aluminum Alloy 6061-T6 (ASTM B308/B308M).
B. Finish: Clear Anodized (AA M12C22A41)
C. Welding: filler alloy 5356
D. Rails: Minimum sizes L3x3x1/4 with 2'-0" clear opening unless indicated on the Drawings.
E. Rungs:
1. 1-inch square or 1-inch diameter extruded aluminum bar with serrated, corrugated or knurled non-slip surface. Grit tape or grit paint shall not be permitted.
2. Prefabricated aluminum rungs with serrated, corrugated or knurled non-slip surface:
   a. Type 950 Ladder Tread by Wooster Products, Inc.
   b. Diamondback by McNichols
2.4 ALUMINUM SAFETY GATE
A. Safety gate shall be a prefabricated, spring-assisted, self-closing safety gate intended to be a physical continuation of adjacent guard systems or to cover openings in step through ladders.
B. Construction Details:
   1. Safety gate shall consist of a 3-sided continuous loop with a minimum of 2 spring-activated hinge brackets welded to a hinge plate on one side and a striker plate on the opposite side.
   2. All gates shall be designed to meet or exceed OSHA requirements for dimensions and load requirements.
   3. Gate shall have a minimum of 3.75 inches of width adjustment to ensure proper fit.
   4. Gate dimensions:
      a. Nominal opening [18] [21] [24] [27] [30] [33] [36] [40] [44] [48] inches. Reduction in clear width will be required for face mount applications.
      b. Height = 22.25 inches
   5. Gate shall come fully assembled, including hardware and brackets for mounting to either circular guard posts or angles as indicated on the Contract Drawings. Mounting shall be by either clamping to guard posts (with U-bolts) or bolting through the ladder rail. Pop rivet connections shall not be permitted.
   6. Provide a “safety first” placard on the hinge plate.
   7. All safety gate assemblies shall be from a single manufacturer.
   8. Manufacturer must demonstrate a minimum of five (5) years of successful experience in design and manufacture of similar products.
C. Materials:
   1. Gate loop: Minimum 1.25-inch square tube. Aluminum Alloy 6061-T6
   2. Springs: Type 316 Stainless Steel
   3. Hardware: Type 316 Stainless Steel
   4. Hinge plate assembly and brackets: Aluminum Alloy 6061-T6
   5. Striker plate: Aluminum Alloy 6061-T6
   6. Finish: Mill
D. Warranty: The manufacturer shall provide a warranty on this product and components to be free from manufacturing defects for a period of one (1) year from Date of Substantial Completion.
E. Acceptable manufacturers:
   1. PS Doors (Model LSG-24-ALU)
   2. Fabenco (Model A82-24), by Tractel
   3. Or equivalent

2.5 STEEL BOLLARDS
A. Material: ASTM A53/A53M Grade B
B. Finish: Hot-Dipped Galvanized (ASTM A123/A123M) and painted
C. Size as indicated on the Drawings
2.6 FLOOR PLATES
A. Aluminum:
   1. Material: Alloy 6061-T6 (ASTM B209/B209M)
   2. Finish: Mill
B. Steel:
   1. Material: ASTM A36/A36M
   2. Finish: Hot-Dipped Galvanized (ASTM A123/A123M)
C. Style: Checkered (diamond) type with raised lug pattern with stiffeners as indicated on the Drawings.
D. Lift Handles: Provide 2 per plate section unless otherwise noted.
E. Maximum gap between adjacent plate sections and between edges of grating and support members: 0.125 inches
F. Fabrication Tolerances:
   1. Camber - Plate span / 360 - maximum 1/8 inch.
   2. Differential camber between adjacent plates: 1/16 inch.
   3. Other tolerances as specified in ASTM B209/B209M.

2.7 PLATES
A. Includes plates embedded in concrete and other miscellaneous plates not specified elsewhere.
B. Aluminum:
   1. Material: Alloy 6061-T6 (ASTM B209/B209M)
   2. Finish: Mill
C. Steel:
   1. Material: ASTM A572/A572M (Grade 50)
   2. Finish: Hot-Dipped Galvanized (ASTM A123/A123M)
D. Stainless Steel:
   1. Material: AISI 316
   2. Finish: Mill

2.8 MISCELLANEOUS FABRICATIONS
A. Includes other miscellaneous metal fabrications and assemblies shown on the Contract Drawings but not specified elsewhere.
B. Stainless Steel Fabrications:
   1. Structural shapes (beams, angles and channels)
      a. Material: AISI Type 316
      b. Finish: Mill
   2. Bars, plates and sheets
      a. Material: AISI Type 316
      b. Finish: Mill
C. Headed Shear Studs:
   1. Steel:
      a. Material: Low Carbon Steel, ASTM A29/A29M or ASTM A108: Grades 1010 – 1020 (chemical properties) and AWS D1.1 (physical properties)
      b. Strength: Minimum yield strength: 49 ksi
      c. Finish: Hot Dipped Galvanized ASTM A153/A153M
      d. Manufacturer: Nelson Stud Welding (Type 4HL or 3SL) or equal
2. **Stainless Steel:**
   a. **Material:** Stainless steel: ASTM A276/A276M or ASTM A493
   b. **Strength:** Minimum yield strength: 35 ksi
   c. **Manufacturer:** Nelson Stud Welding (Type 4HL or 3SL) or equal

D. **Safety Chain:**
   1. **Material:** Steel (Hot-Dipped Galvanized) [or Aluminum].
   2. **Straight link type:** Minimum 3/16” diameter with a minimum 12 links per foot.
   3. **Provide boat type snap hooks.**
   4. **Test safety chain in accordance with ASTM A467/A467M, Class CS**

2.9 **FASTENERS**

A. **Concrete anchorage:**
   1. Expansion and Epoxy Anchors are specified in Section 03300.
   2. **Anchor Rods:** Material: ASTM F1554 Grade 55, S1, threaded and headed
      b. **Finish:** Hot-Dipped Galvanized ASTM A153/A153M

B. **Bolted Joints:**
   1. **Aluminum Fabrications:** Stainless Steel ASTM F593 & F594 Alloy Group 2 (Type 316)
   2. **Steel Fabrications (specified in this Section):**
      a. **Bolts:** ASTM F3125/F3125M Grade A325 Type 1, Style Heavy Hex
      b. **Nuts:** ASTM A563/A563M Heavy Hex.
      c. **Washers:** ASTM F436/F436M.
      d. **Finish:** Painted for painted steel fabrications and hot-dipped galvanized for hot-dipped galvanized steel fabrications (ASTM A153/A153M)

   3. **Weathering Steel:** Bolts ASTM F3125/F3125M, Grade A325, Type 3, Style Heavy Hex [Grade F1852 Type 3 (twist-off tension control assemblies)]
   4. **Stainless Steel Fabrications:** Stainless Steel ASTM F593 & F594 Alloy Group 2 (Type 316).

C. **Provide all fasteners with nuts, flat washers and lock washers of the same material as the anchors or bolts. Provide beveled washers for sloped surfaces.**

D. **Provide a minimum of 2 fasteners per connection.**

PART 3 - EXECUTION

3.1 **FABRICATION**

A. **All miscellaneous metal members shall fit closely together and shall be straight and true, and the finished work shall be free from burrs, bends, twists, and open joints.**

B. **Tolerances:**
   1. **Squareness:** 1/8-inch maximum difference in diagonal measurements.
   2. **Maximum Offset between faces:** 1/16-inch.
   3. **Maximum misalignment of adjacent members:** 1/16-inch.
   4. **Maximum Bow:** 1/8 inch in 48 inches.
   5. **Maximum Deviation from Plane:** 1/16 inch in 48 inches.

C. **All holes, angles, supports, and braces shall be provided as required.**

D. **Except as otherwise indicated on the drawings, gusset plates shall have a minimum thickness of 3/8 inch.**

E. **Holes shall be made in steel members for attachment of wood blocking, nailers, etc.**
Holes shall be sized to suit the fasteners indicated on the drawings: where size and spacing are not indicated, holes shall be 9/16-inch diameter, at 3 feet o.c.

F. Sheared and thermal cut edges shall be true to line and free from rough corners and projections.

G. Re-entrant cuts/corners shall be filleted to a radius of not less than ½ inch.

H. Holes shall be punched, subpunched and reamed, or drilled in accordance with AISC "Specifications for Structural Steel." Holes shall not be made by torch cutting.

I. Holes shall be 1/16 inch larger than the nominal bolt diameter, except holes for cast-in-place anchor bolts which shall be 5/16 inch larger than the nominal bolt diameter and as otherwise shown on the Drawings.

J. The use of oversize or slotted holes not shown on the Drawings shall be subject to prior review by the Engineer.

K. Bent plate shall be in accordance with AISC "Minimum Radius for Bending."

L. Column ends bearing upon base and cap plates and beam ends with end plates shall be saw-cut or milled to true surfaces and correct bevels.

M. Column caps and base plates and beam end plates shall have full contact when assembled.

N. Welding shall be done in a sequence which minimizes distortion and shrinkage.

O. Fabrication holes, notches, etc. not required by nor shown on the Drawings shall be subject to prior review by the Engineer.

3.2 CONNECTIONS (GENERAL)

A. All steel framing connections not detailed on the Drawings shall be either shop-welded, field-bolted or all field-bolted connections designed by the fabricator subject to the provisions of the design drawings, specifications and AISC 360. All connections shall be designed to support [one-half the total uniform load capacity of the framing member as shown in Table 3-6 of the AISC Manual of Steel Construction.] [the reactions indicated on the Drawings]. Fabricator shall use the ASD (Allowable Stress Design) in the connection designs. Connections shall be one of the following:

1. All-bolted double angle connections (Table 10-1)
2. Bolted/welded double-angle connections (Table 10-2)
3. Bolted/welded shear end-plate connections (Table 10-4)
4. Single-plate connections (Table 10-10b)

B. All aluminum framing connections not detailed on the Drawings shall be bolted connections designed by the fabricator subject to the provisions of the design drawings, specifications and the referenced Aluminum Design Manual. All connections shall consist of a minimum of 2 – L3x3x1/4 angles with 2 – ¾ inch diameter AISI Type 316 bolts between each angle and framing member.

C. The axes of axially loaded members which meet at a point shall intersect at the point (unless otherwise indicated).

D. Except as otherwise shown, where three or more members are joined, their centroidal lines of action shall meet at a common point, and there shall be no eccentricity.

E. Accessory material not indicated on the design drawings, intended to be left in place on the completed structure by the erector, shall be indicated on the shop drawings. Where so indicated by the Engineer on the shop drawings, such items shall be
removal before acceptance of the completed work.

F. At the time of connecting, all contact surfaces shall be free from loose or non-adherent rust, loose mill scale, oil, grease, dirt, mud, and any foreign matter, coating, or defect that might adversely affect the connection.

G. At the time of connecting, all faying surfaces at Slip-Critical bolted connections shall be prepared in accordance with the requirements of RCSC Specification Section 3.2.2.

3.3 CONNECTIONS (BOLTED)

A. All bolted connections shall conform to the following:

B. All connections shall have a minimum of two bolts and the minimum bolt size shall be ¾ inch (unless otherwise indicated).

C. Bolts shall be of proper length, and the end of the bolt shall be at least flush with the outer face of the nut. Bolts projecting more than 5/8-inch beyond the face of the nut in exposed work shall be cut off close to the nut as directed by the Engineer. If tension control (twist-off) bolts are used in exposed work in other than Pretensioned and Slip-Critical connections (where the splined bolt extensions are twisted off during installation), the splined bolt extensions shall be removed.

D. All bolts shall have washers between the tightened element and the structural member. Beveled washers shall be used where flange slope exceeds 1:20.

E. All bolts or nuts once tightened shall not be loosened then re-used. Care shall be taken not to damage the threads of high strength bolts during installation. Joints shall be properly aligned and drifted and holes reamed, if required, to permit bolts to be slipped into place by hand. No burning is allowed for hole adjustment.

F. Snug-Tightened Connections:
   1. Snug-Tightened condition shall be defined as that tightness attained with a few impacts from an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected elements into firm contact.
   2. All bolts identified as Snug-Tightened shall be tightened to a Snug-Tight condition with either spud wrenches or pneumatic impact wrenches.
   3. All bolted connections shall be Snug-Tightened N-type bearing unless otherwise indicated on The Drawings.
   4. This type of connection applies to both steel and stainless steel bolts.

G. Finger-Tightened Connections:
   1. Where connections are indicated to be “finger-tight”, the connection is to first be snugged up to ensure that all plies are in contact. The nuts shall then be backed off between one-half and one turn to permit the intended movement of the connection. The bolts shall be provided with double nuts to prevent loosening.
   2. This type of connection applies to both steel and stainless steel bolts.

H. Slip-Critical Connections:
   1. Slip-Critical connections shall be provided as follows:
      a. Where indicated on the Drawings.
b. Where oversized holes are used.
c. Where slotted holes are used, except where the direction of the applied load is normal to the slot.

2. This type of connection applies to both steel and stainless steel bolts.

3. All bolts in Slip-Critical connections shall be tightened (pre-tensioned) with one of the methods specified in RCSC Specification 8.2.1 through 8.2.4. Minimum bolt pretension shall be per RCSC Specification Table 8.1.

4. Pre-Installation Verification: The fastener assemblies and pre-tensioned installation procedures shall be tested according to the procedures specified in RCSC Specification Section 7, as required by Section 8.2, to verify the minimum bolt pretension forces can be achieved:
   a. All tests shall be performed by a tension calibrator (such as those manufactured by Skidmore-Wilhelm).

I. Epoxy anchors shall be tightened to 80% of the epoxy manufacturers recommended maximum torque using a calibrated torque wrench.

J. An Independent Testing Firm (hereafter referred to as “Inspector”), selected and paid for by the Owner, will inspect the bolted connections in accordance with Section 9 of the RCSC Specification as follows:
   1. Snug-Tightened Connections: The Inspector will visually inspect the Snug-Tightened bolted connections. The visual inspections shall consist of the following (in accordance with Section 9.1 in the RCSC Specification):
      a. Verification that the proper components were used in the connection.
      b. Verification that the plies of connecting elements have been brought into firm contact.
      c. Additional non-destructive tests as required by the Engineer.
   3. After inspection, if the joint is satisfactory it shall be marked by the Independent Testing Firm with a symbol which indicates that the work is completed and is satisfactory. If the joint is unsatisfactory, it shall be repaired or removed and replaced with a new bolted connection to the Engineer’s satisfaction.
   4. If it is discovered that bolts marked as approved by the Inspector are not in compliance with the requirements of this section and the referenced specification, codes, or authorities, the erector's bolting and inspecting procedures shall be revised as required by the Engineer before any of the remaining bolts are installed.
   5. The Engineer reserves the right to inspect and test all bolted connections. The costs for this additional testing will be borne by the Owner.

3.4 CONNECTIONS (SHOP AND FIELD WELDING OF FERROUS METALS)
A. Welding shall be only for the connections and assemblages shown on the drawings or specified herein, and shall be performed in the shop, except where specifically noted to be done in the field.
B. All welding shall be done only by certified welders using welding procedures and welding equipment in accordance with AWS D1.1/D1.1M. Welders employed on the work shall be experienced structural welders, previously qualified by tests as prescribed in AWS D1.1/D1.1M using the base metals and electrodes specified
herein.

C. Welding materials and workmanship shall conform to AWS D1.1/D1.1M. All welds shall be considered Prequalified if they conform to the Pre-qualified joints specified in Chapter 3 of AWS D1.1/D1.1M.

D. Welding electrodes shall conform to the requirements of AWS D1.1/D1.1M and shall be the E70XX series.

E. Welding shall be by the manual shielded metal arc process. If the fabricator wishes to use other processes, full details of materials, equipment, and procedures shall be submitted to and approved by the Engineer before any welding, other than as specified herein, is performed.

F. All welds shall be free of undercut, unfilled craters, and cracks, and shall have smoothly faired contours. Flux and loose scale shall be removed from previous weld bead before succeeding bead is laid. Exposed welds shall be ground smooth.

G. All temporary (tack) welds shall meet all the specified requirements of the final welds. Tack welds that will be incorporated into the final weld shall be cleaned and thoroughly fused with final weld. Defective, cracked or broken tack welds shall be removed before final welding. Tack welds not incorporated into the final weld shall be removed.

H. No welding shall be performed during the following weather conditions:
   1. Ambient temperature in the immediate vicinity of the weld is below 0°F,
   2. If the welded surfaces are wet or are exposed to rain or snow,
   3. High wind velocity. A temporary wind shelter may be used in order to reduce the wind directly exposed to the weld to a maximum of 5 mph,
   4. Other inclement conditions that will hamper good workmanship.

I. Welds other than those indicated on the design drawings may be used only if reviewed and no exceptions are taken by the Engineer.

J. Welding of shear studs shall be in accordance with Section 7 of AWS D1.1/D1.1M.

K. When welding is unsatisfactory or indicates inferior workmanship as determined by the Engineer, the welds shall either be repaired or removed and rewelded. Where requirements prescribe the removal of part of the weld or a portion of the base metal, such removal shall be by machining, grinding, chipping or machining. All weld repairs shall be proposed by the General Contractor and reviewed by the Engineer with No Exceptions Taken. Defective or unsound welds shall be corrected either by removing and replacing the entire weld, or as follows:
   1. Overlap, excessive convexity or excessive reinforcement: Reduce to size by removal of excess weld metal.
   2. Cracks in weld or base metal: The extent of the crack shall be verified by acid etching, MT or PT methods. The crack and sound metal 2 inches beyond each end of the crack shall be removed and re-welded.
   3. Excessive concavity of weld or crater, Undersize welds, Undercutting: Clean and deposit additional weld metal.
   4. Incomplete fusion, excessive weld porosity or slag inclusions: Remove and replace the defective portions of weld.
   5. Removal of adjacent base metal during welding: Clean and reform base metal full size by depositing additional weld metal.
6. Base metals distorted from welding: Straighten by mechanical means or by application of a limited amount of localized heat.

L. Where work performed subsequent to the making of a deficient weld has rendered the weld inaccessible or has caused new conditions which would make the correction of the deficiency dangerous or ineffective, the original conditions shall be restored by removal of welds or members or both before making the necessary corrections, or else the deficiency shall be corrected by additional work according to a revised design approved by the Engineer.

M. In the event that faulty welding or its removal for re-welding, shall so damage the base metal that in the judgment of the Engineer its retention is not in accordance with the intent of the Drawings and Specifications, the Contractor shall remove and replace the damaged material at no additional cost to the Owner.

N. Erector shall perform the following inspection of the welding operation and welds:
   1. Verification inspection of the welding materials and procedures and the welder's qualifications,
   2. Visual inspection of all shop and field welds at the jobsite,
   3. UT (Ultrasonic Testing) of all complete penetration welds
   4. Magnetic Particle (MT) of all fillet welds
   5. Additional testing, such as PT (Liquid Penetrant Testing), Dye Penetrant Testing (DP), MT or UT may be performed at the discretion of the Independent Testing Firm.
   6. Acceptance of welds shall be based on Chapter 6 of the AWS Structural Welding Code.

3.5 CONNECTIONS (WELDING ALUMINUM)
A. Structural welds shall be made by qualified welders and shall conform to AWS D1.2/D1.2M.
B. All aluminum welding shall be done by the inert gas shielded arc or fluxless resistance techniques.
C. Welded assemblies to be anodized shall be designed so that faying surfaces are free-rinsing and will not trap anodizing solutions.
D. Where at all possible, welds in assemblies to be anodized shall be located so as to conceal visible discoloration in the heat-affected zone.
E. Where weld metal must be exposed after anodizing, filler alloys shall be selected to closely match the composition of the base metal. Follow parent metal manufacturer's recommendations for such filler alloys.
F. Where weldments are to be made on materials that have been previously anodized, the area of fusion shall be free of the anodic film prior to welding. Parts to be so welded shall be masked during anodizing or sanded clean in the weld areas. Only weldments that will be concealed may be so made. Crazing or discoloring of the anodic coating in the weld area will not be acceptable in exposed areas.
G. Weldments on exposed finished surfaces shall be ground and/or polished to match and blend with finish of adjacent parent metal.
H. Dirt, grease, lubricant, or other organic material shall be removed by vapor degreasing or suitable solvent prior to welding.
I. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter, or tramp metal.
J. When welding is unsatisfactory or indicates inferior workmanship as determined by the Engineer, corrective measures shall be required. Where requirements prescribe the removal of part of the weld or a portion of the base metal, such removal shall be by machining, grinding, chipping or machining. All weld repairs shall be proposed by the General Contractor and reviewed by the Engineer with No Exceptions Taken.

K. Joints rejected because of welding defects may be repaired only by re-welding. Defective welds shall be removed by chipping or machining. Flame cutting shall not be used.

L. An Independent Testing Firm, selected and paid for by the Owner, will perform the following inspection of the welding operation and welds:
   1. Verification inspection of the welding materials and procedures and the welder's qualifications,
   2. Visual inspection of all shop and field welds at the jobsite,
   3. Ultrasonic Testing (UT) of all complete penetration welds
   4. Additional testing, such as Liquid Penetrant Testing (PT), Dye Penetrant Testing (DP), MT or UT may be performed at the discretion of the Independent Testing Firm.
   5. Acceptance of welds shall be based on Chapter 6 of AWS D1.2/D1.2M.

3.6 ERECTION AND INSTALLATION

A. All metals shall be properly located, aligned, leveled and plumbed. All items embedded in or connected to other substrates shall be properly coordinated and installed.

B. General Contractor shall verify elevations of concrete, masonry or other bearing surfaces and locations of anchor rods, bearing plates, and other embedded items. Anchor rod templates shall be used to set anchor rods.

C. Columns and base plates shall be set and accurately plumbed and leveled.

D. Installation of grout for the column base plates shall be performed under Section 03604. Structural grouting shall be non-shrink and conform to the requirements of Section 03604. No load shall be applied to grout until five days after the plate has been grouted.

E. Camber of beams shall be that indicated on the Drawings. Where no camber is indicated, any minor camber resulting from rolling or shop assembly shall be upward.

F. The use of a gas cutting torch in the field for correcting fabrication errors will not be permitted upon any primary member of the structural framing. The use of a gas cutting torch will be permitted only on secondary members, and then only after the review and no exceptions taken by the Engineer.

G. Top edge of weir plates shall be set straight, true and accurately to the elevations indicated on the Drawings.

H. Weir crests shall be adjusted level after filling the tanks with water.

I. Coat surfaces of the following metals in contact with masonry, concrete, grout or dissimilar metals with Polyamide Epoxy Primer:
   1. Cast iron
   2. Aluminum

J. Guards:
   1. Splice pipe rails in field with internal sleeves fastened at one end and free at the other end.
2. Install railing in accordance with manufacturer’s recommendations.
3. Provide smooth end loops to all cut guards.
4. Provide expansion sleeves in guards for continuous runs greater than 20 feet in length.

K. Install grating and floor plate angle supports at all perimeters of covered openings. All angles shall be embedded in the concrete unless indicated otherwise.

L. Attach ladders to structures at a maximum of 4 feet on center unless otherwise indicated.

M. Safety Gates:
   1. Protect installed product and finish surfaces from damage during handling, storage, and installation.
   2. Install safety gates in accordance with manufacturer’s recommendations. Ensure proper fit of the gates within the ladder rails or guard posts.

3.7 GALVANIZING

A. Acceptable manufacturers:
   1. Duncan Galvanizing, Everett, MA
   2. Connecticut Galvanizing, Glastonbury, CT
   3. V&S Taunton Galvanizing, LLC, Taunton, MA

B. All galvanizing processes, materials and systems described herein are based on Duncan Galvanizing, Everett, MA. Equivalent systems by other galvanizing plants will be permitted provided they meet the requirements of the Specification.

C. Provide hot-dipped galvanizing coatings to all structural steel and hardware as indicated on the Drawings and herein. Galvanizing coating shall consist of one of the following products:
   1. Duragalv
   2. Primergalv
   3. Colorgalv
   4. Thermogalv

D. Duragalv
   1. Duragalv coating shall consist of a zinc rich galvanized coating surface without additional finishes.
   2. Hot-dip galvanize all fabricated items in accordance with ASTM A123/A123M and hardware items in accordance with ASTM A153/A153M.
   3. Prior to galvanizing, drill vent and drain holes in hollow steel shapes as required by the galvanizer.
   4. Galvanizing process shall consist of the following steps:
      a. Degreasing - Immerse the steel in an acid degreasing bath or caustic solution in order to remove the dirt, oil, and grease from the surface of the steel. After degreasing, the steel is rinsed with water.
      b. Pickling – Immerse the steel in an acid tank filled with either hydrochloric or sulfuric acid, which removes oxides and mill scale. After all oxidation has been removed from the steel, it is again rinsed with water.
      c. Fluxing - Immerse the steel in an acid tank filled with a combination of zinc chloride and ammonium chloride. The flux shall clean the steel of all oxidation developed since the pickling of the steel and to create a
protective coating to prevent the steel from any oxidizing before entering the galvanizing kettle.

d. After being immersed in the Degreasing, Pickling, and Fluxing tanks, the surface of the steel shall be completely free of any oxides and any other contaminants that might inhibit the reaction of the iron and liquid zinc in the galvanizing kettle.

e. Galvanizing – The galvanizing process shall include the following steps:
   i. Immerse the steel in a galvanizing kettle containing liquid zinc.
   ii. The zinc shall be at least 98% pure and shall be heated to a temperature ranging from 820-860 F, at which point the zinc is in its liquid state.
   iii. The steel products shall be immersed into the galvanizing kettle and remain in the kettle until the temperature of the steel has reached the temperature required to form a hot-dip galvanized coating.
   iv. Once the inter-diffusion reaction of iron and zinc is completed, the steel product is withdrawn from the zinc kettle.
   v. Excess zinc shall be removed by draining or vibrating.
   vi. The finished product shall be inspected by using a variety of simple physical and laboratory tests to determine thickness, uniformity, adherence and appearance.

5. Fill vent holes after galvanizing, if applicable, and grind smooth.

6. Galvanize items after assembly when possible.

7. Galvanizing shall provide a visually acceptable coating and shall be free of lumps, globules, sharp edges or heavy deposits which will interfere with intended use or aesthetic appearance of materials. The Galvanized surface shall exhibit a rugosity (smoothness) of 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

8. Warranty: Provide galvanizer's standard warranty stating that finished galvanized surfaces will be free from 10 percent or more visible rust for 20 years.

E. Primergalv

1. Primergalv coating shall consist of a zinc rich galvanized coating surface with an additional factory applied primer finish.

2. Apply Duragalv coating to the steel as specified above.

3. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer shall have a two year re-coat window for application of finish coat.

4. Primer shall be certified to have a VOC limit less than 2.8 lbs/gal and conform to EPA and local requirements. Primer shall meet or exceed the following performance criteria:
   a. Abrasion Resistance: ASTM D4060 (CS17 Wheel, 1,000 grams’ load) 1 kg load, 200 mg loss.
c. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours, 10 per ASTM D714 for blistering; 7 per ASTM D610 for rusting.
e. Flexibility: ASTM D522, 180 degrees’ bend, 1-inch mandrel, Passes.
f. Pencil Hardness: ASTM D3363, 3H.
g. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours, Passes with no cracking or delamination.
h. Dry Heat Resistance: ASTM D2485, 250 degrees F.
j. Salt Fog Resistance: ASTM B117, 5,600 hours No cracking or blisters.

5. Primer shall exhibit a rugosity (smoothness) of 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

6. Warranty: Provide galvanizer's standard warranty stating that finished galvanized and primed surfaces will be free from 10 percent or more visible rust for 20 years.

F. Colorgalv
1. Colorgalv coating shall consist of a zinc rich galvanized coating surface with an additional factory applied architectural coating.
2. Apply Duragalv coating to the steel as specified above.
3. Apply polyamide epoxy primer within 12 hours after galvanizing at the same galvanizer’s plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
4. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer’s plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer.
5. Coatings shall be certified VOC compliant and conform to applicable regulations and EPA standards.
6. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
7. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing at the galvanizer’s plant. If blasted, galvanizer shall certify that rugosity standards are met.
8. Primer shall meet or exceed the following performance criteria:
   a. Abrasion Resistance: ASTM D4060 (CS17 Wheel, 1,000 grams’ load) 1 kg load, 200 mg loss.
   c. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours, 10 per ASTM D714 for blistering; 7 per ASTM D610 for rusting.
   e. Flexibility: ASTM D522, 180 degrees’ bend, 1-inch mandrel, Passes.
f. Pencil Hardness: ASTM D3363, 3H.
g. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours, Passes with no cracking or delamination.
h. Dry Heat Resistance: ASTM D2485, 250 degrees F.
j. Salt Fog Resistance: ASTM B117, 5,600 hours No cracking or blisters.

9. Topcoat shall meet or exceed the following performance criteria:
a. Abrasion Resistance: ASTM D4060, CS17 Wheel, 1,000 cycles 1 kg load, 87.1 mg loss.
d. Salt Fog Resistance: ASTM B117, 9,000 hours, Rating 10 per ASTM D714 for blistering, Rating 9 per ASTM D610 for rusting.
e. Pencil Hardness: ASTM D3363, F.
f. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 1000 hours, No blistering or delamination.
g. Xenon Arc Test: ASTM D4798, Pass 200 hours.
i. Thermal Shock: ASTM D2246, 15 cycles, Excellent.

10. Topcoat shall exhibit a rugosity (smoothness) of 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

11. Warranty: Provide galvanizer’s standard warranty stating that finished galvanized and coated surfaces will be free from 10 percent or more visible rust for 20 years.

G. Colorgalv Thermoset
1. Colorgalv Thermoset coating shall consist of a zinc rich galvanized coating surface with an additional factory applied heat cured architectural coating.
2. Apply Duragalv coating to the steel as specified above.
3. Apply High-Performance Thermosetting Based Coating. Factory-applied metal coatings shall be applied in a facility acceptable to the coating manufacturer. Factory applied coating shall include an architectural grade primer. Full cure of the coating system shall be verified by the coating manufacturer’s recommended test methods.
4. Thermoset coating shall meet or exceed the following criteria as established by the coating manufacturer.
b. Hardness: ASTM D3363 (pencil), H min.
e. Humidity: ASTM D2247, 3000 hours, few #8 blisters.
g. Color Retention: ASTM D2244, 5 years less than or equal to 5 delta E.
h. Chalk Resistance: ASTM D4214, #8 rating.
i. Gloss Retention: ASTM D523, greater than or equal to 30 percent retention.
j. Erosion Resistance: ASTM B244, less than 10 percent film loss.
k. Compliance: AAMA 2604.

5. Warranty: Provide galvanizer’s standard warranty stating that finished galvanized and coated surfaces will be free from 10 percent or more visible rust for 20 years.

H. Galvanizing Thickness
1. The minimum thickness of zinc coating (in ounces/square foot) on steel shapes shall conform to Table 1 below:

<table>
<thead>
<tr>
<th>Table 1 - Zinc Coating Thickness (oz/sf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Thickness (in)</td>
</tr>
<tr>
<td>Shapes and Plates</td>
</tr>
<tr>
<td>Strips and Bars</td>
</tr>
<tr>
<td>Pipe and Tube</td>
</tr>
</tbody>
</table>

2. The minimum thickness of zinc coating (in ounces/square foot) on steel fasteners shall conform to Table 2 below:

<table>
<thead>
<tr>
<th>Table 2 - Zinc Coating Thickness (oz/sf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastener</td>
</tr>
<tr>
<td>Class A – Castings: Malleable Iron and Steel</td>
</tr>
<tr>
<td>Class B – Rolled, pressed and forged articles</td>
</tr>
<tr>
<td>B1 - 3/16-inch and over in thickness and over 15 inches in length</td>
</tr>
<tr>
<td>B2 - Under 3/16-inch in thickness and over 15 inches in length</td>
</tr>
<tr>
<td>B3 – Any thickness and 15 inches and under in length</td>
</tr>
<tr>
<td>Class C - Fasteners over 3/8-inch diameter. Washers 3/16 inch and ¼-inch thick</td>
</tr>
<tr>
<td>Class D - Fasteners 3/8-inch and under in diameter, rivets and nails. Washers under 3/16-inch in thickness</td>
</tr>
</tbody>
</table>

I. Touch up and repair: After erection, touch-up all damaged galvanized and coated surfaces and field welds as follows:
1. Unless otherwise indicated, all touch up and repairs to galvanized surfaces shall be in strict accordance with the manufacturer’s recommendations.
2. Surfaces to be reconditioned with zinc-rich paint shall be clean, dry, and free of oil, grease and corrosion.
3. Areas to be repaired shall be power disc sanded to bright metal. To ensure that a smooth reconditioned coating can be effected, surface preparation shall extend into the undamaged galvanized coating.
4. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A780/A780M. Galvanizing repair paint shall have 65-95 percent zinc by weight.
5. The paint shall be spray applied in multiple coats until a dry film thickness of 4-6 mils minimum has been achieved.
6. Coating thickness shall be verified by measurements with a magnetic or electromagnetic gauge.
7. Repair Paint:
   a. ZIRP by Duncan Galvanizing
   b. Tneme-zinc by Tnemec
   c. Or equivalent

3.8 SURFACE PREPARATION AND SHOP COATINGS
A. Provide Surface Preparation and Shop Coatings in accordance with specification Section 09905.
B. The following surfaces shall not be shop coated:
   1. Weathering steel (weathering steel shall be shop cleaned in accordance with SSPC SP6).
   2. Galvanized steel not specified to be painted.
   3. Steel surfaces embedded in concrete or masonry.
   4. Surfaces that will receive fireproofing material.
   5. Faying surfaces at Slip Critical connections.
C. Shop coats shall be compatible with and made by the same manufacturer as the field topcoats as specified in Section 09900. Contractor shall coordinate the installation of the topcoats with the shop coats.
D. After erection touch-up all abrasions and field welds with same material used on shop coating.

3.9 CLEANING
A. Clean surfaces of all work of this section as well as the areas in the vicinity.

3.10 PROTECTION
A. Protect installed work from:
   1. Splatter or debris from adjacent construction.
   2. Excess construction loading and use.

END OF SECTION
SECTION 06100
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Temporary enclosures.
   B. All rough lumber, including wood nailers, posts, plates, blocking, strapping, and lumber bases for mechanical and electrical equipment
   C. Plywood Sheathing
   D. T1-11 Plywood Siding
   E. Rough hardware, such as nails, bolts, screws, clips, as required to install rough carpentry work.
   F. Lumber Preservatives

1.2 REFERENCES
   A. American Wood Protection Association (AWPA) u1 - Use Category System - User Specification for Treated Wood.
   B. Plywood shall conform to American Plywood Association APA Grade trademark and Product Standard PS-1.

1.3 QUALITY ASSURANCE
   A. All lumber except as otherwise specified herein shall:
      1. Be new, dressed 4 sides (S4S), clean, and free from warping and other defects.
      2. Conform to U. S. Department of Commerce Simplified Practice Recommendations R-16 for sizes and use Classifications.
      3. Have a moisture content not exceeding 19 percent when delivered to the project.
   B. Plywood shall conform to American Plywood Association APA Grade Trademark and Product Standard PS-1.

1.4 SUBMITTALS
   A. Submit product data under provision of Section 01340.
   B. Submit hardware and hangers indicated on the Drawings.
   C. Submit each type of fastener to be used with the location for use.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Store all materials in an elevated dry location, protected by waterproof coverings. Do not store within the building until masonry, concrete, and other such wet work has been completed and allowed to dry.
PART 2 - PRODUCTS

2.1 LUMBER TREATMENTS
A. Preservative Treatments: All dimension lumber, wood blocking and nailers which will be embedded in or in contact with concrete and masonry or concealed by roofing, flashing and the air barrier system and any wood indicated on the drawings as preservative treated (PT) shall be treated with waterborne preservatives in accordance with AWPA Standard U1 to the requirements of Category 2 (UC2).
B. Brush Preservative Treatment: Brush coat all end cuts after cutting with treatment equal to above. Apply in two heavy coats on all surfaces prior to installation of lumber.

2.2 FRAMING, FURRING AND BLOCKING
A. All dimensional lumber to be Spruce-Pine-Fir No. 2 or better unless indicated otherwise on the Structural Drawings.
B. All preservative treated dimensional lumber to be southern yellow pine, No. 1 or better, unless indicated otherwise.
C. Furring and other lumber less than 1-1/2 inches in thickness to be No. 2 spruce or Douglas fir.
D. Blocking less that 1-1/2" in thickness to be exterior grade plywood.

2.3 SHEATHING
A. Plywood Sheathing shall be thicknesses, exposure rating and structural type indicated on the Drawings.

2.4 T1-11 PLYWOOD SIDING
A. All wood exterior-grade pressure treated panel, 8-inch groove pattern with shiplapped edge.
B. Thickness: 5/8-inch

2.5 HANGERS AND ANCHORS
A. Joist hangers, framing anchors, nail plates and other fasteners as indicated on Drawings.
B. Expansion anchor and anchor bolts shall be as shown on the Drawings and as specified in Section 05500. For other non-specified conditions the following minimums shall apply:
   1. Top plates and sill plates at masonry bond beams - 3/4-inch diameter galvanized anchor bolts
   2. For blocking attached to steel beams - 1/2-inch diameter anchor bolts at 2-feet in center, staggered.
   3. Other nailers and blocking in excess of 7/8 inch thick - 3/4-inch diameter galvanized steel anchor bolts or expansion bolts, as applicable.
   4. Secure other non-specified lumber with galvanized steel fasteners, of a type most suitable for the application.

2.6 FASTENERS
A. Fasteners for PVC trim shall be stainless steel.
B. Hardware and fasteners in contact with pressure treated lumber shall be stainless steel.

PART 3 - EXECUTION

3.1 TEMPORARY BRACING
   A. Provide and maintain, until such time as permanently built into the structure, all temporary bracing for walls, door frames, sills, and other work requiring bracing and which is not specified as being provided under other SECTIONS of the specifications.

3.2 PROTECTION
   A. Do such work as is necessary to cover and protect all finishes and other work from damage during construction.

3.3 NAILERS AND BLOCKING
   A. Fasten nailers and blocking to concrete and masonry with specified bolts, as shown on Drawings or as specified above. Space bolts not over 32 inches on center. Stagger lines of bolts on nailers wider than nominal 3-1/2 inch width. Use not less than two (2) bolts per piece of nailer length. Counterbore nailers so that nut and ends of bolts are recessed below top surface. Install wood shims behind nailers and blocking against masonry, as required, to ensure completely true surface.

3.4 FRAMING AND SHEATHING
   A. Install wood framing as indicated on the Drawings.
   B. Install plywood sheathing, stagger all joints and block all edges with 2x6.
   C. Nailing shall be as per the nailing schedule.
   D. All plywood shall be installed such that the long direction is perpendicular with the main framing members.

END OF SECTION
SECTION 07610
METAL ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Metal Roofing
   1. Architectural Standing Seam Metal Roofing
   2. Metal Eave Fascia
   3. Metal Gable Fascia
   4. Miscellaneous Flashings and Trim
B. Miscellaneous Accessories
   1. Ice and Water Shield
   2. Reflect Flashing

1.2 REFERENCES
B. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies

1.3 SUBMITTALS
A. Submit product data under provision of Section 01340.
B. Submit large scale shop drawings detailing: Roofing, eave and rake trim, soffit vent, gutters and downspouts, and accessories; include all splice plates and method of anchorage.
C. Submit certification that the roof system provided meets UL 580 Class 90. Include a description of all roof system components and method of anchorage.
D. Submit manufacturers recommended cleat location plan identifying each wind zone and the cleat locations and spacing for each zone specific for this project.
E. Submit samples of actual material indicated for the work in all colors and textures available from manufacturers full range for color selection by Architect.
F. Submit manufacturers catalog cuts, spec data sheets, and installation instructions for all accessories.
G. Submit installer's qualifications for review by Engineer.

1.4 QUALITY ASSURANCE
A. Field measurements shall be taken prior to fabrication to assure symmetry and verify as built conditions.
B. All metal work shall be fabricated and installed in accordance with the recommendations in the SMACNA - Architectural Sheet Metal Manual.
C. All materials shall be installed with concealed starter cleats and splice plates to accommodate thermal movement. Exposed through nailing or face nailing is not allowed.
D. Hem all exposed edges.
E. The Contractor shall obtain the services of an installer with a minimum of 10 years of experience of working with the materials specified.
F. The roof shall be installed per the manufacturer’s instructions as required to meet UL 580 Class 90.

1.5 PRE-INSTALLATION CONFERENCE
A. Prior to the installation of roofing and associated work, a meeting shall be held at project site with the installers, the General Contractor and Owner's representative. General Contractor shall record discussions and agreements and furnish copy to each participant. Provide at least 72 hours’ advance notice to participants prior to convening pre-roofing conference.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials with a protective vinyl masking.
B. Store all materials in properly protected and dry storage facilities until ready for use. Do not use materials which have been damaged in any manner.
C. Protect work from damage during construction period so that it will be without any indication of abuse or damage at time of acceptance.

1.7 WARRANTY
A. Metal Roofing Contractor shall guarantee installation for a period of two years for weather tightness from date of acceptance.
B. Warranty finish against color fade, chalking and film integrity for a period of 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S
A. Roofing
   1. Atas
   2. Firestone Metal Products
   3. Englert
   4. Peterson Aluminum Corporation

2.2 FINISH
A. Unless indicated otherwise, finish on all materials shall be Kynar 500, Hylar 5000, or equal, Fluoropon resin finish, color selected by Engineer. Texture shall be smooth
B. Metal used as flashing embedded in the masonry shall be textured, corrugated or embossed to provide a bond with the masonry mortar. The surfaces to be embedded shall also be coated with an asphaltic coating to prevent corrosion.

2.3 METAL ROOFING COMPONENTS
A. Roof panels – nominal 16-inch wide factory formed panels with a 1 ½ inch double lock standing seam. A narrower panel profile may be provided if required to meet the uplift rating specified. Material shall be of 24-gauge AZ-55 Galvalume, coated steel. Panels shall be full length of each roof surface.
   1. Atas FLM Series panels
2. Firestone Uni-Clad UC-3 Series panels
3. Englert 1300 Series
4. Peterson Aluminum PAC Clad 150 double lock series panels
5. MBCI SuperLok Signature 300
6. Or Equal.

B. Fascia, drip edge, formed trim and closures - 24 ga steel formed as detailed on the Drawings in the same color and finish as the roofing panels. Provide continuous keeper to hold the fascia in place.

C. All field formed sheet metal flashing and trim shall conform to "Sheet Metal and Air Conditioning Contractors National Association, Inc., - Architectural Sheet Metal Manual".

D. Cleats and bearing plates for metal roofing shall be manufactured by the roofing system manufacturer, size and type as required to meet the uplift rating specified. The cleats shall be a minimum of 24-gauge galvalume steel.

E. Fasteners for cleats shall be per the manufacturers requirements to meet the uplift rating specified.

2.4 MISCELLANEOUS ACCESSORIES
A. Underlayment
   1. Roofing Felt - 30-pound non-perforated asphalt saturated roofing felt.
   2. Ice and Snow Guard - 40 mil rubberized asphalt and polyethylene membrane.
   3. Or roofing system manufacturer’s standard underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, and properly sloped to drain valleys and eaves.
B. Verify deck is dry and free of snow and ice. Verify joints in wood deck are solidly supported and fastened.
C. Verify correct placement of wood nailers.
D. Notify general contractor of any defects or other characteristics which may be detrimental to the installation and performance of the materials to be installed.
E. Commencement of work shall constitute acceptance of surface conditions.
F. Field verify all dimensions of the prefabricated items prior to fabrication to ensure ease of installation with a proper and tight fit.

3.2 METAL ROOFING INSTALLATION
A. Install all system components in accordance with the manufacturer’s submitted instructions.
B. Install the roofing underlayment per manufacturer’s instructions.
C. Install ice and snow guard over entire roof surface.
D. Layout roof so that the seams are equal distant from gable ends and align at corners and hips.
E. Space cleats per submitted manufacturer’s cleat layout plan. Install cleats with screws as recommended by the manufacturer.
F. Roof panels shall be installed full length of each roofing surface.
G. Double lock cleats into 1 ½-inch high standing seams using a mechanical seamer.
H. At eaves, fold the roofing over the drip edge.
I. Fold seams over at eaves.
J. The SMACNA Architectural Sheet Metal Manual, NRCA Roofing and Waterproofing Manual and Handbook of Roofing Knowledge shall be used as guides and details whenever applicable.
K. No face penetrations or perforation shall be made in metal panels by fasteners without Engineer's specific approval. All panels shall be continuous from ridge to eaves with no horizontal end laps.
L. Exercise proper care during installation to avoid damage or scratching of the panels. Avoid walking over the metal roof after installation is completed.
M. Close and seal the ends of the ridge cap, stepped flashing and all other exposed unfinished ends.

3.3 CLEANING

A. At the completion of the work, clean, and remove from site, all rubbish and accumulated materials and leave the work in a satisfactory condition.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes surface preparation and field painting of the following surfaces of new items unless specified elsewhere to be prefinished. This includes pre-primed surfaces.
   1. Painting of all submerged surfaces.
   2. Painting of all exposed interior surfaces.
   3. Painting of all exposed exterior surfaces.
   4. Staining of exterior and interior exposed wood surfaces.
   5. Staining of concrete surfaces.
B. Painting of existing items:
   1. Any other existing items on the drawings or in this specification indicated to be painted will receive surface preparation and field painting.
C. This Section also includes:
   1. Back prime, with specified interior first coat, all surfaces of wood finish and trim which will be concealed after installation.
   2. All surfaces of ferrous metal fabrications built into concrete and masonry shall be shop primed or receive a primer coat in accordance with this section. All surfaces exposed to view shall receive intermediate and finish coats.
   3. Pipe, pump and valve identification markers.
   5. Motors and equipment which are pre-finished shall receive one top coat to provide a color matching the system color indicated in the pipe identification schedule.
   7. Paint all items modified or relocated in the existing facility.
D. Refer to Maine Turnpike Authority Special Provision Section 506 Painting Structural Steel for painting requirements on Maine Turnpike Authority property.
E. Definitions:
   1. Submerged surfaces are defined as:
      a. Those surfaces which are below the maximum water surface level as indicated on the drawings, and/or extend 3-feet above the maximum water surface for uncovered tanks.
      b. All surfaces contained within covered tanks.
      c. The full height of all partially submerged items such as sluice, slide and weir gates, piping, etc.
      d. All surfaces contained within underground vaults, structures and manholes such as valve pits, dry wells, etc.
   2. Exposed interior surfaces shall be non-submerged surfaces exposed to view that are enclosed and/or protected in such a manner that they cannot be exposed to UV light or weather conditions.
3. Exposed exterior items shall be all other surfaces which don’t fall under the definition of “submerged” or “exposed interior surfaces”.

F. Items not requiring surface preparation and field painting:
   1. Items and equipment that are specifically specified to receive the manufacturer’s standard primer and finish coats in the factory, except as noted for color and touch-up painting.
   2. Copper, bronze, brass, chromium plate, nickel, stainless steel, aluminum or monel metals (unless otherwise noted).
   3. Unprimed galvanized metals not indicated to be painted shall remain unfinished.
   4. Face brick, decorative CMU and tile.
   5. Concrete slabs and walls unless indicated in the finish schedule on the drawings to be painted or receive secondary containment coatings.
   6. Underside of exposed metal decks unless indicated to be painted in the finish schedule.
   7. Prefinished fiber cement siding as specified in Division 7.
   8. Acoustic tile ceilings specified in Division 9.
   9. Acoustical sound control panels or sprayed on acoustical insulation specified in Division 9.
   10. Aluminum door, windows and framing specified in Division 8.
   11. PVC windows specified in Division 8.
   12. Toilet partitions and screens, metal lockers and toilet bath accessories specified in Division 10.
   13. Laboratory, kitchen and office casework specified in Division 12.

1.2 RELATED SECTIONS
   A. Maine Turnpike Authority Section 06100 - Rough Carpentry
   B. Special Provision Section 506 Painting Structural Steel in Appendix A

1.3 REFERENCES
   D. ASTM D6386 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Products for Painting
   G. SSPC - Steel Structures Painting Council.
   I. SSPC-PA2, “Measurement of Dry Paint Thickness with Magnetic Gauges.”
   J. SSPC-SP1, “Solvent Cleaning.”
   K. SSPC-SP2, “Hand Tool Cleaning.”
   L. SSPC-SP3, “Power Tool Cleaning.”
   M. SSPC-SP6, “Commercial Blast Cleaning.”
   N. SSPC-SP7, "Brush Off Blast."
O. SSPC-SP10, “Near-White Blast Cleaning.”
P. SSPC-SP16, "Brush Blast Cleaning of Non Ferrous Metals"
R. VOC Standards - All coatings shall be in accordance with all applicable State and Federal VOC Standards.
   2. Ozone Transportation Commission (OTC) 2005 VOC Regulation.
   3. 38 MRSA: Section 584A; Air Protection and Improvement Law.
AA. USDOT 49 CFR Parts 173, 178 and 179.

1.4 SUBMITTALS
A. Submit product data under provisions of Section 01340 including tested performance characteristics.
B. Submit manufacturer’s color chips showing the full range of colors available for each type of finish coat material specified.
C. Submit schedule on manufactures letter head with list of items to be coated, type and manufacturer of shop coating and type of field coating, including primers, details on surface preparation methods, application procedures and dry mil thickness.
D. Submit a letter from the manufacturer certifying that the products submitted are applicable for the applications indicated.
E. Submit coating manufacturer’s certification that the proposed coatings meet all state and federal VOC regulations.

1.6 QUALITY ASSURANCE
A. The Contractor shall obtain the services of a painting contractor with 5 years experience on similar projects.
B. All materials used on work shall be exactly as specified in brand and quality. No claim by the Contractor as to unsuitability or unavailability of any material specified, or their unwillingness to use same, or their inability to produce first class work with same, will be entertained unless such claims are made in writing and submitted to the Engineer at least seven (7) days prior to the date established for receipt of General Bids.
C. Before purchasing materials for the work, the Contractor shall submit to the Engineer a list of the products they propose to use, and the list shall be reviewed by the Engineer and no exceptions taken before commitment for materials is made.
D. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer.

E. Include on label of all containers:
   1. Manufacturer's name
   2. Type of paint
   3. Manufacturer's stock number
   4. Color
   5. Instructions for reducing, where applicable
   6. Label analysis
   7. Shelf life dates

F. Field Quality Control:
   1. Contractor shall request review by the Engineer, of first finished room, space or item of each color, texture and method of applications, prior to proceeding with additional painting.
   2. Use first acceptable room, space or item as the project standard for each color scheme.
   3. For spray application, when applicable, paint a surface not smaller than 100 square feet as the project standard.
   4. Repainting of materials failing to meet the requirements of the Specifications or Drawings, shall be performed by the Contractor, at no additional cost to the Owner.
   5. The number of coats and total mil thickness specified in the paint schedule are minimums. If the specified minimum film thickness is not achieved, additional coats shall be applied to achieve the total film thickness specified.

G. Paints submitted shall meet all Federal and State regulations pertaining to Volatile Organic Compounds (VOC) compliance, and be in accordance with OTC 2005 Standards.

H. All coating systems used for potable water applications shall be previously approved by the National Sanitation Foundation (NSF) in accordance with Standard 61. Evidence of compliance shall be an approval letter from NSF listing the submitted material.

1.7 DELIVERY, STORAGE AND HANDLING
A. Deliver coating materials in sealed containers with labels legible and intact.
B. Store only acceptable project materials on the project site.
C. All painting materials shall be stored and mixed in a single location coordinated with the Engineer. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse. The Contractor shall carry all necessary water to the mixing room, and shall dispose of all waste outside of the building in a suitable receptacle.
D. Restrict storage location to paint materials and related equipment and supplies.
E. Keep storage location neat and clean.
F. Remove all soiled and used rags, waste and trash from the storage location and building at the end of each work day.
G. Repair all damage to the storage location, caused by painting materials and equipment at no additional cost to the Owner.
H. Comply with all applicable health and fire codes and regulations including safety precautions recommended by the manufacturer. Storage space shall be provided with a suitable fire extinguisher fully charged at all times.

I. Heat shall be provided in the storage area if paints are to be stored during winter months. The temperature shall be maintained above 40 degrees F at all times.

1.8 ENVIRONMENTAL REQUIREMENTS
A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems shall be applied.
B. Do not apply coatings in areas where dust is being generated.
C. Do not apply coatings when the air or material surface temperature is below 50 degrees Fahrenheit and unless the temperature is at least 5 degrees Fahrenheit above the dew point.
D. Do not apply exterior coatings in frosty, damp or rainy weather or while surfaces are exposed to hot sunlight.

1.9 EXTRA MATERIALS
A. For all materials with a shelf life of greater than 12 months, provide one gallon of each type and each color of touch-up paint shall be provided to the Owner by the Contractor in unopened containers.

PART 2 - PRODUCTS

2.3 MANUFACTURERS
A. Tnemec Company, Inc.
B. Sherwin Williams
C. PPG

2.4 MATERIALS
A. Refer to the paint schedule for specific products and application.

2.5 COMPONENTS
A. All finish coats shall be compatible with shop prime coats.
B. Turpentine shall be pure spirits of turpentine.
C. Shellac shall be four pounds and shall meet the U.S. Government specifications as issued by the Bureau of Commerce.
D. When metal are primed in the mill or shop as part of painting contract, use the materials specified in every case for such surfaces and use in accordance with manufacturer's directions for first or priming coat.

2.6 MIXING AND TINTING
A. Deliver paints and enamels ready-mixed to project site.
B. Accomplish job mixing and job tinting only when required.
C. Mix only in mixing pails placed in suitably sized nonferrous or oxide resistant metal pans.
D. Use only tinting colors recommended by the manufacturer for the specific type of finish.
E. Fungicidal agents, when applicable, shall be incorporated into the paints and stains by the manufacturer.
F. Mix and prepare paints in strict accordance with Manufacturers recommendations.

PART 3 - EXECUTION

3.1 INSPECTION
A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Part 3.2, Surface Preparation.
B. Immediately notify the Engineer in writing when a surface to be finished cannot be put into an acceptable condition.
C. Do not proceed with surface preparation or coating application until conditions are suitable.
D. The Contractor shall be responsible for and shall rectify, at no additional cost to the Owner any unsatisfactory finish resulting from the application of coatings on surfaces not in acceptable condition.

3.2 SURFACE PREPARATION
A. At a minimum, all surfaces must be prepared and cleaned in accordance with the manufacturer's written specifications and pertaining to the intended substrate to be coated. The contractor must be fully read and understand all of these requirements and all other required product recommendations prior to commencing any work.
B. Wood and Plywood to be Painted or Finished Natural:
   1. Clean soiled surfaces.
   2. Except when rough surface is specified, sand to smooth and even surface, then dust off.
   3. Apply shellac to all knots, pitch and resinous sapwood after washing with mineral spirits and, before priming coat is applied.
   4. Fill nail holes, cracks, open joints and other defects with paste wood filler before priming coat surface and color to match finish color. When wood filler is applied on open grain wood, allow the grain to secure a smooth, clean surface.
   5. Tint filler to match finished wood to be stained.
C. Concrete and Masonry:
   1. Clean all dust, dirt, oil and efflorescence from surfaces.
   2. Fill cracks and irregularities with Portland cement grout to provide uniform surface texture.
   3. Etch dense and smooth concrete, or concrete that has had a hardener applied, with a five percent solution (by weight) of muriatic acid.
   4. Fill concrete masonry unit surfaces with block filler in sufficient thickness to produce a final result which shall fill all voids and pin holes.
   5. Allow surfaces to thoroughly dry prior to application of first coat.
D. Ferrous Metal Surfaces (Items not shop primed):

1. All submerged ferrous metals shall be sandblast cleaned in accordance to SSPC-SP10 immediately prior to priming.
2. All other ferrous metals shall be sandblast cleaned in accordance to SSPC-SP6 immediately prior to priming.
3. Remove dirt, oil and grease by washing surfaces with mineral spirits.
4. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
5. Feather edges of sound existing paint by grinding, if necessary.
6. Clean and touch up weathered, worn or damaged shop coats of paint with the specified primer.
7. Restore shop coats of paint with identical materials if removed for welding and fabrication.

E. Galvanized metals indicated to be painted (nonferrous metals):

1. Solvent clean in accordance with ASTM D6386.
2. Surfaces shall receive SSPC-SP-16 and shall be surfaced prepared in accordance with ASTM D6386.
3. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
4. Restore shop coats of paint with identical materials if removed for welding and fabrication.

F. Previously Coated Surfaces (including existing items and new items that are shop primed):

1. The areas of the coated surface that are blistered, eroded, brittle or otherwise failed shall be completely removed before beginning the specified surface preparation.
2. The areas where the existing coating is intact shall be sanded to dull the finish.
3. Before applying the new coating over an existing coating, a test section must be done to ensure compatibility of the new and old coatings.
4. All other existing coatings shall be prepared as recommended by the manufacturer and as specified in this section.
5. Ferrous metals arriving at the job site with shop primers other than the polyamide epoxy or rust inhibitive primers specified shall be provided with an intermediate coat as necessary for compatibility with specified topcoats.
6. Special attention shall be paid to the potential for epoxy shop and intermediate coats to chalk upon exposure to sunlight. The Contractor shall follow the manufacturer's required surface protection/covering and surface preparation recommendations before any intermediate or top coats can be applied over chalked surface. Epoxy primers and intermediate coats shall be top coated no later than 45 days after the application of the epoxy coating. If topcoats are to be applied later than 45 days, the following surface preparation shall be provided:
   a. The existing finish shall be etched by sanding with 80 grit paper or cloth.
   b. Surfaces shall be pressure washed with 3000 to 5000 pounds of pressure.
   c. The Engineer, at their discretion, can require the Contractor to conduct adhesion tests of the topcoats.
7. The following shall be the minimum surface preparatory for existing surfaces that are to be painted, unless indicated otherwise:
   a. Existing submerged ferrous metals.
      - Clean
      - Sandblast in accordance with SSPC-SP10.
   b. Non-submerged ferrous metals.
      - Clean
      - Sandblast in accordance with SSPC-SP6.
   c. Existing Concrete and Masonry
      - Clean
      - Scrape existing paint to a sound surface.
      - Sand with 80 grit paper or cloth to provide anchor profile for new coating.
      - Pressure wash all existing epoxy coated surfaces.

3.3 APPLICATION
A. Workmanship:
   1. Employ skilled workmen to ensure workmanship of the highest quality.
   2. Materials shall be applied only by craftsmen experienced in the use of the specific products involved.
B. General Requirements:
   1. Apply all coatings under adequate illumination.
   2. Perform no work in the rain, dew, or fog, when the temperature is below 50 degrees Fahrenheit and at least 5 degrees Fahrenheit above the dew point, or before the other coats have thoroughly dried.
   3. Do not apply coatings until the material surfaces are thoroughly dry.
   4. Apply paints with suitable brushes, rollers or spraying equipment.
      a. The rate of application shall not exceed that as recommended by the paint manufacturer for the surface involved.
      b. Keep brushes, rollers and spraying equipment clean, dry and free from contaminates and suitable for the finish required.
      c. Make each coat a different tint from that of the preceding coat, with final coat tinted to the exact shade selected by the Engineer. Lightly sand surfaces between each coat of gloss and semi-gloss finishes, and wipe clean.
   5. Comply with the recommendation of the product manufacturer for drying time between succeeding coats. Contractor shall follow the manufacturer’s specific curing requirements for rust inhibitive primer shop coats prior to allowing topcoating.
   6. Sand and dust between each coat to remove defects visible from a distance of five feet.
   7. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints and skipped or missed areas.
   8. Inspection:
      a. Do not apply additional coats until the completed coat has been inspected by the Engineer.
b. Only inspected and reviewed coats will be considered in determining the number of coats applied.

9. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.

10. Apply primer on all work before glazing.

11. Refinish entire wall where portion of finish has been damaged or is not acceptable.

12. Runs on face are not permitted.

3.4 PROTECTION
A. Furnish and lay drop cloths in all areas where painting and finishing is being done to adequately protect flooring and other work from damage during the prosecution of the painting work.

B. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

3.5 CLEANING
A. At the completion of the work of this Section, remove all paint spots and oil or grease stains, caused by this work from pads, walls, fixtures, hardware and equipment, leaving their finishes in a satisfactory condition. Remove all materials and debris and leave the site of the work in a clean condition so far as this work is concerned.

3.6 FINAL INSPECTION
A. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Engineer will conduct a final inspection of all painters' work. As part of the final inspection the Contractor shall demonstrate compliance with the specified film thickness with appropriate paint gauges. The Contractor shall be required to repaint, refinish, or retouch any areas found which do not comply with the requirements of this Section.

3.7 PAINT SCHEDULE
A. The following product model and coatings system numbers are listed below to establish the standard of quality. Equivalent products from other manufacturers will be accepted provided they meet or exceed the performance of the listed products.

B. The primer coat is not required on shop primed items. Installer to verify that proposed field coatings are compatible with shop coatings.
<table>
<thead>
<tr>
<th>SURFACE/ITEM</th>
<th>SURFACE PREPARATION</th>
<th>PRIMER</th>
<th>INTERMEDIATE</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>METALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submerged Ferrous Metals in contact with sewer water, higher H2S exposures</td>
<td>SSPC-SP10 Near White Metal Blast Cleaning</td>
<td>Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils</td>
<td>Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils</td>
<td>Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils OR SW Sher-Glass FF Epoxy at 8 to 10 mils</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>OR SW N/A</td>
<td></td>
</tr>
</tbody>
</table>

All portions of submerged metals subjected to UV Exposure shall receive the additional Polyurethane finish coat indicated:

<p>| Weather Exposed Ferrous Metal Piping and Equipment | Per Manufacturer’s Specifications | Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils | Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils | Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils OR SW Acolon 218 HS Acrylic Polyurethane at 3 to 4 mils |
| Enclosed Ferrous Metal Piping and Equipment | Per Manufacturer’s Specifications | Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils OR SW Macropoxy 646 at 5 to 6 mils | Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils OR SW Macropoxy 646 at 5 to 6 mils | Tnemec Series N69 Tneme-Epoxoline 11 at 3 to 5 mils OR SW Acolon 218 HS Acrylic Polyurethane at 3 to 4 mils |
| All Other Weather Exposed and Enclosed Ferrous Metals | Per Manufacturer’s Specifications | Tnemec Series 1 Omnithane Gray at 2.5 to 3 mils OR SW-Kem-Bond HS Universal Primer at 3 mils | Tnemec Series 1028/1029 Enduratone at 2 to 3 mils OR SW Pro Industrial Acrylic Coating at 3 to 4 mils | Tnemec Series 1028/1029 Enduratone at 2 to 3 mils OR SW Pro Industrial Acrylic Coating at 3 to 4 mils |
| Galvanized metal fabrications built into concrete and masonry including lintels. | ASTM D6386 Solvent Cleaning Followed by SSPC-SP16 | Tnemec Series 1 Omnithane Gray at 2.5 to 3 mils OR SW Recoatable Epoxy Primer at 4 to 6 mils | Top coats as noted herein for the surfaces exposed to view | Top coats as noted herein for the surfaces exposed to view |</p>
<table>
<thead>
<tr>
<th>SURFACE/ITEM</th>
<th>SURFACE PREPARATION</th>
<th>PRIMER</th>
<th>INTERMEDIATE</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed electrical conduit, conduit fittings and outlet boxes mounted on painted or finished surfaces or exposed in painted rooms</td>
<td>Same color and finish as background surface and/or equipment</td>
<td>Same color and finish as background surface and/or equipment</td>
<td>Same color and finish as background surface and/or equipment</td>
<td></td>
</tr>
</tbody>
</table>

### WOOD & CARPENTRY

| Exterior Wood Trim and Other Exterior Softwood | Clean & Dry - Scuffed Up with Medium Grit Sandpaper | Tnemec 151-1051 Elasto Grip FC at 2 to 3 mils **OR** SW Exterior Latex Wall and Wood Primer at 1.4 mils | Tnemec Series 1028/1029 Enduratone at 2 mils **OR** SW Pro Industrial Acrylic Coating at 3 to 4 mils | Tnemec Series 1028/1029 Enduratone at 2 mils **OR** SW Pro Industrial Acrylic Coating at 3 to 4 mils |

### NOTES:

1. Surface preparation shall be as specified within this section and as noted in the table above.
2. All dry film thickness indicated are the minimum required.
3. All ferrous metals, piping and equipment delivered to the site with shop primers other than the specified primer shall receive an intermediate coat as necessary for compatibility with the indicated top coats.
4. If the polyurethane top coats are not compatible with the manufacturer’s alkyd primer apply a polyamide epoxy as the intermediate coat.
5. Painting of the piping system shall include all ferrous valves, levers, valve handles, fittings, stands, supports, hangers, pumps and appurtenances.
6. Epoxy primers and intermediate coats that have been in place for more than 45 days shall be prepared as indicated under the "Surface Preparation" Section of this Specification.

END OF SECTION
SECTION 09905

SURFACE PREPARATION AND SHOP COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Surface preparation and application of shop coatings on materials, equipment, and piping indicated in the various specification sections relating thereto, and as specified herein, including primers and topcoats for materials, equipment and piping that are finished at the point of manufacturer or fabrication.
   B. Examine the various Sections of the Specifications and be thoroughly familiar with all provisions regarding shop coatings.

1.2 RELATED SECTIONS
   A. Section 01340 - Submittals
   B. Division 15 - Mechanical - all applicable sections
   C. Division 16 - Electrical - all applicable sections

1.3 PREFINISHED ITEMS NOT REQUIRING PAINT OR FINISH
   A. Copper, bronze, brass, chromium plate, nickel, stainless steel, aluminum or monel metals, except surfaces in contact with or embedded within concrete or masonry, unless otherwise specified elsewhere.

1.4 REFERENCES
   E. SSPC - Steel Structures Painting Council.
   F. SSPC-PA1, “Standard for Shop, Field, and Maintenance Painting”.
   G. SSPC-PA2, “Measurement of Dry Paint Thickness with Magnetic Gauges”.
   H. SSPC-SP1, “Solvent Cleaning”.
   I. SSPC-SP6, “Commercial Blast Cleaning”.
   J. SSPC-SP10, “Near-White Blast Cleaning”.
   K. SSPC-SP16, "Brush Blast Cleaning of Non Ferrous Metals"

1.5 SUBMITTALS
   A. Submit product data under provisions of Section 01340.
B. As a minimum, the following shall be included in the submittal package for all items, products, material or equipment, as specified.
   1. Submit data on the proposed shop coatings, details on surface preparation methods, application procedures and dry mil thickness.
   2. Submit a minimum of three (3) color charts for all factory top coats for color selection by Engineer.

1.6 QUALITY ASSURANCE
   A. All Shop Coatings shall meet the requirements of the materials section. The Contractor shall coordinate this requirement during the Shop Drawing Phase.
   B. All Shop Coatings shall meet all Federal and [State] regulations pertaining to Volatile Organic Compounds (VOC) compliance.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Refer to Part 3 - EXECUTION for specific products and applications.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION
   A. Definitions
      1. Submerged surfaces are defined as:
         a. Those surfaces which are below the maximum water surface level as indicated on the Drawings, and/or extend 3’-0” above the maximum water surface for uncovered tanks.
         b. All surfaces contained within covered tanks.
         c. The full height of all partially submerged items such as piping, etc.
         d. All surfaces contained within underground structures, vaults and manholes such as valve pits, drywells, etc.
      2. Enclosed surfaces are those non-submerged surfaces enclosed and/or protected within a building in such a manner that it can not be exposed to UV light or weather conditions.
      3. Weather exposed surfaces are all other conditions including buried items which do not fall into the definition of submerged or enclosed surfaces, as noted above.

   B. Ferrous Metal
      1. All submerged ferrous metals shall be sandblast cleaned in accordance to SSPC-SP10, near white, immediately prior to priming.
      2. All other ferrous metals, Enclosed and Weather exposed surfaces, shall be sandblast cleaned in accordance to SSPC-SP6, commercial grade, immediately prior to priming.
      3. Remove dirt, oil and grease by washing surfaces with mineral spirits.
      4. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
C. Galvanized Metal (nonferrous metals):
   1. Solvent clean in accordance with ASTM D6386.
   2. Surfaces shall receive SSPC-SP-16 and shall be surfaced prepared in accordance with ASTM D6386.
   3. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming.
   4. Restore shop coats of paint with identical materials if removed for welding and fabrication.

3.2. **APPLICATION**

A. Equipment
   1. Motors, speed reducers and similar parts shall have a surface preparation in accordance with the manufacturer standard coating requirements and suitable for weather exposed use. The minimum coating system shall be polyamide epoxy at 3 mils. Other coatings must be approved by the Engineer.
   2. Items finished at the point of manufacture (shop primed and painted), such as submersible pumps and other similar surfaces, shall receive manufacturer’s standard coating of baked, powder epoxy enamel, suitable for the intended service.
   3. All equipment casing openings requiring protection shall have a water repellent tape and vapor phase inhibitor treated paper.
   4. All other ferrous surfaces shall be factory primed in accordance with Section 3.2.C, except ferrous surfaces obviously not to be painted (such as gears, exposed machined or bearing surfaces, enclosed machined or bearing surfaces, lubricated contact surfaces moving under load, thread connections to be field connected and other similar items) which shall be given a heavy shop coat of grease or other suitable rust resistant coating per manufacturer’s recommendations.
   5. These coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection, until final acceptance by the Owner.

B. Pipe, Fittings and Valves
   1. The following surfaces shall be prepared in accordance with the manufacturer’s recommendations and shall receive a shop coat of asphaltum varnish meeting Federal Specifications TT-C-494A or fusion bonded epoxy coating.
      a) Interior surfaces of all hydrants, ductile iron pipe, fittings and valves except for air piping lines and air valves which shall be completely unlined.
      b) The exterior surfaces of buried valves and miscellaneous piping appurtenances.
   2. The exterior surfaces of all ductile iron pipe and fittings buried shall receive the standard factory applied asphaltic coating (in accordance with AWWA C151).
3. The exterior surfaces of ductile iron pipe, fittings and valves submerged, enclosed or weather exposed shall receive a factory applied shop primer in accordance with Section 3.2.C

4. Machined surfaces shall be cleaned and coated immediately after being machined, with a suitable rust resistant coating per manufacturer’s recommendations.

5. All other ferrous surfaces shall be factory primed in accordance with Section 3.2.C, except ferrous surfaces obviously not to be painted shall receive a heavy shop coat of grease or other suitable rust resistant coating per manufacturer’s recommendations.

6. These coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection until final acceptance by the owner.

C. Schedule: The product model and coatings system numbers listed below are based on products by the Tnemec Company Inc. to establish the standard of quality. Equivalent products from other manufacturers will be accepted provided they meet or exceed the performance of the listed products.

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<tr>
<th>METALS</th>
<th>SURFACE PREPARATION</th>
<th>Tnemec SHOP PRIME</th>
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</thead>
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<td>Submerged Ferrous Metals, Piping, Fittings, Valves and Equipment specified to be shop primed in their respective sections.</td>
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<td>Series 1 Omnithane 2 to 3 mils</td>
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<tr>
<td>Enclosed Ferrous Metals, Piping, Fittings, Valves and Equipment specified to be shop primed in their respective sections.</td>
<td>SPC-SP10 White Metal +Blast Cleaning</td>
<td>Series 1 Omnithane 2 to 3 mils</td>
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<td>Non-Ferrous and Galvanized Metals in contact with or embedded in concrete or masonry</td>
<td>SPC-SP1 Solvent Wiping followed by SPC-SP16 Brush Blast Cleaning</td>
<td>Series 66HS Epoxolime 11 3 to 5 mils</td>
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<tr>
<td>Ferrous Metals in contact with or embedded in concrete or masonry</td>
<td>SPC-SP6 Commercial Blast Cleaning</td>
<td>Series 66HS Epoxolime 11 3 to 5 mils</td>
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</table>

NOTES:
1. Surface preparation shall be as specified within this section and as noted in the table above are minimums. Surface preparation shall be in accordance with the manufacturer’s written recommendations.
2. All dry film thickness indicated are the minimum required.
3. All ferrous metals and equipment delivered to the site with shop primers other than polyamide epoxy or alkyd primer indicated above, shall receive an intermediate coat as necessary for compatibility with epoxy top coats.
4. All ferrous, nonferrous and galvanized metals in contact with concrete or masonry shall receive a polyamide epoxy primer with a minimum dry film thickness of 4 mils applied to the contact area.
5. Galvanized surfaces shall be treated as required by manufacturer to be compatible with the primer and top coats specified.
6. Areas that are designated to receive an epoxy coating as noted either on the Drawings or in Specification Section 09900 - Painting.
7. Galvanized metals shall be finished as indicated for ferrous metals, unless specifically indicated otherwise.

END OF SECTION
SECTION 11000
EQUIPMENT - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install and test all equipment specified in this Contract and as shown on the Drawings.
B. Related Work Specified Elsewhere (When Applicable):
   1. Submittals are specified in Section 01340.
   2. Delivery, Storage and Handling is specified in Section 01600.
   3. Equipment Startup, Certification and Operator Training are specified in Section 01800.
   4. Site work is specified in Division 2.
   5. Concrete and grout are specified in Division 3.
   6. Metals are specified in Division 5.
   7. Field painting is specified in Section 09900.
   8. Surface Preparation and Shop Coatings are specified in Section 09905.
   9. Controls and Instrumentation are specified in Division 13.
   10. Pipe and Pipe Fittings are specified in Division 15.
   11. Electrical work and components, and variable frequency drives, are specified in Division 16.

1.2 QUALITY ASSURANCE
A. Provide only equipment of proven reliability manufactured by reputable manufacturers.
B. Acceptable manufacturers are listed in each equipment item section in this Division and are intended to indicate the type and quality of materials expected. Refer to the General and Supplemental Conditions for the manner in which “or equals” and “substitutes” will be evaluated.
C. Certificates, patents, licenses or other required legalities, when applicable, are specified in each Section of this Division.
D. The Specifications and Drawings direct attention to certain required features of the equipment but do not purport to cover all details entering into its design and construction. Nevertheless, the Contractor shall furnish the equipment complete in all details and ready for operation for the intended purpose.
E. These Specifications are intended to provide standard equipment of a recognized manufacturer meeting all the requirements of the Specifications. Due to differences in such prefabricated equipment of various manufacturers, submit complete shop drawings, cuts, specifications, etc. to the Engineer to review for compliance with the Contract Documents prior to ordering any equipment. If the equipment differs materially from the dimensions given on the Drawings, submit complete drawings showing elevations, dimensions etc. for the installation. If Engineer's acceptance is obtained for alternate equipment, make any needed changes in the structures, piping or electrical systems necessary to accommodate the equipment at no additional cost to the Owner.
F. Workmanship shall be first class in all respects.

1.3 SUBMITTALS
A. Provide shop drawings and samples as specified in the General Conditions and Section 01340 of the Construction Contract. Equipment Systems Manufacturers shall integrate all required shop drawings into a common package.
B. Catalog Data: Submit manufacturer's literature and illustrations for all equipment to be installed, including dimensions, construction details, shop painting details, and materials by generic name.
C. Installation Instructions: Submit complete sets of manufacturer's instructions for each equipment item, including equipment storage requirements.
D. Complete Operation and Maintenance Manuals in compliance with Specification Section 01340.
E. Certificates: Submit manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements. Submit equipment performance testing results as required by these specifications. Should the proposed equipment not comply with all the specification requirements, all deviations from the specification requirements shall be listed.
F. Submit all requirements for interface with controls and/or equipment furnished in Divisions 13 and 16. Submit wiring diagrams as required to accurately depict all such interface requirements to ensure proper operations of each system or item of equipment.
G. Provide certified bearing life calculations on all equipment bearings.
H. Submittals are further specified in this Division.
I. Guarantees/Warranties as specified below.
J. Attention is directed to the fact that the Drawings are based upon a particular piece of equipment.
K. If the equipment to be provided requires an arrangement differing from that indicated on the Drawings, the Contractor shall prepare and submit for review, detailed mechanical drawings showing all necessary changes. Such changes shall be at no additional cost to the Owner.
L. Contractor shall provide a Submittal Certification from each individual Equipment Manufacturer certifying that the Equipment Manufacturer has:
   1. Reviewed the Construction Documents, the intended installation by the Contractor, and the intended functional and operational conditions;
   2. Determined all conditions to be acceptable; and
   3. Found no conditions which would cause the warranty to be void; or the equipment to function improperly, or not meet the performance requirements.
   The submittals will not be reviewed without the inclusion of these noted certifications. Process Equipment Manufacturer Submittal Certification Form is provided in Section 01340.
M. Proposed equipment/valve identification tag information.
1.4  **SEISMIC CONTROL**  
A. Not Applicable.

1.5  **GUARANTEE/WARRANTIES**  
A. The Contractor shall provide the Owner with a Guarantee/Warranty for the entire project in accordance with Article 7.17 (Contractor's General Warranty and Guarantee) and Article 15.08 (Correction Period), and as referenced, of the General Conditions (Section 00700. No shop drawings submittals are required for this item.  
B. Any specified extended warranties (i.e. those which run longer than the Contract Correction/Warranty Period) shall be prepared in the name of the Owner and shall become effective after the completion of the Correction/Warranty Period. The Contractor will be required to handle warranty problems during the Correction/Warranty Period. Extended warranties shall meet the requirements specified in the relevant Section. Proposed extended warranty language shall be submitted to the Engineer for review as a part of the Shop Drawing process.  
C. Equipment that is supplied by a system supplier and is intended to function as a complete and integrated system shall be warranted accordingly.  
D. Any part of a mechanical equipment system that shows undue or excessive wear, or that fails due to normal operational conditions during the Correction/Warranty Period, shall be considered as evidence of defective material or defective workmanship, and it shall be replaced with equipment or parts to meet the specified requirements at no cost to the Owner.

1.6  **DELIVERY, STORAGE AND HANDLING**  
A. Refer to Section 01600 for additional requirements.  
B. Coat all machined surfaces subject to corrosion with an easily removable rust preventive compound prior to shipment.  
C. Ship fabricated assemblies in the largest sections permitted by carrier regulations, properly labeled for field erection.  
D. Deliver equipment in manufacturer's original, unopened and undamaged packages, unless mounted on equipment assembly.  
E. Contractor shall store and maintain all equipment in strict accordance with the manufacturer's written short term and long term storage requirements.  
F. Store in a manner to protect items with epoxy shop coatings from exposure to UV light which can cause chalking of the epoxy. Length of acceptable exposure prior to providing UV protective measures shall be in accordance with coating manufacturer’s recommendations. This includes protection from UV light after installation while awaiting covering or filling of tanks, or prior to field painting for items scheduled to be top-coated.  
G. Should damage occur, immediately make all repairs and replacements necessary to the satisfaction of the Engineer at no costs to the Owner.

**PART 2 - PRODUCTS**

2.1  **GENERAL DESIGN OF EQUIPMENT**  
A. All parts and components of mechanical equipment shall be designed for satisfactory service under continuous duty without undue wear under the specified operating conditions.
B. All parts of mechanical equipment shall be amply proportioned for all stresses which may occur during operations, and for any additional stresses which may occur during fabrication and erection. Iron castings shall be tough, close-grained gray iron casting, Class 30, in accordance with ASTM A48, latest revision. Structural steel shall conform to ASTM A36.

C. Where galvanizing of materials is required, refer to Division 5 for material galvanizing requirements.

D. Mechanical equipment, including drives and electrical motors, unless otherwise noted, shall be supplied and installed in accordance with Occupational Safety and Health Act (OSHA) requirements. The Contractor’s attention is drawn to the requirements for equipment guards. The noise level of equipment, drives and motors, unless otherwise noted, shall not exceed 90 dBA measured 3 feet from the unit under free field conditions.

E. All equipment and machinery furnished under this Contract shall be the latest improved design suitable for the service specified. All equipment and machinery shall be designed and constructed to operate efficiently, continuously and quietly under the specified requirements with a minimum of maintenance, renewals and repairs. The design and construction of all equipment and machinery shall be such as to permit operation with minimum wear, vibration and noise when properly installed.

F. Ample room for erecting, repairing, inspecting and adjusting of all equipment and machinery shall be provided. The design, construction and installation of all equipment and machinery shall conform to and comply with the latest safety codes and regulations.

G. All equipment of identical size, type and service shall be the product of the same manufacturer.

H. All equipment selected shall suit the general arrangement of the space in which it is to be installed.

I. Unless otherwise specified, electrical SCR controller units shall be furnished with the driven equipment, mounted and factory aligned, where applicable. Wiring of motors and controls shall be in accordance with the requirements of Division 16 and other applicable portions of the Specifications. Electrical variable frequency drives shall be furnished and installed by the electrical contractor, unless otherwise noted as specified in Division 16.

J. Suitable provisions shall be made for easy access for service and replacement parts.

2.2 BOLTS, ANCHOR BOLTS AND NUTS

A. Furnish all necessary bolts, anchor bolts, nuts, washers, lock washers or locking nuts, plates and bolt sleeves in accordance herewith. Anchor bolts shall have suitable washers, lock washers and, where so required, their nuts shall be hexagonal.

B. All bolts, anchor bolts, nuts, washers, lock washers, plates, and bolt sleeves shall be stainless steel unless otherwise indicated below or specified elsewhere.
   1. Stainless steel hardware (minimum of Type 304, unless otherwise indicated) is required in all corrosive atmospheres, exterior areas, and/or areas with NEMA 4X or NEMA 7 rating.
   2. Stainless steel hardware (minimum of Type 316, unless otherwise indicated) is required in all submerged applications, including but not limited to the wetwells. For additional description and definition of submerged surfaces refer to Specification Section 09900.
C. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and size.

D. Unless otherwise specified, stud, tap, and machine bolts shall be of the best-quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to AN Standard B 1.1-1974 for Unified Inch Screw Threads (UN and UNR Thread Form).

E. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

F. All bolts shall be suitable size for the intended purpose, with direct input from the equipment or product manufacturer. In no case shall anchor bolt size be less than 3/8" diameter.

2.3 FOUNDATIONS, INSTALLATION AND GROUTING

A. The Contractor shall furnish the necessary materials and construct suitable concrete foundations for all equipment installed by the Contractor, even though such foundations may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting as specified below.

B. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

C. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 in. for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable non-shrink grout.

D. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

E. Where such procedure is impracticable, the method of placing grout shall be as permitted by the Engineer. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner, if necessary. All foundation and grout exposed surfaces shall be given a burlap-rubbed finish and painted with at least two coats of the epoxy-based paint specified for concrete.
F. If threaded rod with lower support nuts are used to secure the equipment in place temporarily during concrete equipment pad placement, the support nuts shall be removed prior to grouting so that the threaded rod anchor bolts are not supporting the equipment and the top nuts can be tightened to secure the equipment directly to the large bedding surface provided by the non-shrink grout and concrete equipment pad. Equipment foundations shall be designed to absorb equipment vibration and transmit forces to building structure or ground. Contractor shall demonstrate that this has been completed to the RPR prior to grouting.

2.4 ELECTRIC MOTORS
A. Unless otherwise specified or permitted by the Engineer, all electric motors furnished and installed by the Contractor shall conform to the requirements hereinafter set forth.
B. All equipment motors and appurtenances (e.g., switches, instruments, etc.) shall meet the area classification and NEMA requirements as listed on Drawing E-1.
C. All motors shall be specifically designed for the installation orientation required by the equipment submitted (i.e., horizontal motor design for horizontal installation, vertical motor design for vertical installation). Universal motors shall not be allowed.
D. Ratings of Motors
1. Every motor shall be of sufficient capacity to operate the driven equipment under all load and operating conditions without exceeding its rated nameplate current or power or its specified temperature limit.
2. When the horsepower rating is specified for a motor, the motor furnished shall meet the requirements of the output specified. When the horsepower rating is not specified, the motor shall have sufficient capacity to operate the driven equipment as given in the Detailed Specifications.
3. All electric motors shall be UL recognized.
4. Motor shall have a service factor of 1.15, unless otherwise specified.
E. Type of Motors
1. All motors shall be NEMA Design B, and shall have starting characteristics and ruggedness as may be necessary under the actual conditions of operation and, unless otherwise specified, shall be suitable for full-voltage starting.
2. Motors shall be manufactured by General Electric Co., Reliance, Toshiba, Siemens, or be an equivalent product, that meets all the requirements herein.
3. All motors shall have Class F insulation with temperature rise in accordance with NEMA Standards for Motors and Generators and based on a maximum ambient temperature of 40 deg. C.
4. Motors Installed in Class I/ Division 1 Hazardous Locations:
   a. Motors shall be explosion-proof (XP) rated for Class I/ Division 1/ Group C and D rated for hazardous locations and shall meet the requirements of the National Electric Code and other safety codes pertaining thereto.
   b. Motors shall include integral high temperature thermostats or similar device with a high temperature interlock to shut down the motor and auxiliary contact to activate an alarm condition.
   c. Thermostats shall be normally closed, hermetically sealed and rated a minimum of 0.5A at 120 VAC. The thermostats shall be set so that the temperature of the motor will not exceed the auto-ignition temperature for a Class I/ Division 1/ Group C and D location.
5. All motors shall be NEMA Premium Efficiency type. The nominal and/or minimum guaranteed efficiency shall be printed on the motor nameplate. The efficiency values shall conform to Energy Policy Act of 1992, unless exempted, and shall be as indicated in the following table:

<table>
<thead>
<tr>
<th>HP</th>
<th>3600 rpm Open Motors</th>
<th>1800 rpm Open Motors</th>
<th>1200 rpm Open Motors</th>
<th>3600 rpm Enclosed Motors</th>
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F. General Design of Motors
1. Motors shall comply with the latest NEMA Standards for Motors and Generators, unless otherwise specified. Motors shall not run beyond nominal full speed rpm.
2. Motor windings shall be braced to withstand successfully the stresses resulting from the method of starting. The windings shall be treated thoroughly with acceptable insulating compound suitable for protection against moisture and slightly acid or alkaline conditions.
3. Bearings shall be of the self-lubricating type, designed to ensure proper alignment of rotor and shaft and to prevent leakage of lubricant.
4. Bearings for open motors shall be of the sleeve or ball type, as specified under the respective items of mechanical equipment. Bearings for totally enclosed
and explosion-proof motors shall be of the ball type. The exception to this shall be belt-drive applications in which case the motor manufacturer shall determine if roller bearings are required in lieu of ball bearings due to higher radial loads.

5. Vertical motors shall be provided with thrust bearings adequate for all thrusts to which they can be subjected in operation.

6. Vertical motors of the open type shall be provided with drip hoods of acceptable shape and construction. When the drip hood is too heavy to be easily removed, provision shall be made for access for testing.

7. All motors installed above or within potable water storage tanks shall use food grade lubrication that is NSF approved.

G. Wound-Rotor Induction Motors
1. Wound-rotor motors shall be designed for operation of the motor-driven equipment under the conditions specified in the Detailed Specifications.

2. Motors shall be of the wound-rotor, induction type suitable for speed control by rotor resistance.

3. The collector rings shall be constructed of hard composition metal of sufficient conductivity and ample contact surface. The rings shall be mounted accurately and securely on the shaft by means of acceptable insulating construction. The leads to the collector rings shall be fastened to and insulated from the shaft in a suitable manner.

4. The collector rings and brushes for the wound-rotor induction motors shall be suitable for operation in an atmosphere containing moisture.

5. The brushes shall be of the electrographite type, or other suitable type, of sufficient hardness and conductivity and shall have ample contact surfaces. Brush holders shall be provided with adjustable, spring-tension devices. Brushes shall be connected to the holders with tinned, flexible, copper-wire pigtails so arranged that no appreciable current shall be carried through the sliding contacts or springs. Brushes shall operate without noise or chattering. Rings and brushes shall be located on top of the motor, and shall be easily accessible for inspection and maintenance.

H. Synchronous Motors
1. Synchronous motors shall comply in all respects with the latest NEMA Standards for Motors and Generators, and AN Standard C50 for Rotating Electrical Machinery.

2. Synchronous motors shall be designed for operation of the motor-driven equipment under the conditions specified in the Detail Specifications.

3. The temperature rise (based on a cooling temperature not exceeding 40 deg. C. and an altitude not exceeding 3,300 ft.) in the various parts of the motors, when operating continuously at rated voltage, frequency, and power factor, shall conform to the applicable requirements of the above-mentioned NEMA Standards.

4. Synchronous motors shall be manufactured by General Electric Co., or be an equivalent product.

I. Single-Phase Motors with Auxiliary Devices
1. Single-phase motors requiring switching devices and auxiliary starting resistors, capacitors, or reactors shall be furnished as combination units with
such auxiliaries either incorporated within the motor housings or housed in suitable enclosures mounted upon the motor frames. Each combination unit shall be mounted upon a single base and shall be provided with a single conduit box.

J. Motor Terminal Boxes and Leads
1. Motors shall be furnished with oversize conduit terminal boxes to provide for making and housing the connections and with flexible leads of sufficient length to extend for a distance of not less than 4 inches beyond the face of the box. The size of cable terminals and conduit terminal box holes shall be as permitted by the Engineer. An acceptable type of solderless lug shall be furnished. Totally enclosed and explosion-proof motors shall have cast-iron terminal boxes.

K. Special Motors
1. Hoists and other devices complying with special safety codes shall be furnished complete with their control equipment and with all accessories and safety devices for code-approved, safe, and efficient operation.

L. Premium Efficiency Motors – “For Use with Variable Frequency Drives”
1. Motors other than inverter duty rated type which are used on variable frequency drive equipment shall have an insulation system that is inverter grade to meet NEMA MG1-2016, Class F insulation system with a Class B temperature rise at a 1.15 service factor. Motors shall be wound with inverter duty wire and shall be multi-dipped and baked in a polyester, Class H varnish.
2. Nameplate on motor shall be stamped indicating motor is “Certified for Use with VFDs”.
3. Motors of the sizes indicated below and operated on variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge electrical shaft currents within the motor and/or its bearings to ground.
   a. Motors between 25 HP and up to 100 HP shall be provided with a minimum of one shaft grounding ring installed either on the drive end or non-drive end.
   b. Motors over 100 HP shall be provided with an insulated or hybrid bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or Contractor and shall be installed in accordance with the manufacturer’s recommendations.
   c. Grounding rings may be external or internal to the motor for open drip proof motors (ODP), totally enclosed fan cooled (TEFC) and totally enclosed non-ventilated (TENV). Grounding rings shall be internal to the motor for all Class 1/ Division 1 and Class 1/ Division 2 motors. Grounding rings shall not interrupt or alter the motor design flame path.
   d. Grounding rings shall be AEGIS or equal.

M. Premium Efficiency Motors – “Inverter Duty Rated”
1. Inverter Duty Rated motors which are used on variable frequency drive equipment shall meet the following requirements:
a. Motor shall be suitable for operation over entire speed range indicated without causing motor overheating at any condition.
b. Forced ventilation type inverter duty rated motors with a separate external continuously operating fan shall not be acceptable.
c. Motors installed in Division 1 hazardous (classified) location shall be identified as acceptable for variable speed when used in Division 1 locations.
d. Motor shall have Class F insulation with a Class B temperature rise at a 1.0 service factor (non-sinewave power) and 40°C ambient conditions per NEMA MG1-2016.
e. Motor shall be wound with inverter duty wire and phase paper and shall be multi-dipped and baked in polyester, Class H varnish.
f. Nameplate on motor shall be stamped indicating motor is “Inverter Duty Rated”.

2. Motors of the sizes indicated below and operated on variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge electrical shaft currents within the motor and/or its bearings to ground.

a. Motors between 25 HP and up to 100 HP shall be provided with a minimum of one shaft grounding ring installed either on the drive end or non-drive end.
b. Motors over 100 HP shall be provided with an insulated or hybrid bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or Contractor and shall be installed in accordance with the manufacturer’s recommendations.
c. Grounding rings may be external or internal to the motor for open drip proof motors (ODP), totally enclosed fan cooled (TEFC) and totally enclosed non-ventilated (TENV). Grounding rings shall be internal to the motor for all Class 1/ Division 1 and Class 1/ Division 2 motors. Grounding rings shall not interrupt or alter the motor design flame path.
d. Grounding rings shall be AEGIS or equal.

N. Submersible Motors

1. Motors which are rated for submersible use shall be of the highest efficiency in the industry for this type of motor and horsepower rating.
2. When used in conjunction with variable frequency drive equipment, the submersible motor shall be rated for inverter duty with Class H insulation.

2.5 DRIVE COUPLINGS

A. Couplings shall be all metal, flexible, designed for both angular and parallel misalignment, provided with a guard, and provided with a means for lubrication.
B. Close-coupled connections shall have machined shouldered joints for motor and pump motor support.
C. High torque couplings shall be all metal gear couplings with external grease fittings. A service factor of 1.50 shall be used based on the motor nameplate rating.
D. Drive couplings for mixers which differ from the above referenced all metal type, which are standard integral parts of a mixer manufacturer's assembly may be permitted, with review and approval of the Engineer.

2.6 GEAR REDUCTION UNITS
A. Gears of gear reduction units shall be made of highest quality alloys treated for hardness and severe service. All gear reduction units on equipment shall be selected for Class II or more severe service as classified by the American Gear Manufacturers Association.
B. Unless otherwise specified, the complete reduction unit shall be fully enclosed in a heavy cast-iron or fabricated steel housing with gears running in oil. All bearings shall be of the anti-friction type.
C. The actual and rated horsepower, torque, overhang capacity, or bearing capacity of each reduction unit shall be not less than the horsepower rating of the drive motor, nor less than that which will be encountered under full load or under the most severe loading conditions of the equipment. The Engineer may reject any gear reduction unit that does not meet the above requirements. The manufacturer of gear reduction units shall be long established with a good reputation.
D. Unless otherwise specified, all gear reduction units shall be helical or spiral bevel helical combinations. The planetary gear units and worm gear type units may be used only where specified. Class of service shall be Class II or heavier, as determined by the manufacturer or as directed by the Engineer.
E. The equipment manufacturer shall furnish the Engineer with complete engineering information, catalog data, design features, loading capacities, and mechanical efficiency ratings for every gear reduction unit incorporated in the work.

2.7 LUBRICATION FITTINGS
A. All lubrication fittings shall be brought to locations that are readily accessible to operators from normal operating walkways or platforms. Equipment lubrication fittings shall be extended to outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards, floor plating or other obstruction, and to eliminate creating falling hazards by unusual elevations. Fittings shall be buttonhead type. Lubrication fittings shall be mounted together wherever possible.
B. Pressure grease-lubricated fittings shall be the "Zerk Hydraulic" type or the "Alemite" type.
C. Housings of grease-lubricated bearings shall be automatically exhausted to the atmosphere to prevent excessive greasing.
D. Oil drains shall be piped to a location outside the equipment frame for ease of draining. Provide ball valve for positive shutoff. Pipe shall be type-L copper or galvanized steel.

2.8 SPARE PARTS AND SPECIAL TOOLS
A. For each type of equipment furnished, the Contractor shall provide spare parts, as specified on the respective sections of the Division, and a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment.
B. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.
C. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.
D. All spare parts and special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts and special tools until completion of the work, at which time they shall be delivered to the Owner.
E. Spare parts shall be appropriately labeled and containerized, and shall be properly packaged for long-term storage.
F. If the Contractor utilizes a spare part to remedy an issue during the Contract work (through Final Completion) they shall replace the spare part at no additional cost to the Owner.

2.9 EQUIPMENT DRIVE GUARDS
A. All equipment driven by open shafts, belts, chains, or gears shall be provided with all-metal or rigid fiberglass OSHA approved guards enclosing the drive mechanism. Guards shall be securely installed but shall be removable with quick open latches.
B. Guards shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members, unless otherwise specified.
C. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment.
D. The guards shall conform in all respects to all applicable safety codes and regulations.

2.10 PROTECTION AGAINST ELECTROLYSIS
A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis.
B. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

2.11 NAMEPLATES
A. Each piece of equipment shall be provided with a substantial nameplate of noncorrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.
B. An enlarged paper copy of all the nameplate data on equipment and motors shall be provided in the Shop Drawings and Operation and Maintenance Manuals.

2.12 SURFACE PREPARATION AND SHOP COATINGS
A. Provide surface preparation and shop coatings in accordance with Specification Section 09905.

2.13 ELECTRICAL CONTROLS
A. Additional controls for various items of equipment are specified under Division 13
and/or Division 16, as indicated on the Drawings, and as specified. Due to potential differences in electrical requirements for equipment of various manufacturers, the Contractor shall coordinate the electrical requirements of the equipment supplied with the work specified in Division 13 and/or Division 16.

B. Provide auxiliary contacts as required for remote status and alarm conditions. Contractor shall coordinate each piece of equipment. Refer to the Electrical and Instrumentation Drawings.

C. Electrical controls for all equipment shall comply with the requirements of Division 16 and the National Electric Code, including provisions to allow each piece of equipment to be locked out/tagged out for maintenance or repairs.

D. Control panels shall be constructed in conformance with UL 508A and bear the UL 508A seal confirming the construction. UL inspection and seal application can be accomplished at the panel fabrication facility or by field inspection by UL inspectors. Obtaining the UL seal and any inspections shall be provided at no additional cost to the Owner.

2.14 GAUGES

A. General:
1. Unless otherwise indicated, gauge assemblies shall be complete with 1/2-inch brass pipe and fittings, 1/2-inch ball valve with bronze body, stainless steel ball, Teflon seats and a tee with a brass test cock with female outlet end all arranged to allow field checking with a 4½-inch test gauge. Gauge assembly piping and valves for chemical feed systems shall be compatible with the chemicals being handled.

2. All gauges shall be equipped with snubbers or other protective throttling device(s) to dampen workings and pointer. If single snubber does not correct pulsing, provide additional snubbers in series.

3. All gauges shall meet requirements as outlined hereinafter.

4. All gauges provided are to be from the same manufacturer.

5. All gauge assemblies shall be supported by brackets to prevent excessive vibration that will cause damage to the gauge assembly.

6. The ranges of the gauges shall be suitable for any range of pressure that can occur during operation.
   a. Suction gauges shall be compound-type, having a range of -15 feet to 0 feet to +30 feet of water.
   b. Discharge gauges shall be selected at the nearest standard range which provides a top limit above the pump shutoff head or pump relief valve setting. Discharge gauges shall read in feet of water.

B. Process Liquid Applications:
1. Gauges shall be round black case, 4½-inches diameter, 1/2-inch NPT bottom male threaded connections, glycerin filled, stainless steel rack and pinion movement, black micro-adjusted rezeroing pointers, rack and pinion movement, black micro-adjusted rezeroing pointers, and black figures with white plastic dials and a threaded ring. Gauges shall have an accuracy of 1/2 percent of scale range.

2. Gauges shall be furnished where called for on the Drawings or within other Specification Sections.
3. All gauge assemblies shall be supported by brackets to prevent excessive vibration that will cause damage to the gauge assembly.

C. Diaphragm Seals
   1. Gauges shall be provided with factory-mounted protective diaphragm assembly and snubber. Diaphragm assembly shall be cleanout type, which will allow cleaning of the lower diaphragm assembly without breaking the seal or refilling and shall not require recalibration of the gauge.
   2. The diaphragm shall be 316 stainless steel with a 316 stainless steel housing (process and instrument flanges) and shall be fitted with a bleed screw on the instrument flange, and flushing connection on the process flange. Connecting bolts and nuts shall be 316 SS. Other diaphragm materials will be considered for acceptance on a case-by-case basis when dictated by chemical compatibility.
   3. The diaphragm shall be rated for gauge operating pressure range. Provide a locking plate or lock-wire to prevent turning of the assembly and to maintain the factory calibration.

D. Process Isolator Diaphragm Ring Seal: Shall be provided for all gauges on wastewater sludge, chemical slurries, grit and polymer applications, as specified in other Division 11 Specifications, and as shown on the Drawings. All other gauge applications shall be provided with a diaphragm seal as specified above
   1. Provide a wafer-style pressure isolation flange to isolate the connected gauge from the process fluids.
   2. The ring shall be constructed of 316 stainless steel meeting ANSI B16.5 Class 150 standards.
   3. The pressure shall be transferred from an elastomeric ring embedded around the inside diameter of the flange to a ½” NPT port on the outside of the flange with isolation needle valve.
   4. All nipples, valves and fittings will be 316 stainless steel.
   5. Liner material:
      a. Wastewater/Sludge Application: NBR, natural rubber or EDPM
      b. Polymer Applications: NBR
   6. Fill fluid: Silicon (10Cst)
   7. Pressure gauge: per this section
   8. The pressure gauge and diaphragm seal shall be factory assembled and tested.
   9. Manufacturers:
      a. Ashcroft Type 80 Iso-Ring
      b. Red Valve Series 48
      c. Or equal

E. Gauges Assemblies shall be manufactured by:
   1. Ametek U.S. Gauge Division
   2. Ashcroft
   3. Trerice
   4. or equal.

F. Contractor shall provide a gauge schedule listing all gauges, functions, locations, scales, etc., as part of the shop drawing submittal package.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall carefully inspect receiving structures and anchor supports for defects in workmanship prior to equipment arrival.

B. Contractor shall carefully inspect all equipment for:
   1. Damage in shipping.
   2. Defects in workmanship and materials.
   3. Tightness of all nuts and bolts.

C. Inspection shall include, but not be limited to, the following as applicable:
   1. Soundness (without cracked or damaged parts).
   2. Correctness of setting, alignment, and relative arrangement of various parts.
   3. Adequacy and correctness of packing, sealing and lubricants.
   4. Completeness in all details, as specified.

D. Field Quality Control
   1. As part of the equipment cost, the Contractor shall provide the services of a duly authorized Manufacturer's representative to assist the Contractor with equipment adjustment, start-up, and necessary testing to prove that the equipment is in proper and satisfactory operating condition.
   2. On completion of the work, the Manufacturer's representative shall provide written certification that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void, as outlined in the attached equipment certification form.
   3. As part of the startup services, the Manufacturer's representative shall provide the Owner's personnel with training in the proper operation and maintenance of all associated equipment. The equipment training certification form shall be used for this purpose.
   4. When the work is substantially complete the Contractor will be required to demonstrate, to the satisfaction of the Engineer, the ability of all equipment to operate as intended without defect including binding, vibration, jamming, overheating, etc.
   5. All equipment found defective by the Engineer shall be replaced by the Contractor at no expense to the Owner.
   6. The cost of any retesting by Owner's independent inspector, required because of defective equipment, shall be borne by the Contractor.

3.2 PREPARATION

A. Provide all required adhesives, sealants, insulation, lubricants, waterproofing, fireproofing or other protection specified in each Section of this Division.

3.3 INSTALLATION

A. Contractor shall install equipment in accordance with Manufacturer's requirement. Manufacturer(s) shall work with the Contractor to ensure that the equipment has been properly installed.

B. Do not install equipment until all defects or inadequacies in receiving structure have been corrected to meet Specifications.
C. Erect and lubricate equipment in strict accordance with the manufacturer’s instruction. Installation shall include all oil and grease required for proper operation.

D. All equipment mechanisms shall withstand all stresses that may occur during fabrication, erection, and intermittent or continuous operation.

E. Contractor to furnish and install supports as indicated on the Drawings, and as required by the equipment manufacturer.

F. Thoroughly clean all equipment and appurtenant piping to remove all dirt, grease, mill scale, and other foreign matter and touch up factory finish to the satisfaction of the Engineer.

3.4 STARTUP AND TESTING
A. Test and adjust all equipment in accordance with the general requirements of Specification Section 01800, and the specific requirements of the various Division 11 Specification Sections.

B. Demonstrate the equipment's ability to operate without overloading jamming, excessive vibration, etc. during normal operation conditions.

C. Demonstrate the equipment's ability to meet all the performance requirements specified for the equipment system to make a complete operational system, suited for its intended use.

3.5 EXISTING EQUIPMENT RELOCATION
A. All relocated equipment shall be reconditioned and serviced prior to operation in the new locations. Equipment shall be cleaned, rust removed, re-primed and painted in accordance with Section 09900, balanced, lubricated, oiled, calibrated and properly wired and plumbed to provide the intended service. Start-up of relocated equipment shall be done in accordance with the manufacturer’s instructions.

END OF SECTION
SECTION 11310
PUMPS - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Furnish, install, test and place into satisfactory operation pumping equipment and appurtenances as shown on the Drawings, as specified herein and as required for a complete installation.
   2. Contractor will perform pump tests in the Engineer's presence to indicate that pump efficiency, capacity, and discharge head conform to specifications in Pump Schedule in this Division.
B. Related Work Specified Elsewhere (When Applicable):
   1. Additional requirements in Sections 01800 and 11000.
   2. Surface preparation and shop coatings are specified in Section 09905.
   3. Field Painting is specified in Section 09900.
   4. Instrumentation is specified in Division 13.
   5. Piping and valves are specified in Division 15.
   6. Electrical is specified in Division 16.

1.2 QUALITY ASSURANCE
A. In accordance with the requirements of Section 11000.
B. All pumping equipment shall be designed, constructed, installed and tested in accordance with the best practice and methods and the standards of the Hydraulic Institute.
C. Additional performance requirements are outlined in pump specifications.
   1. Pumps shall meet all performance requirements listed in this specification, and associated specifications.
   2. In the event that the pump(s) equipment fails to meet the performance requirements specified, the Engineer shall have the right to require the Manufacturer to modify or replace the pumping equipment to enable said system to meet the performance requirements specified.
   3. A second test, and any subsequent tests as may be necessary to ensure compliance with the Specifications shall be performed at no additional cost to the Owner.
   4. All costs arising from project delays caused by failure to meet the performance requirements specified herein shall be borne by the Manufacturer and shall be responsible to the Contractor for any liquidated damages incurred due to any delay in passing all factory testing.
D. Only pumping units having wire-to-water efficiencies within a reputable manufacturer's equipment range of efficiencies will be accepted.
1.3 **SUBMITTALS TO THE ENGINEER**

A. In accordance with the requirements specified in Section 01340 and 11000. Submit such shop drawings, manufacturer’s literature, short-term and long-term storage requirements, and operations and maintenance manuals.

B. Submit the following information for all pumps specified:
   1. Manufacturer's rating curves showing the following pump characteristics for each unit of flow:
      a. Total dynamic head.
      b. Brake horsepower.
      c. Efficiency.
      d. Required net positive suction head.
      e. Allowable suction lift.
   2. Variable speed units:
      a. Variable speed curves with at least five speeds plotted from maximum RPM to minimum RPM required to obtain the minimum pump flows at the heads indicated in the pump schedule.
   3. Literature, layout drawings and typical specification describing pumping equipment, showing all important details of construction and dimensions.
   4. Maintenance instructions shall be furnished to indicate operation, assembly, disassembly and troubleshooting.
   5. Mechanical seal drawing shall be furnished indicating service conditions, materials of construction, and basic interface dimensions.
   6. Literature and Layout Drawing for the pump seal water system supply and drain piping.
   7. Literature, Schedule and Layout Drawing for pump Gauge assemblies.

C. After fabrication and prior to shipment, shop test completed pump and motor assemblies indicated in the Pump Schedule for performance in accordance with the Hydraulic Institute Standards and submit certified copies of the pump and motor performance data furnished.

1.4 **DELIVERY, STORAGE, AND HANDLING**

A. In accordance with the requirements of Section 11000. Manufacturer shall deliver equipment to the project site where and when directed by the Contractor.

1.5 **WARRANTY**

A. In accordance with the requirements of Section 11000.

B. The Contractor shall obtain a 5-year prorated warranty from the pump manufacturer, in the name of the Owner, against defects in workmanship and materials, covering parts and labor. The terms of the warranty shall be as follows:
   - 0-18 months – 100%
   - 19-39 months – 50%
   - 40-46 months – 25%
PART 2 - PRODUCTS

2.1 PUMPING SYSTEM

A. General:

1. Pump:
   a. Pump type and use are specified in Pump Schedule in this Section.
   b. See the Specification Section noted in the Pump Schedule for additional information for each specific pump type.
   c. Pump shall be suitable for intended purpose as specified and as shown on Drawings.
   d. Pumps designated for a certain function shall be supplied by same manufacturer.
   e. Pumps shall be supplied by the same manufacturer.
   f. All parts shall be designed and proportioned to have liberal strength, stability and stiffness to perform required function.
   g. Provide ample room and fittings for inspection repairs and adjustments.
   h. Pump base accurately aligned, sized and rigidly anchored into position in accordance with Drawings.
   i. Anchor bolts, plates, nuts and washers shall be SAE bolt steel of ample size and strength for purpose intended, furnished and installed by Contractor in accordance with manufacturer's instructions.
   j. Provide adaptor flanges, as necessary, to match piping system.
   k. Brass or stainless steel name plates providing manufacturer's name, rated capacity, total dynamic head, operating speeds and other pertinent data shall be attached to pump equipment.

2. Motors:
   a. Refer to requirements in Section 11000.
   b. Type specified in the Pump Schedule in this Division.
   c. All motors shall be of nationally known manufacturer and conform to NEMA standards and specifications.
   d. Maintain sufficient capacity to operate pump throughout designated operating range without exceeding name plate rating for current and power.
   e. Vertical motors provided with radial keyways to absorb thrust caused by the shafting.

3. Mechanical Seals (unless otherwise indicated).
   a. As specified in Section 11319.

4. Gauges:
   a. Provide one discharge gauge per pump at Falmouth Road Pump Station, unless otherwise specified. Gauges shall be provided in accordance with Section 11000.

5. Lifting Cable:
   a. Each pump shall be equipped with a stainless-steel lifting cable of adequate lifting capacity for the pumps supplied. The cable length shall be adequate to extend a minimum of 15-feet above the top of the wet well to allow connection to lifting equipment. Terminate upper end of cable with a swag ball end for easy connection to the portable hoist.
b. Install a stainless-steel hook bolt below the top of the tank within reach of the access hatch for storage of the excess cable.

6. Surface Preparation and Shop Coatings
   a. Provide surface preparation and shop coatings in accordance with Specification Section 09905.

7. Field Coatings
   a. Provide field coatings in accordance with Specification Section 09900.

8. Spare Parts:
   a. Spare parts shall be delivered at the same time as the equipment to which they pertain.
   b. The Contractor shall properly store and safeguard such spare parts until Substantial Completion of the work, at which time they shall be delivered to the Owner.
   c. Parts shall be packaged in individual suitable containers labeled with the part number, name and quantity.

2.2 PUMP SCHEDULE
   A. Falmouth Road Pump Station: Section 11319
      1. Function: Pump raw, unscreened wastewater from wet well to terminus manhole.
      2. Number of Units: Two (P-1, P-2)
      3. Type: Submersible, non-clog centrifugal
      4. Capacity: 400 GPM each at 215 ft TDH with a minimum hydraulic efficiency of 52%. Minimum shutoff head of 306 feet TDH. Maximum NPSHR of 22 ft. The pump shall be capable to operate without any limitation between 50% and 125% of the Best efficiency point (B.E.P) of the performance curve. Pump must be capable of operating at 122 feet TDH without overloading the motor.
      5. RPM: 3,550 maximum.
      6. Seal: Refer to Section 11319.
      7. Drive: VFD
      9. Controls: Control shall be as specified in Division 13.

PART 3 - EXECUTION

3.1 EXAMINATION, PREPARATION AND INSTALLATION
   A. In accordance with the requirements of Section 11000 and the manufacturer’s written instructions.

3.2 START UP AND TESTING
   A. In accordance with the requirements of Section 01800 and 11000.
   B. Perform all adjustments necessary to place equipment in satisfactory working order and to meet performance testing requirements. If equipment fails to meet performance requirements, the Contractor shall modify or replace the equipment at no additional cost to the Owner.
3.3 CLEANING AND FIELD COATINGS
   A. In accordance with the requirements of Section 09900 and 11000.

3.4 TRAINING AND WARRANTY PERIOD SUPPORT
   A. In accordance with the requirements of Section 01800.

END OF SECTION
SECTION 11319
SUBMERSIBLE NON-CLOG CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install and test submersible non-clog centrifugal pumps, and all appurtenances necessary to make a complete and operable system as indicated in the Specifications and as shown on the Drawings.
B. Related work specified elsewhere:
   1. Additional requirements are specified in Sections 01800, 11000 and 11310.
   2. Concrete and grout are specified in Division 3.
   3. Metals are specified in Division 5.
   4. Surface Preparation, Shop and Field Coatings are specified in Division 9.
   5. General Pump System Requirements and Pump Schedule are specified in Section 11310.
   6. Instrumentation and Controls are specified in Division 13.
   7. Pipe, fittings and valves are specified in Division 15.
   8. Electrical is specified in Division 16.
C. Performance Requirements: Each pump shall be capable of continuously pumping raw unscreened wastewater at all flow and head conditions indicated in the Pump Schedule, and along the pump curve.

1.2 QUALITY ASSURANCE
A. In accordance with the requirements of Section 11000.
B. All system components specified herein shall be furnished by a single Manufacturer who regularly engages in the production of this type of equipment. The Manufacturer shall be responsible for the performance and warranty of the entire system provided under this section. The Contractor shall be responsible for the satisfactory operation of the entire system.
C. Qualifications of Manufacturers: The Manufacturer shall have a minimum of 10 years of experience in the design and manufacture of the specified equipment. Products shall have proven reliable in similar installations over a reasonable number of years.
D. Acceptable Manufacturers:
   1. Xylem Water Solutions, FLYGT Pumps – N-Impeller – Woburn, MA, no equal

1.3 SUBMITTALS
A. In accordance with the requirements specified in Section 01340, 11000 and 11310 and as specified herein. Submit such shop drawings, manufacturer’s literature, short-term and long-term storage requirements, and operations and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING
A. In accordance with the requirements of Section 11000. Manufacturer shall deliver equipment to the project site where and when directed by the Contractor.
1.5 WARRANT
A. In accordance with the requirements of Section 11000 and 11310.

PART 2 - PRODUCTS

2.1 MATERIALS
A. General:
   1. All pumps designated for a certain function shall be supplied by the same manufacturer.
   2. All parts shall be designed and proportioned to have liberal strength, stability, and stiffness to perform required functions.
   3. Exposed hardware shall be 316 stainless steel.
   4. Provide ample room and fittings for inspection, repairs and adjustments.
   5. Pumps shall pass any rags, trash or stringy material which may pass through the average house and commercial business collection system.
   6. Pumping units shall draw untreated raw sewage from a wet well and discharge into a force main as specified in Section 11310. Pumps motors shall be U.L. Class 1, Div 1, Group D, Design B for use in an explosion-proof system.
B. Pump Support System
   1. Pumps shall be mounted on a 316 stainless steel guide rail system, with slide away coupling base/discharge elbow.
   2. The lower guide holders shall be integral with the discharge connection and shall be anchored to the wet well floor by means of 316 stainless steel anchors. Pump base shall be raised from the wet well floor on a concrete base as indicated on the Drawings. Stainless steel anchors shall extend through the concrete base and into the wet well bottom as indicated on the Drawings.
   3. Pump base accurately aligned, sized, and rigidly anchored in position in accordance with the manufacturer's requirements and recommendations and allow for complete removal of each pump.
   4. Sealing of pump to discharge connection shall be by means of metal to metal contact.
   5. No portion of the pump shall bear directly on the floor.
   6. There shall be two non-sparking guide rails per pump which shall be a minimum of 2-inch diameter 316 stainless steel pipe.
   7. Slide-away coupling shall be designed so that when pump is idle, it may be removed for service or inspection and then returned to service without entering the wet well to unbolt or unlock the connection between the pump and piping.
C. Pump Casing:
   1. Constructed of gray cast iron, Class 35B (ASTM A48) of ample thickness, capable of prolonged resistance to the abrasive action of solids or foreign matter contained in the liquid passing through the pump.
   2. All castings must be blasted before coating. All wet surfaces are to be coated with two-pack oxyrane ester Duasolid 50. The total layer thickness should be at least 120 microns.
D. Discharge Nozzles: Minimum size and type indicated in the Pump Schedule, Section 11310.
E. Impeller:
1. The submersible non-clog sewage pump impeller shall be a semi-open, multi-vane impeller. The impeller shall be wear-resistant and made of high chromium cast iron with at least 24% chrome.
2. The impeller blades shall be self-cleaning upon each rotation as they pass across a sharp relief groove in the insert ring and shall keep the impeller blades clear of debris. The clearance between the insert ring and the impeller leading edges shall be adjustable.
3. Impellers shall be mounted to the motor shaft.
4. Impellers that are not capable of cutting debris must be capable of passing a 3-inch solid.

F. Shaft: The pump-motor shaft shall be stainless steel ASTM A479 S43100-T, accurately machined.

G. Mechanical Seal: The pump shaft seal shall be of the double mechanical type, with pump seal leak detection system as specified hereinafter.
1. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. Any leakage passing the sealing shall not pass the bearings. Before it reaches the bearings, the liquid shall create an alarm via the floating leakage sensor.
2. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication. Seal lubricant shall be non-hazardous.
3. An electric sensing probe or a small float type switch shall be mounted in the seal chamber to detect any water leakage past the lower seal. The sensor shall activate a "Seal Fail" alarm light at the control panel.

H. Motor:
1. Submersible non-clog sewage pump motor ratings shall be as specified in the preceding Pump Schedule, Section 11310.
2. Pump and motor shall be by the same manufacturer.
3. Squirrel-cage, induction, shell type design housed in an air-filled, watertight chamber, NEMA Design B.
4. Motors shall have normal starting torque and low starting current.
5. Motors shall maintain sufficient capacity to operate pump throughout designated operating range without exceeding name-plate rating for current and power.
6. The motor shall be capable of no less than 30 evenly spaced starts per hour and be able to operate throughout the entire pump performance curve from shut-off through run-out.
7. The stator windings shall be insulated with moisture resistant Class H insulation rated for 356°F.
8. Pump motors shall be furnished with ball bearings. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated and have a nominal L10 lifetime of 50,000 hours. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two-row angular contact bearing to compensate for axial thrust and radial forces.
9. The pump motor shall be provided with an integral motor cooling system. A 316 stainless steel cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. Pumps that rely on the pump media or motor submergence (full or partial) for motor cooling shall not be acceptable.
10. The motor shall be fitted with heavy lifting eyes, each capable of supporting the entire weight of the pump and motor.
11. The pump shall be supplied with a Motor Protection Relay (MPR) to monitor motor temperature and seal status. The MPR shall be installed in the Division 13 and/or Division 16 panel. The Contractor is to coordinate delivery and installation of the MPR in the Division 13 and/or Division 16 panel.
12. A float switch shall be mounted in a leakage chamber below the main bearing, and be connected to a signal light on the pump control panel (PCP), to detect any water leakage.
13. Three thermal switches embedded in the stator shall protect motor against excess heat in compliance with its U.L. rating. Sensor shall reset automatically at the motor when motor cools. Heat sensor overload alarm light shall be manually or automatically reset at the Pump Control Panel (PCP).
14. Controls are specified in Division 13. Refer to the Instrumentation and Electrical Drawings.

2.2 SPARE PARTS:
A. In accordance with the requirements of Section 11000.
B. Provide the following spare parts:
   1. Two complete sets of gaskets per each type pump.
   2. Any special tools required to service the equipment.
PART 3 - EXECUTION

3.1 EXAMINATION, PREPARATION AND INSTALLATION
   A. In accordance with Specification Section 11000.

3.2 START-UP AND TESTING
   A. In accordance with Specification Sections 01800 and 11000.
   B. Manufacturer or Manufacturer's Representative shall demonstrate that manufacturer-provided controls (i.e., seal fail, motor over temperature) function as per the manufacturers written requirements and Division 13 requirements, prior to equipment being put into service.

3.3 CLEANING AND FIELD COATINGS
   A. In accordance with the requirements of Section 09900 and 11000.

3.4 TRAINING AND WARRANTY PERIOD SUPPORT
   A. In accordance with the requirements of Section 01800.

END OF SECTION
SECTION 13410

INSTRUMENTATION AND PROCESS CONTROL GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements and Definitions:

1. A single System Integrator shall furnish all services and equipment as specified herein and in the following Specification sections:

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<td>Programmable Logic Controllers</td>
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<td>13444</td>
<td>Control Panels</td>
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</tbody>
</table>

2. The System Integrator (SI) provide all labor, materials, equipment, operations, methods and procedures as indicated in the Contract Documents to achieve a fully integrated and operational system. The SI shall be responsible for integrating hardware into the Division 13 control panels, local control panels, and instruments.

3. Items specifically excluded from the scope of the System Integrator include the following:

a. Programming and configuration of the Programmable Logic Controllers (PLCs), Operator Interface Terminals (OITs), and the SCADA system as defined in Section 13441 shall be done by the Owners Application Engineering Services Supplier (AESS) under a separate contract. The Contractor shall coordinate with the AESS as outlined herein and in Section 13441.

4. All systems indicated in the Contract Documents shall mean all necessary supervision, labor, equipment and materials required to provide complete, properly integrated systems.

5. All hardware systems shall be adjusted, tested, inspected and optimized to the satisfaction of the Engineer and Owner prior to being turned over to the Owner.

6. The words "provide", "supply", "supply and install", "install", "furnish" or "furnish and install" shall mean a complete and properly functioning hardware installation performed by the System Integrator unless otherwise noted. The System Integrator shall design and coordinate the Instrumentation & Process Control system for proper operation with related equipment, materials, and labor (AESS) furnished by others under other sections of these Specifications and with related existing equipment.

7. Refer to Civil, Mechanical, Instrumentation, and Electrical Drawings to coordinate material and equipment locations. Refer to the Process Drawings for locations and connection to primary instrumentation, control valves and process equipment. Refer to the Electrical Drawings for the location of transmitters, control stations, motor drives and centers, variable speed drives, control panels, wiring diagrams, network, and computer equipment.
B. Work Included:
1. Field Instruments: Refer to Section 13440
2. Control Narratives: Refer to Section 13441
3. Programmable Logic Controllers: Refer to Section 13442
4. Control Panels: Refer to Section 13444
5. Application Development:
   a. The AESS, under a separate contract, will provide PLC programming, SCADA programming, and IP addresses for all network equipment (network configuration shall be the responsibility of the SI) for equipment control or connection to control, status indication and alarm annunciation of equipment as shown in the Instrumentation Drawings, and described in Section 13441 – Control Loop Descriptions.
   b. The Contractor and SI shall coordinate and schedule the work of the AESS under this project.
6. Application Development: Refer to Section 13441
7. Meetings:
   a. The SI shall attend construction meetings as necessary to coordinate construction sequencing.
   b. The AESS shall attend construction meetings as necessary to coordinate construction sequencing.
   c. The Contractor, SI, and AESS shall attend a separate construction meeting shall be dedicated specifically for SCADA Testing to include types of test, responsibility and requirements, scheduling, coordination, verification of test results prior to witness testing by the Engineer/Owner, and testing notification requirements.
8. Miscellaneous:
   a. Furnish and install all transducers, media converters, protocol converters, terminals, transformers, interposing or pilot relays (for both new and existing equipment), signal transmitters, signal splitters/boosters, intrinsic safety barriers, power supplies, power supply connections and other miscellaneous instrumentation required to make a complete system.
   b. Furnish all software as specified in Specification 13444.
   c. Furnish and install all transducers, media converters, protocol converters, terminals, transformers, interposing or pilot relays (for both new and existing equipment), signal transmitters, signal splitters/boosters, intrinsic safety barriers, power supplies, power supply connections and other miscellaneous instrumentation required to make a complete system.
   d. Furnish and install all vendor or manufacturer cables and appurtenances between primary instruments and the transmitters, receiving instruments or destination terminals. All methods, materials and supplies will meet the requirements of Division 16.
   e. Furnish mounting hardware for each instrument. The System Integrator will provide information on the proper installation in accordance with the Manufacturer’s requirements for each instrument and shall supervise the
installation. Tubing, process taps, and an isolation valve will be provided under Mechanical in Division 11 and 15. Coordinate the size and type of connection required. Refer to the Instrument Installation Detail Drawing in the Contract.

9. O&M Documentation:
   a. Provide complete O&M documentation as listed under paragraph 1.4 and other related Division 13 specifications.

10. Demolition:
    a. Remove and/or relocate existing equipment as indicated on the Drawings.
    b. Deliver PLC and OIT equipment not reused to Owner.

11. Coordination:
    a. Process Instrumentation and Process Control Systems will be provided under Division 11, where specified. The System Integrator shall coordinate with the instrumentation and control systems provided under these sections.
    c. Conduit and wiring (not including integral or vendor furnished cables) shall be provided and tested under Division 16 and as shown on the Electrical Drawings.
    d. The SI shall provide the drawings as specified in Section 13444 to be used by the Electrical Contractor as a wiring aid.
    e. The SI shall coordinate with the Electrical Contractor to update all ISA S5.4 or equivalent loop diagrams with actual terminal and wire label information as required.
    f. Provide manufacturer recommended installation and mounting requirements for each instrument to be connected to process equipment, piping or fittings requiring a process connection such as NPT taps, sample piping and process line insertion. The System Integrator will supervise and provide guidance on proper installation of instrumentation equipment. This shall include manufacturer’s recommended mounting installation heights and locations for gas detection sensors, clearances for level sensors per manufacturer’s blanking distance, etc.

C. Related Work Specified Elsewhere:
   1. Coordination is specified in Division 1.
   2. Manufacturer's control systems for process equipment are specified in Division 11.
   3. Electrical Systems are specified in Division 16.

D. Related Work by Others under this Contract:
   1. Local control stations (including E-stops, local hand switches, speed pots, and local indicating lights) and equipment control panels (i.e. MCCs, VFDs), indicated on Electrical Drawings.

E. Demonstration of Complete Instrumentation and Process Control System:
   1. The Owner will assume no liability or responsibility for any portions of the installation under this Contract until they are demonstrated by the Contractor and accepted by the Engineer in writing. Final demonstrations shall be made only after the Engineer is satisfied that the work has been completed in accordance with the intent of the Contract Documents.
2. After the Instrumentation and Process Control System is completed, and when directed by the Engineer, demonstrate the total system operation and make final adjustments to the system. If any system or piece of equipment within a system fails to function properly, rectify such defects or inadequacies and make a final demonstration as directed by the Engineer.

3. Provide the services of authorized manufacturers' representatives to instruct the Owner's representatives in the proper operation of each partial or complete system installed under this Contract where noted.

4. Pay all charges or fees, including the cost of any special test equipment, factory engineers, etc., necessary for the proper performance of the specified tests, demonstrations and instructions.

5. All demonstrations and instructions referred to shall be scheduled at the convenience of the Engineer and the Owner and in no case shall be scheduled without at least 72 hours written notice to the Engineer. Scheduling of testing and certification of equipment by the Engineer until all instrumentation and electrical equipment have been installed, calibrated including testing/transmitting of alarms, status, etc. have been performed in the field in accordance with the Specifications. Once the systems have been tested in the field, the Contractor shall notify the Engineer a minimum of 72 hours before a formal startup and testing of each location. All testing of the equipment or system(s) shall be performed in a single contiguous block of testing dates or as agreed upon by the Engineer.

6. Service calls:
   a. Provide system integrator services of one 8-hour working day (not including travel time) upon request of the Owner within the first year of operation. Unused time shall be issued to the Owner as a credit.

F. Removals, Relocations and Rearrangements:
   1. Examine the existing site for the work of all trades, which will influence the cost of the work under Division 13. This work shall include removals, relocations and rearrangements relating to the work of all trades which may interfere with, disturb or complicate the performance of the work under Division 13; and relating to the work involving systems, equipment and related service lines which shall continue to be utilized as part of the finished project.
   2. Provide in the bid a sufficient amount effort to include all removals, relocations, rearrangements and reconnections herein specified, necessary or required to provide approved operation and coordination of the combined new and existing systems and equipment.

1.2 QUALITY ASSURANCE
   A. All materials provided under this Contract shall be equal in quality, appearance and performance to that specified herein and shall be subject to the approval of the Engineer. Verify the availability of all materials proposed to be used in the execution of the work prior to submitting same for the Engineer's approval. The discontinuance of production of any material or product after approval has been granted shall not relieve the Contractor from furnishing an Engineer approved alternate of comparable quality and design without additional cost.
B. Materials and equipment furnished under this Contract shall be standard products of manufacturers regularly engaged in manufacture of such products and shall be manufacturer's latest standard design that complies with Specification requirements. Products shall essentially duplicate material and equipment that have been in satisfactory local use at least three years.

C. The Contractor shall have supplied comparable systems to those specified herein and shall maintain engineering and service departments capable of designing and maintaining these systems. Provide, for a period of 12 months from the date of final acceptance of the work, all necessary supervision, labor, materials, and equipment, in order to correct any defects in any system due to faulty materials, equipment, installation methods, or workmanship and consequent damage resulting from such defects. This work shall be scheduled during normal working hours and at the convenience of the Owner.

D. System Integrator:

1. The Contractor’s attention is directed to the fact that the instrumentation is an integrated system and as such, shall be furnished by one supplier, who shall provide all of the equipment and appurtenances regardless of manufacturer, and be responsible to the Contractor for satisfactory operation of the entire system provided. Substitutions on functions specified will not be acceptable.

2. The exception shall be where instrumentation and control packages are furnished by respective equipment manufacturers as required in Division 11, 14, 15, and 16. All necessary provisions will be made to ensure a proper signal and communication interface as indicated on the P&IDs and associated equipment specifications between the main process instrumentation and control packages specified within this section and those provided. The Contractor shall provide startup reports which demonstrate proper operation of Division 11, 14, 15, and 16 equipment and associated Division 11 control systems.

E. Acceptable System Integrators:

1. Northeast System Controls & Engineering, Inc., Laconia, NH
2. Electrical Installations Inc., Moultonboro, NH
3. I&C Systems Engineering, Scarborough, ME
4. AEC Engineering, Freeport, ME
5. Stultz Electric, Portland, ME
6. Or equal, having a minimum of 5 years’ experience in supplying comparable systems.

1.3 SUBMITTALS TO THE ENGINEER

A. Shop Drawings and Samples:

1. Submit Shop Drawings and O&Ms in accordance with General Conditions Section 01340 and as indicated herein.

2. Shop Drawings shall consist of:

   a. Project name and location
   b. Contractor’s name
   c. Index Sheet - Listing the equipment being submitted utilizing equipment designations, or symbols, indicated on the Contract Documents together with the proposed manufacturer, style/type and catalog number.
d. Manufacturer's scale or dimensioned drawings along with standard catalog number.

e. Equipment ratings, service clearances and configuration.

f. Listing of accessories to be furnished

g. Panel wiring diagrams showing the location of each mounted component, front panel elevation(s), internal wiring diagram of each component including terminal numbers.

h. Bill-of-Material Table showing a complete listing of the components in each control panel. Table shall include separate columns for the following: Item Number, Quantity, Manufacturer, Part number, Description, Designator Tag, Supplier name and phone number.

i. SAT Report:

   i. The SI shall furnish an I/O checkout sheet identifying and acknowledging that field wiring is properly terminated to the SI furnished hardware.

   ii. The SI shall furnish a checklist of all the instruments that have been configured and ready for additional testing.

j. Refer to the other Division 13 Sections for additional shop requirements.

3. All material shall be contained in one submission; partial submissions will not be accepted.

4. Submissions shall be in the form and quantity indicated in the General Conditions. Each equipment type shall be separated by index tabs with typewritten titles.

5. Provide samples of programs, graphics, etc., within 10 days upon receipt of request from the Engineer.

B. Maintain properly documented and witnessed test and checkout reports and submit these to the Engineer. No form of energy shall be applied to any part of the instrumentation system prior to receipt by the Engineer, from the Contractor, of the supplier's certified statement of approval of the installation and containing his authorization to energize the system, except that the supplier's serviceman may do so for the purpose of check-out as described herein.

1.4 DELIVERY, STORAGE AND HANDLING

A. Coordinate material and equipment delivery with the project schedule. Notify the Engineer immediately, in writing, if material or equipment delivery will adversely affect the project schedule, include documentation from equipment suppliers indicating the revised delivery dates and the reason for the delay.

B. Coordinate delivery of equipment directly to other vendors where instrumentation supplied under this section has to be installed in panels supplied under other specification sections.

C. Exercise care during loading, transporting, unloading and handling of materials to prevent damage.

D. Check for defective or damaged materials, and for incomplete equipment shipments within seven days after equipment delivery to the project site.
E. Store materials and equipment on the construction site in enclosures or under protective covering in order to assure that materials and equipment are kept undamaged, clean and dry. The Contractor shall maintain an inventory of instruments and control panels received on site and store in a safe, secure, dry and temperature controlled location. This inventory shall be made available to the Engineer upon request.

F. Replace or repair, to the satisfaction of the Engineer, all materials and equipment that are defective or that have been damaged during installation, at no additional cost to the Owner.

1.5 O&M REQUIREMENTS:

A. Provide the Owner with a list of local service departments of duly authorized distributors of materials and equipment of the type installed, which will stock the manufacturer's standard parts, etc. The list may be included on the bill-of-materials.

B. At the completion of the installation, provide Record Drawings on sheets no less than 11" x 17", indicating the final configuration of all systems as they were installed. Symbols, equipment designations, instrument ISA designations, etc., shall be consistent with the Contract Documents. Provide exact locations of all work which has been concealed in concrete, masonry or underground. The following diagrams shall be included:

1. Control Panel diagrams on 11" by 17" sheet showing the front face and panel mounted equipment with full listing of components including names, descriptions and model numbers for each component. One copy of the panel diagrams will be laminated for insertion into the pocket inside each control panel.

2. All drawings will be provided to the Owner as record drawings in both AutoCAD DWG format and Adobe PDF format.

3. Panel wiring diagrams showing the location of each mounted component; front panel elevation(s) and name plates; internal wiring diagram of each component including field instruments and terminal numbers; and network communications including all provided equipment, on 11” by 17” sheets.

4. Provide a hardcopy set of applicable drawings in each control panel and one binder with a hardcopy of all record drawings.

5. Provide a copy of all record drawings to the Owner and Engineer in AutoCAD DWG format or Adobe PDF format on a USB drive.

C. Refer to the other Division 13 Sections for additional O&M requirements.

D. O&M Manual Organization: The hardcopy operations and maintenance manuals shall be organized in three ring binders with a maximum size of 4". The following is a proposed outline for the O&M Manual(s), provide applicable Sections:

Table of Contents
Section 1 - Reserved for description of system by Owner
Section 2 - Field Instruments (arranged alphabetically by Tag No.)
  2.1 ISA instrument calibration data sheets and instrumentation listing with part numbers
  2.2 O&M literature for each type of instrument with labeled dividers
  2.3 Instrument configuration data
Section 3 - Panel Equipment (arranged alphabetically by manufacturer)
3.1 Bill-of-Material Table
3.2 O&M and Manufacturer's literature
Section 4 - Miscellaneous devices (arranged alphabetically by manufacturer)
4.1 Bill-of-Material Table
4.2 O&M and Manufacturer's literature
Section 5 - Drawings
5.1 Network drawings
5.2 Panel fabrication and assembly drawings
5.3 Panel wiring diagrams
5.4 Interconnection wiring diagrams
5.5 ISA S5.4 loop diagrams
Section 6 - PLC
6.1 CPU, memory capacity, communication ports
6.2 Rack Layout and module configuration
6.3 I/O List
6.4 PLC communication parameters/ port configuration
Section 7 - Miscellaneous Data
7.1 Data Networking Equipment List
7.2 Data Networking Equipment Configuration, IP Addresses, Layout, and Security Access.
Section 8 - Program (Reserve for AESS)
8.1 PLC Program with data tag registers, cross reference list, and comments.
8.2 Operator Terminal Screen Color Printouts, communication configuration, and data tag printout.
8.3 SCADA Screen Color Printouts, communication configuration, and data tag printout.
8.4 Custom Report Printouts
8.5 Alarm Configuration and alarm tag printouts.

E. The cover and edge of each volume shall contain the following information:

Project Name
Owner's Name

Instrumentation and Control System
Operations and Maintenance Manual
Specification Section 13###
Volume X of Y
(where X is the volume number and Y is the number of volumes)
Subcontractor Name, Date

F. Electronic O&M Information:
1. Supply all electronic files on 4.8 GB DVD-R media or USB drive
2. Refer to other Division 13 specifications for additional information.
G. **Warranty Documentation:** The Contractor and System Integrator shall investigate, diagnose, repair, update and distribute all pertaining documentation of deficiencies which become evident during the warranty period. All such documentation shall be submitted to the Engineer within 30 days of solving the problem.

**PART 2 - PRODUCTS**

2.1 **MATERIALS**

A. **General:**

   1. All of the equipment shall be the manufacturer's latest proven design. If a piece of equipment was sole sourced, but is no longer the current version, the SI shall propose and carry the latest version of the product migration path. Specifications and Drawings call attention to certain features, but do not purport to cover all details entering into the design of the instrumentation and process control system. The completed system and the equipment furnished by the Contractor shall be compatible with the functions required.

   2. Components shall be finished to the manufacturer's standard for the service intended unless otherwise indicated in the Specifications or on the Drawings.

   3. All electrical components of the system shall operate on 120-volt, single-phase, 60-Hertz current, except as otherwise noted in the specifications and drawings. Power shall be supplied from either local electrical distribution panels, or an associated control panel UPS with breakers for each circuit as indicated on the Instrumentation and Electrical drawings.

   4. All controls for electrically operated or motor-driven equipment (including electrically actuated valves, small pumps and chemical feed equipment, etc.) shall be complete, including all necessary auxiliary relays, so as to require only wiring and connections to the equipment control circuit. All contacts for control of motor-operated or electrically operated equipment shall be rated not less than 10 amperes on 120 volts unless otherwise specified herein.

   5. Panel components including switches, relays, instrumentation, etc. supplied by the various process equipment manufacturers, but indicated to be installed within panels furnished by the System Integrator, shall be furnished to the System Integrator for incorporation into his panels. System Integrator shall install these items within his panel and shall produce a complete, functional, pre-wired system for installation requiring only external power and instrumentation connections. The Contractor shall coordinate this requirement and shall ensure that equipment manufacturers provide all necessary installation instructions and requirements to the System Integrator.

   6. **Identification:**

      a. All panels, and control devices shall have identifying nameplates. Equal quality nameplates shall be attached to all field-installed units.

B. **Lightning/Surge Suppression**

   1. Refer to Section 13444.
PART 3 - EXECUTION

3.1 INSTALLATION
A. General:
   1. The Specifications and Drawings do not attempt to fully indicate the degree of assembly, subassembly, shipped condition, extent of field work, or degree of accuracy required to install the equipment or materials. The Contractor shall be required to rely on his prior experience or to otherwise inform himself of the amount of field work required to assemble, erect, and install the equipment or material, as received, to produce a finished installation ready for use or operation.
   2. All equipment installed as part of the work shall be positioned, assembled, aligned, doweled, and otherwise set to the tolerances required by the equipment manufacturer. Where tolerances and methods are not specifically indicated, they shall be in accordance with best millwright practice.
   3. All materials incorporated in the work shall be installed in accordance with the Drawings and Specifications. Where detailed drawings or technical specifications are not provided, the materials shall be installed in accordance with the manufacturer's preferred recommendations and conforming to the best practice of the trade involved. Installation shall include all accessories required to produce a completed installation ready for use.
   4. The Owner will assume no liability or responsibility for any portions of the installation under this Contract until they are demonstrated and accepted in writing. Final demonstrations shall be made only after the Owner and Engineer are satisfied that the work has been completed in accordance with the intent of the Contract Documents.

B. Electrical Work:
   1. All electrical work shall conform to the requirements indicated in Division 16.

C. Procedures Prior to Startup:
   1. The Contractor and System Integrator shall:
      a. Coordinate and schedule the work of the AESS service personnel through Engineer as necessary. The AESS shall be onsite during VFD and MCC startup and configuration to verify proper connection and scaling to the control panel using PLC program.
      b. All wiring will be installed, terminated, and tested by the Contractor in each control panel. Wire labeling shall be coordinated between the SI and the Electrical Contractor during construction to assign terminal numbers in loop drawings of all field terminations, including intermediate junction boxes. Refer to Section 16010.
      c. Calibrate and configure all Division 13 supplied instrumentation as specified in Section 13440.
         i. Verify that each instrument is properly installed, configured, and is properly measuring values for the application.
         ii. Coordinate with the AESS that the control system is scaling matches the instrument scaling.
         iii. Provide digital averaging/filtering or any other advanced configuration where required for proper equipment control.
d. Coordinate with Division 11 control panel manufacturers in establishing network communications as required on the Drawings. If the Division 11 provided PLC’s communication protocol does not match that of the PLC being provided by the Division 13 System Integrator, the System Integrator shall provide a protocol converter as specified in Section 13445.

e. Verify the facility installation.

f. Be onsite during Equipment Startup to verify equipment wiring and basic functionality of Division 13 furnished equipment.

g. Coordinate and verify interface with electrical equipment, including field wiring terminations.

h. Document hardware configuration and wiring information.

i. Configure all furnished network equipment unless otherwise specified.

j. Demonstrate network functionality.

2. The Contractor and AESS shall:

a. Prior to the witnessed site acceptance testing, the AESS shall perform a preliminary test to verify operation prior to witnessed testing. The Contractor shall assist as necessary.

b. Perform and IO checkout from field device to PLC prior to any automated and PLC testing.

   i. The AESS shall monitor and manipulate the PLC inputs and outputs through the PLC program.

   ii. The Contractor, Electrical Contractor, and SI will assist with testing IO from devices. The individual(s) assisting with checkout shall be qualified to do the required testing.

c. Coordinate VFD interface and scaling.

D. Site Acceptance Testing

1. A Site Acceptance Test shall be performed on each Division 13 control system after the installation at each site to verify that each instrument and equipment drive is connected properly to the control panel and that all functions of the control panel are operating as specified.

   a. The Contractor shall schedule Startup and SAT activities with the Engineer at least 5 business day in advance.

   b. The Contractor shall not schedule more than 3 days of site acceptance testing, or training during any week without agreement from the Engineer and Owner. No site acceptance testing shall occur on Fridays without agreement from the Engineer and Owner.

   c. Additional SAT activities restrictions may be determined by the Owner.

2. The Contractor and SI shall:

   a. Verify the facility installation.

   b. Provide final instrument field calibration sheet/documentation after SAT has been completed.

   c. Verify accuracy of documentation, operator’s manuals, software documentation, and site operating instructions, etc. after SAT has been completed. Documentation shall include all field modifications.
3. The Contractor and AESS shall:
   a. The AESS will be responsible for all PLC, OIT, and SCADA programming. The Contractor will be responsible for all hardware and equipment unless otherwise specifically stated.
   b. Demonstrate each functional requirement identified by the Specification.
   c. Demonstrate all equipment control functions, including the operation of automatic control strategies. Actuation of field devices and operation of equipment shall be closely coordinated with Engineer and Owner’s staff.
   d. Demonstrate all networking functionality.
   e. Verify system performance parameters and system responses under field operational conditions.
   f. Demonstrate all equipment control functions, including the operation of automatic control strategies. Actuation of field devices and operation of equipment shall be closely coordinated with Engineer and Owner’s staff.
   g. Verify system performance parameters and system responses under field operational conditions.
   h. Verify accuracy of documentation, especially operator’s manuals, software documentation, and site operating instructions. Documentation shall include all field modifications.
   i. Provide completed site acceptance testing (SAT) test documentation. Including:
      i. Startup reports
      ii. Initial startup values

4. The SAT will be observed by the Engineer and/or Owner's representative.

E. Refer to Section 01800 for additional startup, testing, training requirements for the instrumentation equipment.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Field Instruments:
      a. Furnish and install the instrumentation as shown on the Drawings and listed in the Instrumentation Schedule at the end of this Section. The locations of the instruments are shown on the Process and Electrical Drawings.
      b. Instruments shall be installed in accordance with the Drawings and as indicated in the Manufacturer’s installation manuals. Any deviation in instrumentation or electrical installation requirements for the supplied equipment shall be provided at no additional cost to the Owner.
      c. Provide support as necessary during Site Acceptance Testing to adjust the configuration of field instruments (ie. signal dampening, ranges, echo suppression, etc.).
      d. Provide ISA sheets and instrument configuration documentation after acceptance testing.
   2. Miscellaneous:
      a. Furnish and install all transducers, media converters, protocol converters, terminals, transformers, interposing or pilot relays (for both new and existing equipment), signal transmitters, signal splitters/boosters, intrinsic safety barriers, power supplies, power supply connections and other miscellaneous instrumentation required to make a complete system.
      b. Furnish and install all vendor or manufacturer cables and appurtenances between primary instruments and the transmitters, receiving instruments or destination terminals. All methods, materials and supplies will meet the requirements of Division 16.
      c. Furnish mounting hardware for each instrument. The System Integrator will provide information on the proper installation in accordance with the Manufacturer’s requirements for each instrument and shall supervise the installation. Tubing, process taps and an isolation valve will be provided under Mechanical in Division 11 and 15. Coordinate the size and type of connection required. Refer to the Instrument Installation Detail Drawing in the Contract.
   3. Acceptance Testing:
      a. A Factory Acceptance Test will be performed on each Division 13 control panel prior to being delivered to the site. The Factory Acceptance Test requirements are Provide support as necessary during Site Acceptance Testing to adjust the configuration of field instruments (ie. signal dampening, ranges, echo suppression, etc.).
b. Refer to Section 13410 for additional requirements.

c. O&M Documentation:

d. Provide complete O&M documentation as listed in Specification 13410, including:
   i. Final ISA S20 instrument data sheets (or equivalent) with updated calibration data. The ISA instrument datasheet shall be representative of the latest version. If the calibration and configuration data is on the instrument configuration sheets, the calibration and configuration data does not need to be replicated.
   ii. Instrument configuration sheets (often seen in the appendixes of the instrument manuals). Configuration sheets shall be completed with all non-default values.

4. Coordination:
   b. Provide manufacturer recommended installation and mounting requirements for each instrument to be connected to process equipment, piping or fittings requiring a process connection such as NPT taps, sample piping and process line insertion. The System Integrator will supervise and provide guidance on proper installation of instrumentation equipment. This shall include manufacturer’s recommended mounting installation heights and locations for gas detection sensors, clearances for level sensors per manufacturer’s blanking distance, etc. Refer to installation details on the drawings for additional information.

c. The System Integrator shall coordinate and provide calibrated instrument ranges to the AESS for scaling and programming purpose.

C. Related Work Specified Elsewhere:

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<th>Section</th>
<th>Title</th>
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<td>13444</td>
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1.2 QUALITY ASSURANCE

A. All materials provided under this Contract shall be equal in quality, appearance and performance to that specified herein and shall be subject to the approval of the Engineer. Verify the availability of all materials proposed to be used in the execution of the work prior to submitting same for the Engineer's approval. The discontinuance of production of any material or product after approval has been granted shall not relieve the Contractor from furnishing an Engineer approved alternate of comparable quality and design without additional cost.

B. Materials and equipment furnished under this Contract shall be standard products of manufacturers regularly engaged in manufacture of such products and shall be manufacturer's latest standard design that complies with Specification requirements.
Products shall essentially duplicate material and equipment that have been in satisfactory local use at least three years.

1.3 **SUBMITTALS TO THE ENGINEER**
A. **Shop Drawings and Samples:**
   1. Submit Shop Drawings and O&Ms in accordance with General Conditions Section 01340, 13410, and as indicated herein.
      a. Manufacturer's scale or dimensioned drawings along with standard catalog number.
      b. Equipment ratings, service clearances and configuration.
      c. Listing of accessories to be furnished
      d. ISA Instrument Sheets (or equivalent)
   2. All material shall be contained in one submission; partial submissions will not be accepted.

**PART 2 - PRODUCTS**

2.1 **MATERIALS**
A. **General:**
   1. All of the equipment shall be the manufacturer's latest proven design. Specifications and Drawings call attention to certain features, but do not purport to cover all details entering into the design of the instrumentation and process control system. The completed system and the equipment furnished by the Contractor shall be compatible with the functions required.
   2. Components shall be finished to the manufacturer's standard for the service intended unless otherwise indicated in the Specifications or on the Drawings.
   3. Instrumentation equipment supplier shall provide "vendor furnished cable" between instrumentation system equipment components as indicated on the Instrumentation and Electrical Drawings, unless otherwise indicated. Conduit shall be provided under Division 16 and is shown on the Electrical Drawings.
   4. **Identification:**
      a. All panels, and panel mounted instruments and control devices shall have identifying nameplates. Equal quality nameplates shall be attached to all field-installed units.
      b. Each field transmitter shall have an attached manufacturer's tag with the Manufacturer's name, model number, serial number, power requirements, and scaled range of the instrument.
      c. Provide suitable lamicoid labels for each process measurement element and transmitter. Label will identify each medium being measured, range and units of measurement and indicating transmitter/element ID No., for example:

         Pump Station Flow  
         0.00 to 1,000.0 (GPM)  
         FIT-115
B. Instrumentation Equipment (Refer to Instrumentation Schedule at the end of this Section)

1. Magnetic Flow Meters and Indicating Transmitters: FE/FIT
   a. Provide electromagnetic type flow meters, as indicated in the Instrumentation Schedule, with the following requirements.
   b. Transmitter:
      i. Type: Remote Panel Mount
      ii. Display: Backlit LCD
      iii. Power: 120 VAC
      iv. Accuracy: Minimum 0.50% of rate above 1 ft/s fluid velocity
      v. Analog Output: 4 to 20 mA DC
      vi. Discrete Output: Sinking 24 VDC Pulse
      vii. Operating Temperature: -4 to 120 ºF
      viii. Electrical Connections: ½" NPT
      ix. Enclosure Rating: NEMA 4X
      x. Communications Protocol: None
      xi. Memory: Non-volatile
      xii. Measuring Range: Per Instrumentation Schedule
   c. Measuring Element:
      i. Type: Flange Style flow tube for continuous flow measurement
      ii. Applications:
         (1) Pretreated Wastewater
      iii. Materials:
         (1) Housing & Flanges: Carbon Steel with painted corrosion resistant coating
         (2) Measuring tube: 304 Stainless Steel
         (3) Liner: Hard Rubber
         (4) Measuring Electrodes: Hastelloy C
      iv. Ground Reference: Stainless Steel Ground Rings
      v. Operating Temperature: -30 to 150 °F
      vi. Operating Pressure: Max 230 psi
      vii. Electrical Connection: ½" NPT
      viii. Process Connection: ANSI B16.5 Class 150 connections compatible with the type and classification of pipe installed.
      ix. Size: Per Instrumentation Schedule
      x. Enclosure Rating: Per Instrumentation Schedule
   d. Accessories and Spare Parts:
      i. One ductile iron pipe spool piece with the same flange to flange dimension as the magnetic flow meter to replace the meter during maintenance (one for each pipe size). Paint spool pieces per Painting - Section 09900.
      ii. Grounding electrodes.
e. For Flow Tubes mounted in Class I, Div. 1/2 areas, the entire flow meter system shall be rated for that classification and carry the required Factory Mutual approval. Refer to Instrumentation Schedule for required flow tube enclosure rating.

f. The PLC shall use a counting function, in conjunction with the transmitter pulse output, to totalize flow through the flow meter. The pulse output shall close the circuit each time a configurable volume passes through the flow tube. The pulse output shall be configurable through the flow meter transmitter.

g. Equivalent to:
   i. Siemens Sitrans Mag 5000 with 5100 flow tube
   ii. Krohne IFC 300 with Optiflux 2000 series flow tube
   iii. Rosemount 8712E with 8750W series flow tube
   iv. Or Equal

2. Ultrasonic Measurement for Level: LE/LIT

a. Provide an ultrasonic transducer with separate transmitter, as indicated in the Instrumentation Schedule, with the following requirements.

b. Transmitter:
   i. Type: Remote wall mount
   ii. Display: Backlit LCD
   iii. Power: 120 VAC
   iv. Accuracy: 0.02% full span
   v. Analog Output: Two 4 to 20 mA DC
   vi. Discrete Output:
      (1) Six (6) SPDT relay individually configurable
      (2) Contact Rating: 5 amps at 120 VAC or 24 VDC
   vii. Enclosure Material: Polycarbonate
   viii. Operating Temperature: -5 to +122 °F
   ix. Electrical Connections: Field drilled
   x. Temperature Compensation: Internal through ultrasonic transducer
   xi. Enclosure Rating: NEMA 4X, IP65
   xii. Communications Protocol: None
   xiii. Memory: Battery backed with capacitor for backup during battery replacement
   xiv. Configuration: Handheld programmer or onboard keypad
   xv. Mounting: Front Panel Mounted on FRCP

c. Measuring Element:
   i. Type: Non-contacting ultrasonic continuous level measurement.
   ii. Applications:
      (1) Drinking Water Clearwells
      (2) Chemical Storage Tanks
   iii. Materials:
      (1) Housing: PVDF
      (2) Radiating Face: CSM
Chemically resistant to the following:
(a) Acids
(b) Bases
(c) Sodium Hypochlorite
(d) Sodium/Magnesium Hydroxide
(e) Ferric/Ferrous Chloride
(f) Sodium Bisulfite
(g) Neat and Dilute Polymer

iv. Enclosure Rating: NEMA 4X, IP68
v. Operating Temperature: -4 to 150 °F
vi. Mounting: Stainless Steel Bracket
   (1) Contractor shall not install sensor within blanking distance of highest anticipated water level.
   (2) Contractor shall not install sensor in location where 3dB sensing cone is infringed upon.

vii. Measuring Range: Per Instrumentation Schedule
d. Transducers that are mounted in Class I, Div. 1/2 designated areas shall be explosion proof and shall carry the required Factory Mutual approval. Refer to Instrumentation Schedule for hazardous area requirements.

e. Accessories and Spare Parts:
i. One handheld programmer for transmitter configuration as required
ii. Submergence shield
f. Equal to:
i. Siemens HydroRanger 200 HMI with Echomax series transducer
ii. Or Equal

3. **Float Type Level Switches (for Intrinsically Safe circuits):** LSLL, LSL, LSH, LSHH

   a. Provide a float switch, as indicated in the Instrumentation Schedule, with the following requirements. A non-mercury float switch shall be provided with non-oxidizing contacts to allow low DC voltage signals for use with intrinsic safety devices.

   b. Float Switch
      i. Type: Narrow angle float switch
      ii. Applications:
         (1) Raw Wastewater
      iii. Materials: Polypropylene float
      iv. Operating Temperature: 32 to 140 °F
      v. Float Rating: Submersible
      vi. Cable:
         (1) Water resistant
         (2) Oil Resistant
      vii. Switch Contacts:
         (1) Non-oxidizing
         (2) 0.1 amps at 125 VAC or 30 VDC
(3) Non-mercury mechanically activated

c. Accessories and Spare Parts:
   i. Open Tanks or Channels:
      (1) Provide a stainless steel mounting rack with an adjustable
cable stop for each float switch.
      (2) External weight set for setting float switch activation angle
d. Class I, Div. 1/2 Installations:
   i. Float switches that are mounted in a Class I, Div. 1/2 designated
areas shall be intrinsically safe and be protected by a suitable
intrinsically safe barrier.
   ii. Float switch cables will terminate in a junction box rated for Class
I, Div. 1/2 areas as required by the installation. The gas tight seal,
required when transitioning between hazardous and non-hazardous
areas, will be installed after the junction box. The manufactured
cable will be spliced in the junction box and extend to the respective
control panel.

e. Refer to Instrumentation Schedule for hazardous area requirements.
   Equivalent to:
   i. Milliamppmaster Control Switch by SJE Rhombus
   ii. 9G-EF Float Switch by Siemens
   iii. SNF-52 Series by MDI
   iv. Eco-Float Gold by Anchor Scientific
   v. or equal

1. Temperature Element, Indicator with Switch: TSL, TSH
   a. Provide temperature switch, as indicated in the Instrumentation Schedule,
   with the following requirements.
   b. Temperature Switch:
      i. Type: Two stage temperature switch with thermistor type sensor.
         Sensor and relay shall be provided by the same manufacturer and
         shall be matched to make a function instrument system. Thermostat
         shall have one heating stage and one cooling state.
      ii. Applications:
         (1) Air
      iii. Display: LCD
      iv. Power: Refer to Instrumentation Schedule
      v. Analog Output: None
      vi. Enclosure Materials: Thermoplastic
      vii. Switch Contacts:
         (1) SPDT
         (2) 10 amps at 120 VAC
      viii. Setpoint Adjustment: Programmable through onboard keypad
      ix. Operating Temperature: 32 to 104 ºF
      x. Enclosure Rating: NEMA 1
      xi. Electrical Connections: ½" NPT
xii. Memory: Non-volatile
xiii. Mounting: Panel Mount

3.1 INSTALLATION
A. General:
1. The Specifications and Drawings do not attempt to fully indicate the degree of assembly, subassembly, shipped condition, extent of field work, or degree of accuracy required to install the equipment or materials. The Contractor shall be required to rely on their prior experience or to otherwise inform himself of the amount of field work required to assemble, erect, and install the equipment or material, as received, to produce a finished installation ready for use or operation.
2. All equipment installed as part of the work shall be positioned, assembled, aligned, doweled, and otherwise set to the tolerances required by the equipment manufacturer. Where tolerances and methods are not specifically indicated, they shall be in accordance with best millwright practice.
3. All materials incorporated in the work shall be installed in accordance with the Drawings and Specifications. Where detailed drawings or technical specifications are not provided, the materials shall be installed in accordance with the manufacturer's preferred recommendations and conforming to the best practice of the trade involved. Installation shall include all accessories required to produce a completed installation ready for use.

B. Electrical Work:
1. All electrical work shall conform to the requirements indicated in Division 16.

C. Field Calibration:
1. All instrumentation shall be calibrated in the presence of the Owner and Engineer using manufacturer's recommended calibration procedure and standards.
2. All flow and level transmitters shall be factory calibrated and set up to the extent possible at the factory. Span, range, and operating parameter adjustment shall be made at the factory or in the field by a factory trained personnel. Each system shall meet the manufacturer's standard accuracy.
3. Analyzing instruments shall be field calibrated by a factory-trained engineer or technician using procedures recommended by the manufacturer. Provide all materials required for proper calibration. Calibration shall be done in the presence of the Engineer.
4. Secondary functions such as alarm actuations and pacing shall be adjusted during initial calibration and demonstrated after the system is placed in service. Range adjustments shall be sealed by colored lacquer in the presence of the Engineer immediately following calibration.

5. Process calibration, such as volumetric drawdown tests on flows and level measurements, shall be conducted on all measuring systems as requested by the Engineer.

6. Provide instrument calibration sheet if factory calibrated (per the scaled range in the instrumentation schedule) by the instrument manufacturer.

7. Each instrument will be provided with an adhesive sticker declaring the date of certified calibration and initialed by the factory authorized field personnel.

8. Update any instrument configuration documentation after acceptance testing.

9. Refer to Specification 01800 and 13410 for startup, testing, training requirements for the instrumentation equipment.
## INSTRUMENTATION SCHEDULE

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<thead>
<tr>
<th>TAG</th>
<th>TYPE/SIZE</th>
<th>DESCRIPTION</th>
<th>LOCATION</th>
<th>RANGE</th>
<th>UNITS</th>
<th>SERVICE</th>
<th>POWER</th>
<th>P&amp;ID</th>
<th>SPEC. SECTION</th>
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<tr>
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<td>ULT</td>
<td>Wet Well Ultrasonic Level Element and Indicating Transmitter</td>
<td>Element: Wet Well Transmitter: FRCP</td>
<td>0.0 to 10.0</td>
<td>ft</td>
<td>Element: NEMA 4X C1D1 Transmitter: NEMA 12</td>
<td>120 VAC</td>
<td>I-2</td>
<td>13440</td>
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<td>6” MAG</td>
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<td>Element: Valve Vault Transmitter: FRCP</td>
<td>0 to 1,000</td>
<td>gpm</td>
<td>Element: NEMA 4X, IP68, C1D2 Transmitter: NEMA 12</td>
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<td>FRCP</td>
<td>32 to 104</td>
<td>Deg F</td>
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ULT – Ultrasonic   FLT – Float     MAG – Electromagnetic       TEMP - Temperature

**END OF SECTION**
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes control descriptions for loop diagrams shown on the Instrumentation Drawings.

B. At a minimum, all status, alarm, and control signals shown on the drawings shall be provided as such and in accordance with the CONTROL DESCRIPTIONS - GENERAL part whether explicitly called out or not.

C. The specific requirements of the custom software will be defined during the Shop Drawing submittal process, with the input of the Owner and Engineer. A meeting(s) will be held at the project site, with a representative of the System Integrator, PLC Programmer/Supplier, Client, Contractor, and Engineer, to finalize the custom programming specifications.

D. An additional two (2) days of programming time, including any travel expenses, shall be provided during the first year of operation to modify operational programming of the PLCs or OITs at no cost to the Owner.

E. AESS:
   
   1. Control Loops Descriptions shall be used by the Application Engineering Services Supplier (AESS) for developing PLC code and SCADA development under a separate Contract with the Owner.
   2. The General Contractor shall coordinate with the AESS and System Integrator to maintain project schedule. General Contractor shall notify the AESS 5 business days prior to startup activities and give the AESS a choice between 2 days for scheduling.
      a. Equipment startup shall be completed at least two weeks before substantial completion.
      b. Site Acceptance Testing shall be started no later than 4 weeks prior to substantial completion.
   3. The specification is provided for the Contractor’s information with regard to the scope of the programming and the level of coordination that the System Integrator and General Contractor shall include in the Contractor’s Bid.
      a. The AESS shall coordinate with the General Contractor and System Integrator, refer to Section 13410 for factory acceptance and site acceptance testing roles.
      b. The AESS shall keep the existing format of the SCADA screens to the greatest extent possible when modifying the controls interface.
3. The AESS Provide an O&M as outlined in Section 13410 with annotated ladder logic as outlined in Section 13444.

4. The AESS shall update the SCADA Screens and alarms for the new functionality as described herein. The AESS shall update SCADA computers at the WWTP.

5. Section includes control descriptions for loop diagrams shown on the Instrumentation Drawings.

6. At a minimum, all status, alarm, and control signals shown on the drawings shall be provided as such and in accordance with the 3.1 CONTROL DESCRIPTIONS - GENERAL part whether or not explicitly called out.

7. The AESS shall assign IP addresses and establish communication to all network VFD’s and other networked equipment outside of Division 11 manufacturers.

8. The specific requirements of the custom software shall be defined during the Shop Drawing submittal process, with the input of the Owner and Engineer. A meeting shall be held at the project site, with a representative of the System Integrator, AESS, Client, Contractor, and Engineer, to finalize the custom programming specifications.

   a. After the meeting, provide sample screens for review and comment by the Engineer and Owner. Submit an example of screens relating to this contract of each control hierarchy (system, equipment, popup) and overview screen for an additional review by the Owner and Engineer prior to the creation of all of the screens.

1.2 SYSTEM DESCRIPTION

   A. Provide instrumentation hardware, software, and programming as necessary to perform control functions specified herein and as shown on drawings. Ensure coordination with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

   B. The specifications direct attention to certain required features of the system, but do not purport to cover all details entering into its design and construction. Nevertheless, the Contractor shall furnish the CONTROL LOOPS complete in all details and ready for operation.

1.3 SUBMITTALS

   A. Operation and Maintenance Manuals:

      1. Provide annotated final versions of the modified PLC, operator interface terminal and SCADA programming files on DVD.
B. AESS:
   1. Shops
      a. Provide annotated versions of the PLC, operator interface terminal and SCADA programming files in .pdf format for review by the Engineer. Provide the PLC and OIT native applications files 15 days prior to FAT.
   2. Operation and Maintenance Manuals:
      a. Provide annotated final versions of the modified native application PLC, operator interface terminal and SCADA files on DVD or USB drive. The PLC and OIT programing files shall be stored on individual USB drives located in each of the respective control panels as well as a USB drive with the SCADA programming files.
      b. Refer to Section 13410 for additional O&M sections.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONTROL DESCRIPTIONS – GENERAL

A. Operator Interface Terminal (OIT) and SCADA software will be used for process monitoring and control as noted in the specific control loop descriptions. OIT and SCADA screens shall be constructed in accordance with the following general requirements:
   1. Process Overview Screen showing status and location of each process related field instrument and process equipment in relation to the Process Flow Diagrams (PFD) and Process and Instrumentation Diagrams (P&ID). Operators shall be able to access more detailed screens for equipment control, process control setpoints and time delays, mode control, alarm history, and alarm setpoints and time delays.
   2. Process Equipment Control Screens: Screens and pop-up displays shall be provided for process equipment monitoring, equipment control, and operating parameters/setpoints and delay timer adjustment.
   3. Alarm Summary and Alarm Set-up Screens: Screens shall be provided to display active alarms, entry of alarm set point values and delay timer settings, and enable/disable alarms. The screens shall also include capability to acknowledge and reset alarms.
   4. Graphical symbols shall be used to represent each piece of process equipment and field instrument. Equipment symbols that are used shall be representative of each piece of equipment displayed. Instrument symbols shall be in accordance with ISA S5.1 standards and Instrument Drawing I-1.
      a. Refer to Instrumentation Drawing I-1 “Indicator Light Color Legend” for light color convention.
      b. Display the status and process values for all equipment in the system.
      c. Refer to the Instrument Schedule in Section 13440 for all process value scaling and ranges.
   5. Skeuomorphism shall be used as a design theme as required for quickly familiarizing the operator with the functionality.
6. Alarm History Screen: A screen shall be provided to display all active and past alarms. The operator shall also be able to acknowledge and reset alarms from this screen.

7. Provide an alarm banner on each OIT/SCADA screen that displays at a minimum the last three alarm conditions. Active alarms shall flash in red. Acknowledged alarms shall be “solid” red.

8. Process Variable Historical Trends shall include the following:
   a. Screens shall be provided to display historical trends of all process variables with adjustable scale and units.
   b. The operator shall be able to add and delete pens as necessary and load and save pen groups to form analytical groups of data.
   c. Trends shall be configured to minimize space on hard drive by updating on change only.

B. All process, operational and alarm setpoints and associated delay-timer setpoints will be adjustable through the OIT/SCADA screens and will be generated and controlled at each respective PLC.

C. All Control Loop programming shall be done in the PLC where the inputs/outputs terminate unless otherwise stated. All PLC tags shall be descriptive in nature.

D. Equipment Fail Alarms:
   1. Equipment Fail alarms are defined as a condition where a command is given and the status confirmation of that command is not received within an acceptable time-frame. Fail Alarms shall not be triggered in the event of Loss of Power, or any other alarms related to the equipment (ie. High Temp, O/L. Fault, Low Pressure, etc.). Examples are as follows:
      a. Fail to start-stop: A piece of equipment is given the command to start and the running status is not confirmed within an appropriate time delay. Conversely a piece of equipment is commanded to stop and the run status does not drop out within an appropriate time delay.
      b. Fail to make speed: A VFD driven piece of equipment is commanded to go to a specific speed and it does not reach that speed (within a deadband) within an appropriate time delay.
   2. Provide the applicable Equipment Fail alarms for all equipment based on type and I/O available.

E. Where specifically noted in the loop descriptions software Hand/Off/Auto and On/Off selector switches shall be forced to the OFF position under certain interlock logic conditions so that an energized run output from the PLC is de-energized. This will require an operator to manually restart the equipment or to place the equipment in AUTO to allow for automatic operation. The H/O/A selector shall not be enabled in the HAND or AUTO positions until the condition causing the forced placement to the OFF position has returned to normal.
F. In the event of an instrument or process analyzer failing or loss of signal, the PLC shall utilize last know value as not to upset the process condition/control. An alarm shall be generated as “loss of signal” for that particular instrument/analyzer.

G. All SCADA Servers, View Nodes, and PLCs shall time sync once a day. A single SCADA Server shall time sync with the NIST server. A Firewall exception policy shall be created to allow for the specific address and protocol.

H. Control Loops
   1. Local HOA – all local hardware selector switches shall:
      a. In Hand position, run the associated equipment to be used in conjunction with a potentiometer for VFD speed.
      b. In Off position, Stop the associated equipment
      c. In Auto position, the control of the associated equipment shall be transferred to the PLC. At the OIT/SCADA the operator shall control the equipment with a software HOA. The OIT/SCADA system will display the “In Auto” and “Not in Auto” status based on an auxiliary contact in the Auto position. This status shall be displayed near the software selector switch. The same shall apply for “Auto” and “E-stop”.

2. Software MOA – all OIT/SCADA software selector switches shall:
   a. In Manual position, Run the associated equipment in manual mode whereby an operator can make adjustments with setpoint entry.
   b. In Off position, Stop the associated equipment from running remotely.
   c. In Auto position, the control of the associated equipment shall be transferred to PLC control as described in the control loop.
   d. Related alarms such as Not in Auto, E-Stop, etc. shall be displayed as statuses at the HOA controls or with the equipment status.

3. Historical Trends –
   a. All analog and digital signals shall be available at SCADA.

4. Flow Totalizing –
   a. All flow meters shall be configured in PLC for flow totalizing with display at OIT/SCADA.
   b. Flow totals shall be configured as both running totals with a password protected (or higher user privilege) reset and with a separate pushbutton resettable total.
   c. Systems with more than one flow meter will also have a combined flow totalizer in the same style.
   d. Flow meters from other divisions shall be displayed and totalized similarly.

5. Runtime Hours Totalizing –
   a. All equipment with a Run Status signal shall be configured in the PLC for run hour totalizing with display at OIT/SCADA.
   b. Runtime Hour totals shall be configured as both running totals with a password protected (or higher user privilege) reset and with a separate pushbutton resettable total.
6. Analog Alarms – shall be configured at the OIT/SCADA with the following (operator adjustable):
   a. Low and High Setpoints
   b. Low-Low and High-High Setpoints as specified in specific loops below.
   c. Delays – Alarm shall activate if the setpoint is reached for this adjustable time period, (0-60 seconds, initially 5s).
   d. Ability to Enable/Disable the alarm with a button.
   e. All alarms shall be latched upon activation and reset with the Alarm Acknowledge pushbutton.

7. Digital Alarms – all alarms noted as such or as other (fault, overload, fail, E-Stop, etc.) on drawings as shall be configured at the OIT/SCADA with the following (operator adjustable):
   a. Delays – Alarm shall activate if TRUE for this adjustable time period, (0-60 seconds, initially 5s).
   b. Ability to Enable/Disable the alarm with a button.
   c. All alarms shall be latched upon activation and reset with the Alarm Acknowledge pushbutton.

8. Timer modes – Any control that requires a duration setpoint shall include a countdown displayed value to indicate to the operator the length of time until the mode expires.

9. Totalizer mode – Any control that requires a totalized setpoint shall include a current total displayed value to indicate to the operator the current progress towards the setpoint.

10. PLC Failure Mode – Upon PLC failure, all discrete outputs shall de-energize to an off condition.

I. Integration of Division 11 Control Panels
   1. Standard Functionality - Control Panels provided by others shall be integrated to provide controls equivalent to the OIT control provided by the Division 11 manufacturer.
   2. Enhanced Functionality – Communications, calculations, and any other additional provisions shall be made as necessary to meet the requirements listed in the CONTROL DESCRIPTIONS.

J. Emergency Standby Power:
   1. The System Integrator shall provide programming of time delays to stagger restarting of equipment and loads as sequenced in Section 16620 – Diesel Generators.

K. Reading/Writing across the Network– Provisions shall be made such that multiple points of access have the ability to change setpoints and modes. This functionality shall be furnished such the setpoint or command will automatically reset and the operator does not have to intervene. The setpoint or command shall change to a value that does not have control in the system once the required change is made.
3.2 CONTROL DESCRIPTIONS – FALMOUTH ROAD CONTROL PANEL

A. Loop 100 – Falmouth Road Control Panel (FRCP)

1. General: Two status lights will be on the face of the Control Panel to provide an indication of panel status. The PLC generates a latching alarm that illuminates a light on the face of the panel. A Reset pushbutton on the panel shall unlatch the alarms. The control panel temperature will be monitored.

2. Panel Control definitions are defined on the Instrument Drawing I-1.
   a. Normal Power Indicator Light (YL-100)
   b. Common Alarm indicator Light (AL-100)
   c. Reset Pushbutton (HS-100)

3. Local Control:
   a. The Normal Power indicating light (YL-100) shall be illuminated and a power fail relay shall be energized when the control panel is powered from an external 120 VAC power circuit.

4. Panel Monitoring Instruments:
   a. Control Panel Temperature (TSH/TSL-100)

5. PLC:
   a. The PLC shall monitor the power failure contact and shall activate the Control Panel Power Fail alarm if an adjustable on-delay timer expires (0 to 600 seconds, initially 60 seconds).
   b. The PLC shall output a common alarm if any of the alarms configured in the PLC program are active. This common alarm output shall activate the Common Alarm indicating light on the panel (AL-100).
   c. The contact state of the reset pushbutton (HS-100) shall be monitored by the PLC. When pushed, hardwired control shall reset the PLC Fail and the PLC shall unlatch the Common Alarm if the alarm condition has returned to normal.
   d. The PLC shall monitor the UPS battery failure/fault condition contact (EY-100) and shall activate an alarm if an adjustable on-delay timer expires (0 to 60 seconds, initially 10 seconds).
   e. The PLC shall monitor the Surge condition contact (ESH-100) and shall activate an alarm if an adjustable on-delay timer expires (0 to 60 seconds, initially 10 seconds).
   f. The PLC shall monitor the temperature inside the control panel.
      i. The PLC shall activate a Control Panel High Temperature Alarm contact activates (delay 0 to 600 seconds, initially 300 seconds).
      ii. The PLC shall activate a Control Panel Low Temperature Alarm when the contact activates (delay 0 to 600 seconds, initially 300 seconds).
   g. A Loss of Communication Alarm will be activated at the PLC and at SCADA if the PLC and SCADA do not communicate after an operator determined number of consecutive attempts.
   h. The PLC shall monitor and display the status of the Backup Control Active contact.
6. Alarms at OIT/SCADA:
   a. Falmouth Road Control Panel Power Fail
   b. Falmouth Road Control Panel Common
   c. Falmouth Road Control Panel UPS Fail
   d. Falmouth Road Control Panel Surge
   e. Falmouth Road Control Panel Low Temperature
   f. Falmouth Road Control Panel High Temperature
   g. Falmouth Road Loss of Communication

7. Monitoring and Control at OIT/SCADA:
   a. Reset Pushbutton
   b. Backup Control Active/Inactive Status

B. Loop 105 – Wet Well Monitoring:
   1. General: The wet well is monitored for level with an ultrasonic level instrument, a high-high level float switch, and a low-low level float switch. The ultrasonic level indicating transmitter is located on the front of the control panel. The level is displayed and trended graphically at the OIT. The high-high and low-low level floats are used for backup control and alarming.
   2. Field Instruments:
      a. Ultrasonic Level Instrument and Transmitter (LE-105, LIT-105)
      b. High-High Level Float Switch (LSHH-105)
      c. Low-Low Level Float Switch (LSLL-105)
   3. PLC:
      a. The PLC shall monitor the wet well level and calculate the % full. The level shall be displayed (in feet) and trended graphically from 0.0-100.0% full.
      b. The PLC shall activate a Wet Well High Level Alarm and a Wet Well Low Level Alarm based on adjustable level setpoints (delay 0 to 60 seconds, initially 10 seconds).
      c. The PLC shall activate a Wet Well High-High Level Alarm when the contact activates (delay 0 to 60 seconds, initially 5 seconds).
      d. The PLC shall activate a Wet Well Low-Low Level Alarm when the contact activates (delay 0 to 60 seconds, initially 5 seconds).
      e. The PLC shall activate a Level Instrument Fail Alarm if the measured level is outside of range (delay 0 to 180 seconds, initially 60 seconds).

4. Alarms at OIT/SCADA:
   a. Falmouth Road Wet Well High-High Level
   b. Falmouth Road Wet Well High Level
   c. Falmouth Road Wet Well Low Level
   d. Falmouth Road Wet Well Low-Low Level
   e. Falmouth Road Wet Well Level Instrument Fail

5. Monitoring and Control at OIT/SCADA:
   a. Falmouth Road Wet Well Level and Trend

C. Loops 110 and 111 – Submersible Pumps:
   1. General: Two submersible pumps (P-1,2) convey sewage from the wet well to the Wastewater Treatment Plant. Each pump shall be driven from a VFD.
a. Each pump shall have a virtual Manual/Off/Auto switch. In Manual, the pump shall run at an operator defined speed. In Auto, the PLC shall control the pumps using proportional control, where the pumps ramp from a maximum to minimum speed between on and off levels. The VFDs shall operate within adjustable VFD minimum and maximum speed setpoints. In Off, the pumps shall not run.
b. The pumps shall run in Lead/Lag configuration.
c. The pumps shall have a float backup circuit. When the high-high level float (LSHH-105) is activated, the selected backup pump will turn on and run for a set period of time. The low-low level float (LSLL-105) shall shut down any running pumps when activated.

2. Field Instruments:
a. None.

3. PLC:
a. Pump Monitoring:
i. The status of the drive shall be displayed as RUN/STOP based on the run status contact. The PLC shall totalize the run time hours.

ii. The PLC shall activate a Pump Motor High Temperature Alarm when the contact activates (delay 0 to 60 seconds, initially 5 seconds).

iii. The PLC shall activate a Pump Seal Leak Alarm when the contact activates (delay 0 to 60 seconds, initially 5 seconds).

iv. The PLC shall activate a VFD Fault Alarm when the contact activates (delay 0 to 60 seconds, initially 5 seconds).

v. The PLC shall monitor and display the Speed Feedback from the VFD (0 to 100%).

vi. The PLC shall monitor and display the Load Feedback from the VFD (0 to 100%).

vii. The PLC shall activate a High Load Alarm when the load feedback exceeds an adjustable setpoint (0 to 100%, initially 95%) for an adjustable period of time (delay 0 to 60 seconds, initially 10 seconds).

b. Pump Activation:

i. The PLC shall control the pump when the Hand/Off/Auto selector switch is in the Auto position and the pump is available. In Off, the pump shall not run. In Local, the pump shall run at an operator determined speed. The pump is available if the following status conditions are true:

   (1) Motor High Temp Alarm: Inactive
   (2) Seal Leak Alarm: Inactive
   (3) VFD Fault Alarm: Inactive
   (4) Fail Alarm: Inactive

ii. The pump shall be displayed as In Auto/Not In Auto based on the contact from the HOA.

iii. A Fail Alarm shall be activated if the HOA selector switch is in Auto and the PLC attempts to start the equipment and the return run
contact does not indicate that the motor is running (delay 0 to 120 seconds, initially 60 seconds). The Fail Alarm shall not activate if any other alarm is active.

iv. The operator shall be able to set each pump as Lead or Lag. If the Lead pump becomes Unavailable, the Lag pump shall become the Lead pump. If a pump is unavailable, the PLC shall not command the pump to run, or trigger new alarms associated with the pump.

v. The operator shall be able to set a VFD Minimum and Maximum Speed (0 to 100%, initially 80% and 100%).

vi. In Auto, the PLC shall provide a virtual Manual/Off/Auto switch. In Virtual Off, the pump shall not run. In Virtual Manual, the pump shall run at an operator adjustable VFD speed setpoint (0 to 100%).

vii. In Virtual Auto, the PLC shall activate and control the speed of the pumps based on the level in the wet well.

1. The PLC shall activate and control the speed of the pumps based on the level in the wet well using operator determined setpoints. The pump speed shall be linearly proportional between the minimum speed and maximum speed setpoints. The PLC shall use a fixed 1 second time delay at the pump on and off levels. Refer to Process Drawings for pump level setpoints.

viii. Alternation:

1. Pump Cycle Auto Alternation shall alternate the Lead and Lag pump every time the Lead pump turns off. The operator shall be able to disable Pump Cycle Auto Alternation.

ix. Backup Control:

1. The PLC shall monitor the status of the Backup Control Circuit. If Backup Control is active, the PLC shall not attempt to start the pumps until both pumps have stopped running.

4. Alarms at OIT/SCADA:

a. Falmouth Road Pump No.1,2 (P-1,2) Motor High Temperature
b. Falmouth Road Pump No.1,2 (P-1,2) Seal Leak
c. Falmouth Road Pump No.1,2 (P-1,2) VFD Fault
d. Falmouth Road Pump No.1,2 (P-1,2) High Load
e. Falmouth Road Pump No.1,2 (P-1,2) Fail

5. Monitoring and Control at OIT/SCADA:

a. Falmouth Road Pump No.1,2 (P-1,2) Run Status and Totalizer
b. Falmouth Road Pump No.1,2 (P-1,2) HOA Status
c. Falmouth Road Pump No.1,2 (P-1,2) Availability Status
d. Falmouth Road Pump No.1,2 (P-1,2) Virtual Manual/Off/Auto
e. Falmouth Road Pump No.1,2 (P-1,2) Speed Command (0 to 100%)
f. Falmouth Road Pump No.1,2 (P-1,2) Speed Feedback (0 to 100%)
g. Falmouth Road Pump No.1,2 (P-1,2) Minimum and Maximum Speed (0 to 100%, common setting for both pumps)
h. Falmouth Road Pump No.1,2 (P-1,2) Lead/Lag Selection
i. Falmouth Road Proportional Control
   i. Wet Well Level Setpoints

j. Falmouth Road Pump Cycle Auto Alternation

k. Backup Control Active Status

D. Loop 115 – Flow and Valve Vault Monitoring:
   1. General: The Falmouth Road Pump Station flow is monitored using an electromagnetic flow meter. The Valve Vault is monitored for high water level using a float.
   2. Field Instruments:
      a. Electromagnetic Flow Meter and Transmitter (FE/FIT-115)
      b. High Level Float (LSH-115)
   3. PLC:
      a. The PLC shall monitor, display, totalize (total, today, and yesterday), and trend the flow (0.0 to 1,000.0 gpm).
      b. The PLC shall activate a Low Flow alarm when at least one pump is running, and the flow is below a setpoint (0 to 1,000 gpm, initially 100 gpm) for a period of time (0 to 300 seconds, initially 60 seconds).
      c. The PLC shall activate a Valve Vault High Level Alarm when the contact activates (delay 0 to 60 seconds, initially 10 seconds).
   4. Alarms at OIT/SCADA:
      a. Falmouth Road Low Flow
      b. Falmouth Road Valve Vault High Level
   5. Monitoring and Control at OIT/SCADA:
      a. Falmouth Road Flow and Trend

E. Loop 120 – Generator and ATS
   1. General: The PLC shall monitor the stat of the ATS and Generator. The PLC shall provide Load Stepping during emergency power startup.
   2. Field Instruments:
      a. None.
   3. PLC:
      a. Generator: The PLC shall monitor the state of the Generator conditions.
         i. The PLC shall display the run status of the generator.
         ii. The PLC shall activate a Generator Fault Alarm when the contact activates (delay 0 to 60 seconds, initially 1 second).
         iii. The PLC shall activate a Generator Low Fuel Alarm when the contact activates (delay 0 to 120 seconds, initially 60 seconds).
      b. Automatic Transfer Switch: The PLC shall monitor the state of the ATS for normal and emergency power conditions.
         i. The PLC shall display the status of the ATS position.
         ii. The PLC shall activate an ATS in Emergency Power Alarm when the ATS position contact is in the emergency position (delay 0 to 60 seconds, initially 1 second).
         iii. The PLC shall activate an ATS Warning if the ATS is not in the Emergency or Utility position (delay 0 to 180 seconds, initially 60 seconds).
iv. The PLC shall remove the run command to the pumps when Utility Power is unavailable and the ATS is not in the Emergency Position. The PLC shall remove the run command to the pumps when Emergency Power is unavailable and the ATS is not in the Utility Position.

c. The PLC shall remove the start command to all equipment when the ATS moves from the Utility to the Emergency position. The PLC can reapply the start command once the ATS has switched to the available power source.
d. When the station is on generator power, the PLC shall run the pumps in Lead/Standby configuration.

4. Alarms at OIT/SCADA:
   a. Falmouth Road Generator Fault
   b. Falmouth Road ATS in Emergency
   c. Falmouth Road Loss of Utility Power
   d. Falmouth Road Loss of Emergency Power
   e. Falmouth Road Generator Low Fuel

5. Monitoring and Control at OIT/SCADA:
   a. Falmouth Road Generator Run Status
   b. Falmouth Road ATS Status
   c. Falmouth Road ATS Warning
   d. Falmouth Road Utility Power Available

6. Falmouth Road Emergency Power Available

END OF SECTION
SECTION 13442

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included:
   1. Furnish, install, and test the programmable logic controllers (PLCs) and graphical interfaces as shown in the Instrumentation Drawings and described herein.
   2. Furnish, install, configure, wire, and test the uninterruptable power supply (UPS) and maintenance bypass switch (MBS) as shown in the Instrumentation Drawings and described in Specification Sections 13410 and 13442 herein.
B. Related Work Specified Elsewhere.
   Section    Title
   13410     Instrumentation and Process Control
   13440     Instruments
   13441     Control Loop Descriptions
   13444     Control Panels
   Division 16 Electrical Requirements
   Electrical and Instrumentation Drawings

1.2 QUALITY ASSURANCE
A. The PLCs and OITs form an integral part of the overall control system for the facility and as such all PLCs shall be the product of one manufacturer. The Contractor shall provide all coordination as necessary to ensure that all PLCs, whether provided by the System Integrator, individual equipment manufacturers or others, are by the same manufacturer.
   1. All PLC’s provided within each line-up (e.g. micro, modular, automation modular) shall be part of the same series unless otherwise specified.
B. The OITs form an integral part of the overall control system for the facility and as such all OITs shall be the product of one manufacturer. The Contractor shall provide all coordination as necessary to ensure that all OITs, whether provided by the System Integrator, individual equipment manufacturers or others, are by the same manufacturer.
C. The manufacturer or its authorized representative shall provide complete technical support for all their products.

1.3 SUBMITTALS
A. Submit shop drawings in accordance with the General Conditions of the Construction Contract, Section 01340 (Submittals) and Section 13410.
B. AESS shall submit the PLC programming logic (ladder logic, function blocks, structured text, etc.). Ladder will be fully documented including a listing of each task/function. Annotations shall clarify the intent of each task/function with a description of the process so that the engineer or a future programmer will be able to
clearly understand. Include the following:
1. PLC I/O configurations
2. PLC communication configurations
3. PLC cross reference list
4. PLC tag data base and memory usage
C. AESS shall submit the OIT Program. Submit the following:
   1. OIT communication configurations
   2. OIT Screen List
   3. OIT Screen printouts

1.4 DELIVERY, STORAGE AND HANDLING
A. In accordance with Section 13410.

PART 2 - PRODUCTS

2.1 GENERAL
A. The PLC shall consist of rugged components designed specifically for industrial environments. The PLC shall consist of a power supply and one or more racks containing a central processing unit (CPU) module, I/O modules, PLC memory, and PLC network interface module(s). All components shall be housed in structurally secure enclosures.
B. The central processing unit CPU shall be modular and fully enclosed within a durable plastic shroud. When mounted on the system base, the modular CPU shall not occupy more than one available slot.
C. The I/O system shall be modular. Each module shall be fully enclosed within a durable plastic shroud. When mounted on the system base, each I/O module shall not occupy more than one available slot.
D. All components within the controller family shall be manufactured with a high degree of durability. All switches and other operator controlled devices shall be of the size and durability for their intended use as is normally offered for industrial applications. All signal and/or rack expansion cables furnished by the manufacturer shall be constructed so as to withstand, without damage, all normal use and handling.
E. All components within the controller family shall be part of the same series unless otherwise specified, or noted on the drawings, or approval by the engineer.
F. In order to minimize spare parts stocking requirements, the controller family shall have a high degree of interchange ability. The system shall incorporate a modular design using plug in assemblies with pin and socket connectors. Wherever possible, all assemblies and sub-assemblies performing similar functions shall be interchangeable. The system design shall accommodate the replacement of assemblies/modules without having to disconnect field wiring. Wherever possible, removable connectors shall be used to connect field wiring to the individual circuit board assemblies. All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings each of which indicates the manufacturer's catalog number and a product manufacturing date code.
G. Refer to the control panel descriptions in Specification Section 13444.
2.3 MICRO PROGRAMMABLE LOGIC CONTROLLER (MPLC)
A. General: Provide micro Programmable Logic Controllers (mPLC) in the control panels as identified on the Instrumentation Drawings, capable of performing the functions and handling the network communications as described in Section 13441.
B. The following Control Panels provided by Division 13 shall have a PLC:
  1. Falmouth Road Control Panel (FRCP)
C. Min. Memory: 12 Kilobytes of programmable memory with battery backed-up static RAM and memory module.
D. Max. Scan Time: 1 ms/K
E. Max. Bit Execution Time: 0.4 microseconds
F. Power: 110/220 VAC power supply.
  1. Provide power supplies as required by PLC.
G. Mounting: DIN rail mounted
H. Required agency approvals:
  1. UL Listed (UL 508)
  2. CSA Certified (CSA 142)
I. External communications: Each PLC shall contain both an RS-232/485 Port and an Ethernet port.
J. Programming and diagnostic software shall be Windows based via Relay Ladder Logic (RLL) custom programming tools for the PLCs.
K. Provide an unlocked copy of the PLC program, the program nor functions or add-on instructions within the program shall be password protected.
L. I/O Requirements:
  1. Discrete Inputs: 120VAC or 24VDC. Use high speed modules as required.
  2. Discrete Outputs: 120VAC relay outputs.
M. Future Connections: Provide a minimum of the following spare inputs/outputs for future connections:
  1. 20% additional discrete inputs (DI) per PLC.
  2. 20% additional discrete outputs (DO) per PLC.
  3. 10% with a minimum of two (2) spare analog inputs (AI) per PLC.
  4. 10% with a minimum of two (2) spare analog outputs (AO) per PLC.
  5. Space in the control panel for two additional I/O modules
  6. All available spare discrete inputs, analog outputs, and analog inputs shall be wired to field terminal strips. All available spare discrete outputs shall be connected to interposing relays with the relay contacts connected to field terminal strips.
N. Spare Parts:
  1. None
O. Acceptable Programmable Logic Controller (PLC):
  1. Allen Bradley MicroLogix 1400 (1766-L32BWAA)
  2. No equal
2.4 OPERATOR INTERFACE TERMINALS
A. General: Provide an Operator Interface Terminal (OIT) at each control panel to continuously indicate status of equipment, change operational parameters and indicate alarm status as described in Sections 13410, 13440, and 13441. The OIT shall be fully compatible with the PLC provided. The following Control Panels provided by Division 13 shall have an OIT:
   1. Falmouth Road Control Panel (FRCP)
B. Screen Size: 7-inch color active matrix screen with a minimum resolution of 640 by 480 pixels with field replaceable backlight.
C. Interface: Touchscreen rated at 1 million cycles (minimum).
D. Memory: 64 MB minimum application and graphic memory. The OIT shall also include a compact flash port. Provide a compatible SD card.
E. Clock: Provide integral real time clock with battery backup.
F. Communication: RS-232, Ethernet and USB ports.
G. Power: 120 VAC
H. Operating Temperature: 32-130°F
I. Enclosure: NEMA 12 with NEMA 4X front-face and touchpad
J. Provide programming time required to configure OIT interface as described in Sections 13440, 13441 and finalized in the instrumentation meetings.
K. Provide all cables required to connect the OIT to the network or PLC.
L. The integrated OIT software shall have the following features:
   1. Trending
   2. Data Logging
   3. Alarms
   4. Graphic Symbols
   5. Animation
M. Acceptable Operator Interface Terminal (OIT):
   1. Maple System Advanced HMI 5070NL
   2. No Equal

2.5 UNINTERRUPTIBLE POWER SUPPLIES (UPS)
A. Provide an uninterruptible 120-volt backup power supply for each PLC, OIT, Ethernet switch or other device as shown on the Drawings to maintain continuous operation of PLCs, operator interface terminals, Ethernet switches, monitoring instrumentation and control and process circuits during a power outage.
B. UPS type shall be provided as a continuous-duty, on-line, solid state, double conversion, single-phase 120 VAC input, single-phase 120VAC true sinewave output uninterruptible power system with auto-bypass. The UPS shall be provided with surge arresting capabilities to prevent sudden surges to the attached electrical control systems.
C. The UPS will be inside the control panel, located in the bottom section of floor stand type control panels or provided an independent wall mounted enclosure. The UPS shall be installed per UL 508 requirements and be powered by a simplex outlet.
D. UPS shall be installed in a manner to not impede access to terminals or field wiring.
E. Provide appropriate maintenance bypass switch as specified herein to easily remove and bypass the UPS.
F. The UPS shall have “hot-swappable” batteries and be capable of being replaced with
the UPS in operation. The run time operation of the UPS shall be accomplished using batteries mounted within the UPS enclosure and supplemented as necessary with batteries in an enclosure to provide the battery runtime specified herein. The battery enclosure shall match the main UPS enclosure as closely as possible.

G. The UPS shall be type rated for industrial use and capable of supplying standby power to all connected control panel equipment and circuits at peak load for a minimum of fifteen (15) minutes at full load, thirty (30) minutes half load. UPS minimum rating shall be 750 VA.

H. Acceptable manufacturers:
   1. Schneider Electric APC Smart-UPS
   2. Liebert GXT3 Series
   3. Tripp-Lite SU Series
   4. Eaton Powerware
   5. or equal.

2.6 MAINTENANCE BYPASS (MBP)
A. Each UPS shall be provided with a two-position external maintenance bypass switch and outlet system to permits the UPS to be removed for repair or maintenance without causing power disruption to the connected power loads. The external bypass switch shall be a snap-action type with switching speed 10ms or less independent of operator action. External bypass switch positions shall be labeled UPS and UTILITY. The bypass switch shall be capable of switching the required amps for the UPS system.

B. For UPS units up to and including 3 KVA, furnish Liebert MicroPOD, Tripp-Lite PDUB15, or equal
   1. Substitution of standalone switches along with custom plugs, receptacles, and appropriate wiring to achieve the specified functionality is acceptable.
   2. For UPS units above 3 KVA, substitute standard manufacturers Maintenance Bypass switch offering or standalone switches as indicated above.

PART 3 - EXECUTION - In accordance with Sections 13410 and 13444

END OF SECTION
SECTION 13444

CONTROL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Includes: Furnish, install, test, and commission the following panels listed in the control panel schedule. Provide enclosure NEMA ratings shall be as indicated in the control panel schedule and the Electrical Drawing - Electrical NEMA Classifications and Conduit Installation Schedule.

B. Related Work Specified Elsewhere:

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1.2 CONTROL SYSTEM TESTING:
A. Tests Procedures Prior to Start-up:
   1. Refer to Section 13410.
   2. Factory Acceptance Test (FAT): A witnessed Factory Acceptance Test and verification for all deliverable equipment, software, and associated documentation shall be performed prior to shipment of control systems. The factory tests shall be performed to verify that the control systems are manufactured and assembled correctly, are operating as designed, and are in compliance with the contractual requirements for the deliverables. Communication and integration with Division 11 equipment shall be demonstrated by indication of network addresses and required data tags with forced status/value changes to be witnessed on SCADA.
   3. The FAT shall include verification and integrated testing of all components. These tests shall include the following.
      a. Visual Inspections: The following inspection checks shall be performed on all deliverable hardware items, as a minimum:
         i. I/O Subsystem physical layout
         ii. Power supply mounting
         iii. Power cable routing
         iv. Data cable routing and mounting
         v. Wiring runs properly separated and installed
         vi. Fans, blowers, and heaters are unobstructed
         vii. Power supply and power conditioning equipment correctly installed
         viii. Wire numbering and color coding
         ix. Device labeling
         x. Enclosure integrity
xi. Paint work
xii. Control panel lighting
xiii. Panel and enclosure ground connections
xiv. Provide photos:
   (1) Panel Exterior
   (2) Panel Interior – Door
   (3) Panel Interior – Deadfront
   (4) Panel Interior – Enclosure
   (5) Incoming power distribution
   (6) PLC
   (7) Communications devices
   (8) Rear view of enclosure OIT/HMI

b. Relay Logic Checkout:
   i. The System Integrator shall perform a complete checkout for all
      ladder logic circuits to ensure designed functionality.

c. I/O Point Checkout:
   i. The System Integrator shall perform a complete checkout for every
      I/O point from the field wiring terminal strip to the operator interface
      terminal functions. The System Integrator shall test every input and
      output point including spares for proper operation. Test signals shall
      be generated to verify the operation of each Analog Input (AI) and
      Discrete Input (DI) including connected interposing relays,
      intrinsically safe circuits and relay circuits. Each Analog Output
      (AO) and Discrete Output (DO) shall be also tested for proper
      operation including control circuits, isolation relays, signal
      conditioner/isolators and other required control circuits.
   ii. The System Integrator shall demonstrate that signals are alarmed
       when reporting under 4 mA and over 20 mA and do not report
       negative or out of range values.
   iii. The System Integrator shall develop a point checkout form for each
       I/O point. The point checkout form shall include the point ID,
       description, all checks performed for the point, date and time of the
       check, and a signoff block for the System Integrator. For each item
       checked, the form shall include both the expected value/result and
       the actual value/result witnessed.
   iv. The following items shall be checked for each I/O point:
      (1) For each analog input point, the following values shall be
          checked:
          (a) Value at -2% of full scale (ramped in both directions)
          (b) Value at 0% of full scale (ramped in both directions)
          (c) Value at 25% of full scale (ramped in both directions)
          (d) Value at 50% of full scale (ramped in both directions)
          (e) Value at 75% of full scale (ramped in both directions)
(f)  Value at 100% of full scale (ramped in both directions)

(g)  Value at 102% of full scale (ramped in both directions)

(h)  Each High and Low Alarm condition

(i)  Alarm Delay

(j)  Alarm Enable/Disable

(2)  For each analog output point, the following values shall be checked:

(a)  Milliamp reading at 0% of full scale (ramped in both directions)

(b)  Milliamp reading at 25% of full scale (ramped in both directions)

(c)  Milliamp reading at 50% of full scale (ramped in both directions)

(d)  Milliamp reading at 75% of full scale (ramped in both directions)

(e)  Milliamp reading at 100% of full scale (ramped in both directions)

(3)  For each discrete input point, the following items shall be checked:

(a)  For status points, proper indication

(b)  For alarm points, proper alarm notification

(4)  For each discrete output point, the following items shall be checked:

(a)  Proper operation

d.  PLC Programming and OIT/SCADA Operation Checkout:

i.  Submit the proposed PLC program and OIT/SCADA Configuration (screen printouts) as a shop drawing 15 days prior to the performance of the Factory Acceptance Testing.

ii.  Verify to the extent possible that the PLC program and OIT/SCADA Operation, as submitted, performs all control and monitoring requirements as described in section 13441 - Control Loop Descriptions. A list of all modifications to the submitted PLC program shall be maintained and submitted after the FAT.

e.  48-Hour Continuous Burn-in Test:

i.  After the successful completion of the functional testing specified above, a 48-hour continuous run of each control panel provided shall be performed. The test shall be passed if no function is lost, no hardware or software failure occurs, and no module automatic failover occurs. Hardware failure is defined for this test as the loss of a major piece of hardware, such as a PLC processor, I/O board, power supply, UPS, other panel equipment, or improper operation by the controller.
ii. During this test, the PLC shall be occasionally (a minimum of 3 times per 24-hour period) exercised with simulated inputs, events, and conditions in a manner that approximates an operational environment in order to verify proper operation.

iii. No programming changes will be allowed to bypass failed modules during this test. Any major software and/or hardware correction made to the control panel shall result in the mandatory rerun of the entire 48-hour test for that control panel.

B. Procedures Prior to Start-up:
   1. The Contractor shall coordinate the work of the system manufacturer’s service personnel as necessary. This shall include the installation, interconnection, testing, and calibration of the instruments, and the scheduling of the manufacturer's service personnel.
   2. The supervisory services of a factory-trained service engineer/technician who is specifically trained on the type of equipment herein specified, shall be provided during construction to assist the Contractor in the methods of installing conduit and special cable; mounting, piping, and wiring of one of each type of device, and the methods of protecting all of the equipment prior to placing it into service. Upon completion of the installation, a trained service engineer/technician will calibrate andstartup the equipment in the presence of the Engineer and provide instruction and training for the operating personnel. A sufficient number of service days shall be provided to place the system in satisfactory operation.
   3. The Owner will assume no liability or responsibility for any portions of the installation under this Contract until they are demonstrated and accepted in writing. Final demonstrations shall be made only after the Owner and Engineer are satisfied that the work has been completed in accordance with the intent of the Contract Documents.

C. Onsite Control System Startup:
   1. Site Acceptance Test (SAT): Perform a witnessed Site Acceptance Test to verify that each instrument and equipment drive is connected properly to the control panel and that all functions of the control panel are operating as specified.
      a. The System Integrator shall:
         i. Refer to Section 13410.
      b. The System Integrator’s test support personnel shall be qualified to resolve and correct problems encountered with the system during the tests. In addition to test support personnel, the System Integrator shall provide all test instruments and equipment necessary to troubleshoot any of the problems encountered.
      c. The SAT will be observed by the Engineer and/or Owner's representative.
      d. Provide the services of authorized manufacturers' representatives to instruct the Owner's representatives in the proper operation of each control system installed under this Contract.
1.3 QUALITY ASSURANCE
   A. The specifications direct attention to certain required features of the equipment but do not purport to cover all details entering into its design and construction. Nevertheless, the Contractor shall furnish the control panels complete in all details and ready for operation.
   B. The control panels are an essential component of an integrated system with all plant controls and as such shall be supplied by the System Integrator in accordance with Sections 13440 and 13441.

1.4 SUBMITTALS
   A. Submit shop drawings in accordance with the General Conditions of the Construction Contract, Section 01340, Submittals, and Section 13440.
      1. Control Panel Layouts, Wiring Diagrams, Network/Communication Diagrams
      2. Bills of Materials (with separate columns for the following: Item Number, Quantity, Manufacturer, Part number, Description, Designator Tag)
      3. FAT Report Results
      4. SAT Report Results

1.5 DELIVERY, STORAGE AND HANDLING
   A. In accordance with Section 13440.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. General: Refer to the General Conditions of Section 13440.
   B. Intrinsically Safe Equipment
      1. Intrinsically Safe Relays:
         a. Relays shall be provided for all intrinsically safe sensing or actuation circuits which terminate in hazardous areas.
         b. Relays shall be located in non-hazardous areas and installed in accordance with UL requirements.
         c. Refer to the instrumentation drawings for signals that require Intrinsically Safe Relays. Relays shall be 120VAC powered.
         d. Approvals: FM
         e. Equal to:
            i. Phoenix Contact
            ii. Gems Safe Pak
            iii. MTL 7700 Series
            iv. or equal
      2. Intrinsic Safety Barriers
         a. Barriers shall be provided for all intrinsically safe sensing or actuation circuits which terminate in hazardous areas.
         b. Barriers shall reduce the level of energy as required by intrinsically safe protection between safe and hazardous locations.
         c. Barriers shall be suitable for use with 4 to 20 mA DC signals.
         d. Barriers shall be located in non-hazardous areas and installed in accordance with UL requirements.
e. Refer to the instrumentation drawings for signals that require Intrinsically Safe Barriers. Barriers shall be 120VAC or loop powered.

f. Approvals: FM

g. Equal to:
   i. Phoenix Contact
   ii. Gems Safe Pak
   iii. MTL 7700 Series
   iv. or equal

C. Control Panels

1. PLC Control Panels (CP):
   a. PLC control panels, furnished by Division 13, shall house all of the required PLC and communications equipment.
   b. For PLC and OIT hardware in the panel, see Programmable Logic Controllers - Section 13442.
   c. For other components in the panels, see Control Panel Components section herein.
   d. A laminoid label on the door of the enclosure shall identify the PLC Control Panel. Label shall include the panel tag number and the panel name as indicated on the Instrumentation Drawings and in the list below.
   e. The enclosure ratings shall be NEMA 12 or NEMA 4X, refer to Electrical drawing E-1 for NEMA ratings required by area.
   f. Refer to Electrical power plans for maximum panel sizes (use scaled drawings).

2. PLC Control Panel Requirements
   a. Each control panel enclosure shall be a NEMA 4X enclosure. The panel shall be sized by the System Integrator house all equipment and room for 20% I/O expansion and meet UL 508A requirements. Control panel enclosures shall be continuously hinged.
   b. All control components shall be mounted using a 35 mm DIN rail.
   c. The center of the Operator Interface Terminal (OIT), Human Machine Interface (HMI), or panel mounted transmitter shall be mounted no higher than 63" and no lower than 57" above the finished elevation where an operator will stand.
   d. Provide a PLC control panel shall be provided with a marshaling shelf for top conduit entry cable management as indicated in the panel schedule.
   e. Floor mount Panels will be located on a 4" high housekeeping pad. Provide a window-kit for outdoor installation.
   f. Outdoor installations:
      i. Provide a dead-front enclosure with front panel components mounted to the interior swing-door kit.
      ii. Provide enclosure with provisions for mounting in a NEMA 4X enclosure.
      iii. Conduit penetrations on top of enclosure shall not be permitted.
      iv. Provide a door stop kit to prevent doors from opening further than 120°.
g. Unheated spaces or general outdoors:
   i. Shall be equipped with a factory installed built-in heater and adjustable thermostat to heat enclosure to the minimum operating temperature of the installed devices.
   ii. The heater shall include a fan to circulate the air within the enclosure to prevent hot spots. Thermostat shall measure air temperature, not surface temperature.
   iii. Heater shall be Hoffman Enclosures DAH series or approved equal.
   iv. For smaller panels where an enclosure heater would exceed the requirements (temperature, spacing), provide a strip heater with thermostat for condensation control.

h. The enclosure shall open with a padlock-able three-point latch.

i. All equipment shall be DIN rail mounted to a subpanel in the enclosure.

j. Provide an LED enclosure light fixture for each panel door at the top of the enclosure with an accessible On/Off switch. Provide a duplex GFI receptacle in the panel with a label showing "For Test Instruments only/Computer use only". The receptacle and panel light shall be provided with a separate overcurrent protective device and connected in such a manner so as to not disconnect control, instrumentation, or PLC power in the event that the GFI outlet should trip.

k. Each PLC control panel shall have a UPS. See section 13442 for specific UPS requirements. The UPS shall be mounted inside of the enclosure on a specific UPS shelf which keeps it off of the floor of the enclosure. Provide a UPS maintenance bypass switch (MBS) that allows the panel to be powered through the UPS or from line power.

l. Unless stated otherwise each field instrument whether powered by 120 VAC or 24 VDC shall be powered from the associated Control Panel’s UPS. Field instruments that measure processes that are not disrupted during a power outage, require a significant amount of time to reset after power is restored from a power outage, or will cause disruptions to process control if the process value is not immediately available once power is restored shall be backed up by the UPS from the associated Control Panel.

ii. The following shall NOT be powered from the UPS:
   (1) Control panel lighting.
   (2) Control panel heating.
   (3) Control panel cooling.
   (4) Instrumentation powered from control panel, but not indicated by UPS power as indicated on the Instrumentation and Electrical Drawings.

D. Components and Requirements:
   1. Enclosures
      a. Shall be UL508A or UL698 Listed as an assembly, as indicated in schedule.
b. Enclosures shall be sized as required to contain the necessary apparatus for the particular installation. Final panel/enclosure dimensions shall provide for easy access to all internal components with ease of maintenance and future modifications considered. Enclosure size shall accommodate UL requirements. Conflicts with panel sizing and available spacing shall immediately be brought to the attention of the Engineer prior to proceeding to procurement. Panels purchased without submittal/Engineer approval that present installation/egress/clearance issues shall be replaced by the Contractor at no additional cost to the Owner/Engineer.

c. Panels larger than 36-inches in any dimension shall not be wall mounted. Provide two doors if panel is larger than 36-inches wide.

d. Enclosures larger than 16" in any dimension shall utilize a three-point latching system.

e. Provide door and body stiffeners where necessary for a rigid enclosure. Floor mounted enclosures shall be provided with lifting eyes and, where floor-mounted, with 12-inch floor stands. No floor stands are to be provided for free-standing models.

f. Doors shall have side mounted, stainless steel, continuous length, piano-type hinges and pins.

g. Panels/enclosures shall be equipped with print pockets located on the inside of the door.

h. A complete “As-Built” panel wiring diagram including exterior devices and motors to be connected shall be encased in clear re-sealable plastic pouch(es) and placed in the print pocket.

i. NEMA 4X stainless steel enclosures shall be Type 304 stainless steel enclosures shall be 16 gauge for box sizes up to and including 24" by 24", 14 gauge for box sizes larger than 24" by 24" up to 36" width, and 12 gauge for box widths greater than 36 inches. Free-standing enclosures shall be 12-gauge minimum. Enclosures shall have continuously welded seams, ground smooth, supplied with no holes or knockouts and a rolled lip around door and enclosure opening. Enclosures to be installed outdoors shall be provided with drip shields. Provide oil-resistant door gaskets all around door openings. All enclosure hinges, clamps, etc. shall be stainless steel. Enclosures/panels shall be provided unpainted, with metal enclosures having a smooth brushed finish.

j. Provide enclosures equivalent to:
   i. Saginaw Control and Engineering
   ii. Hoffman
   iii. Or equal

2. Control Panel Wiring Requirements:
   a. All control panel wiring shall conform to the latest requirements of NEC and all state and local code requirements.

   b. Bundles of wires not in raceways must be secured to the panel structure every 8 inches minimum. All interior wiring will be point to point with no splices.
c. Wires to the front of panel devices shall be looped, extra flexible, bundled and located in a manner to prevent damage due to opening and closing the door.

d. All control wires internal to panels shall be minimum No. 14 AWG. Wires carrying line voltage shall be minimum No. 12 AWG. All conductors shall be copper. Wiring in close proximity to heating devices shall be Type AVA UL approved. All wiring shall be run in PVC wiring channels and bundled with nylon cable ties. Line voltage wiring must be run separately from control, signal and intrinsically safe wiring. PVC wiring channels shall be properly sized for the capacity of wires being installed based on the overall project needs and shall not be over filled.

e. Discrete and analog wiring shall be separated to the greatest extent possible. It shall be assumed that discrete and analog conduits shall be installed into the panel on opposing sides. PLC I/O modules slots and field terminal blocks shall be grouped by type.

f. Wiring to equipment shall be distributed to the greatest extent possible amongst the PLC I/O modules to minimize the amount of common failure points across common equipment. Example: If there are four DI modules and four raw water pumps, each DI module shall have IO for one of the raw water pumps.

g. All managed network switches and routers shall be powered with redundant power supplies.

h. Analog wire shields shall be continued until the PLC I/O modules.

i. All branch circuits shall be provided overcurrent protection. PLCs, OITs, HMIs, instruments, power supplies (if not supplied with a field resettable fuse), and networking equipment shall have a dedicated fuse. Overcurrent protection shall be sized appropriately and account for inrush currents.

j. All outgoing power (120 V and 24 V) to field devices shall be fused.

k. Each digital input module shall have a dedicated fuse.

l. All wires shall be marked at both ends with numbers by self-sticking wire markers or with slip-on style plastic markers. Wire markers shall match the terminal block labels, unless otherwise specified.

m. Wire color coding shall include the following:

   i. Red wires - Interior control circuits
   ii. Yellow wires - Power from external sources
   iii. Blue wires - DC voltages
   iv. Blue/White wires – DC return (i.e.-24VDC)
   v. Green wires - Ground

n. Terminals shall be arranged in alphabetic and numeric order in columns on removable sub-plates. A maximum of two connections shall be made to each side of a terminal, including jumpers. Provide an additional 20 percent spare terminals with the following minimum requirements:

   i. Power terminals
      (1) 1 spare 120VAC
      (2) 1 spare 24VDC
ii. Control terminals
   (1) 5 spare
iii. Signal terminals
   (1) 2 spare
   (2) 1 spare terminals wired for loop powered devices

o. Provide ground terminal for each panel.
p. All control panels shall be provided with spare mountings for additional relays. Number of spare mountings will correspond to 5% of the total number of relays within each panel, with a minimum of one (1) spare mounting.
q. All wiring entering and leaving control panels shall be terminated on field terminal blocks and labeled.
r. Provide individual surge protection for all for all field instruments mounted outside of the building or facility housing the control panel and/or as indicated on the drawings. Instruments mounted within the same structure as the associated control panel do not require surge protection.
s. Provide protection on all signal and data circuits that leave a building or are routed external to a building. Circuit protection shall be provided at both ends of the signal or data highway lines within the control panel at one end and as close to the instruments or termination device as possible.
t. Provide equipment labels for all devices on the subpanel to easily identify panel components (relays, network switches, power supplies, etc.) Labels on equipment is not acceptable.
u. Provide a label indicating the power source on the front of each panel. As-built Panel drawings shall also indicate power source.
v. Wiring shall be in compliant with the National Electric Code and with the applicable UL requirements. All wiring shall be done with best practices and follow equipment manufacturer guidelines.
w. Provide complete "As Built" wiring diagrams to be provided with the O&M manuals and in the enclosures for all control panels.

3. Programmable Logic Controllers (PLC):
   a. Refer to Specification 13442 - Programmable Logic Controllers for PLC requirements.

4. Operator Interface Terminal (OIT):
   a. Refer to Specification 13442 - Programmable Logic Controllers for OIT requirements.

5. Uninterruptible Power Supply (UPS):
   a. Refer to Specification 13442 - Programmable Logic Controllers for UPS requirements in Control Panels.

6. Unmanaged Ethernet Switches:
   a. Provide unmanaged Ethernet switch(s) for connection to the control network as shown in the Drawings and specified herein.
   b. Physical Features
      i. Copper ports: 4
      ii. PoE Copper ports: None
      iii. Fiber ports: None
iv. Operating temperature: 32 to 130 degrees f
v. Power: 24 VDC
vi. Enclosure: Metal case, DIN-rail mountable
vii. Rating: ANSI/ISA Class 1, Division 2 Groups A, B, C, and D

c. Network Features
i. Auto sensing duplex and speed
ii. LED link/activity status indication

d. Acceptable Manufacturers
i. Phoenix contact
ii. N-Tron
iii. Moxa
iv. Or equal

e. Basis of design: The drawings are based on generic network equipment. Equivalent alternate equipment will be considered provided that all revisions required to the design be accomplished at no cost to the owner.

7. Data/Power Port:
   a. Provide a Data/Power port with Ethernet RJ45 jack and 120 VAC GFI outlet to meet Arc flash 70E requirements. Data power port will have a lockable hinged cover with panel mounted hardware and shall be installed on the front of the control panel.
   b. Control panels with a keyboard shall have a Data/Power port with a USB connection.
   c. Environmental Rating: To match panel NEMA rating.
   d. The Data and Power port shall be:
      i. Grace Engineered Products
      ii. Hubble "Panel-Safe" Power and Data Access Ports
      iii. Or equal

8. 12 and 24 VDC Power Supplies:
   a. Provide 12 and 24 VDC power supplies in the control panel to power field instruments, panel devices, etc., as required.
   b. No more than three internal panel devices or external field instruments requiring 12 or 24 VDC power shall be powered from a single 12 or 24 VDC power supply.
   c. Input voltage: 115 VAC
   d. Output voltage: 24 or 12 VDC.
   e. Ripple: <50 mVpp.
   f. The power supply shall be sized to accommodate 125% of the design load.
   g. Operating temperature: 32 to 140 °F.
   h. The power supply shall be provided with a means to protect instruments from over current and over voltage.
   i. Mounting: Din rail mount inside enclosures. Power supply shall be located in the enclosure such that heat generated does not cause other panel components to malfunction or become damaged.
   j. 12 or 24 VDC power supplies shall be:
      i. Sola SDN
      ii. Allen-Bradley 1606
Hand Switches: HS

a. Push buttons and selector switches shall be 30 mm and heavy duty oil-tight.

b. Switches shall have the same NEMA rating as the panel that the switch is installed in.

c. Contact blocks shall be stackable and provide all necessary contacts as shown on the Drawings.

d. Each switch shall be labeled as indicated on the Drawings.

e. Equal to:
   i. Allen Bradley 800H series
   ii. Eaton Cutler-Hammer HT800 series
   iii. Or equal

Indicator Lights: YL, AL

a. All indicator lights shall be 30 mm, heavy duty oil-tight, 120 VAC, LED with push to test option. Indicator Lights shall be wired such that they can be tested with Control or UPS Power source.

b. Lights shall have the same NEMA rating as the panel that the light is installed in.

c. Indicator lights shall be provided with a chrome-plated metal or anodized-aluminum mounting rings, engraved as indicated on the Drawings.

d. All indicating lights will use the following light color convention: See Instrumentation Drawing I-1 “Indicator Light Color Legend”.

e. Equal to:
   i. Allen Bradley 800H series
   ii. Eaton Cutler-Hammer HT800 series
   iii. Or equal

Fuses:

a. Fuses shall be 3AB ceramic body fuses rated for at least 125 volts at the current ratings shown on the Drawings. Fuse size shall be ¼” by 1¼”.

b. Blow time shall be: 110%, 4 hours minimum; 135%, 1-hour maximum; 200%, 15 seconds maximum for 1/8-12 amp fuses and 60 seconds maximum for 15-30 amp fuses.

c. Fuses shall be:
   i. Entrelec
   ii. Bussmann,
   iii. Or approved equal.

Line Surge Protection:

a. A UL1449 dedicated surge protection device (non-UPS) shall be installed for main power into a panel.

b. A UL1449 dedicated surge protection device (non-UPS) shall be installed for panel powered instruments located outside of the building.

c. Surge protection shall protect L-G, L-N and N-G.

d. Surge arrester shall be adequate for intended function and shall be by a nationally recognized manufacturer with a minimum of 3-years’ experience in manufacturer of such devices. Technology shall a hybrid of
Silicone Avalanche Diodes and MOV or MOV and thermal fusing. GDT or sole MOV technology is not acceptable.

e. Surge arrestor to include a dry contact for remote monitoring of a surge event.

f. Surge arrestor shall be installed per manufacturer recommendations, as close to incoming power as possible, and incoming leads shall be as short as possible.

g. Surge arrestor shall have a positive indication of device operation or failure.

h. Surge arrestor shall have a Surge Current rating of 25kA per phase.

i. Surge Arrestor shall be:
   i. Weidmuller SPD series
   ii. Citel DS40 series
   iii. Or Equal

13. Control Relays:
   a. Scope: Control relays used for relay logic.
   b. Relays shall be electrically held, Form C, electrically operated with 120 volt coils except as noted otherwise on the Drawings. Contacts shall be rated 10 amps at 600 volts.
   c. The number of poles required shall be determined by the System Integrator depending on specific requirements of what the relay is used for. Each relay will be at minimum DPDT or one spare pole per relay.
   d. Control relay shall have an energized indicator in either the form of a mechanical flag, or neon lamp (LED for DC applications).
   e. Relays shall be provided with a suppression diode for inductive loads.
   f. Control Relays shall be:
      i. Allen Bradley 700-HF Series
      ii. Idec RU Series
      iii. Or equal

14. PLC Output Relays:
   a. Scope: Control relays used for PLC outputs (isolation relays)
   b. Each PLC discrete output shall be protected with an interposing relay including spare PLC discrete outputs. PLC output relays shall be SPDT electrically held, Form C, electrically operated with 120 volt coils. Contacts shall be rated at a minimum 5 amps at 300 volts. System Integrator shall use higher capacity relays for equipment that is being powered directly through the relay's contacts.
   c. Control relay shall have an energized indicator in either the form of a mechanical flag, or neon lamp (LED for DC applications).
   d. PLC output relays shall be DIN rail mounted and have a slim profile in order to conserve panel space.
   e. Relays shall be provided with a suppression diode for inductive loads.
   f. Control Relays shall be:
      i. Allen Bradley 700HK Slim Line Series
      ii. Phoenix Contact PLC relay series
      iii. Or equal
15. Time Delay Relays:
   a. Time delay relays shall be used as required for use as shown on the
drawings or described in the specifications. Time delay relays shall be
capable of the following functions:
      i. Off Delay (delay on release)
   b. An off delay time delay relay shall change the state of the relay contacts
after the preset time delay from when control power is removed from the
relay coil. Contacts shall immediately change state when control power is
removed from the relay coil.
   c. Delay timing relays shall be solid state, Form C, electrically operated with
120 VAC coils except as noted on the drawing.
   d. The number of poles required shall be determined by the System Integrator
depending on specific requirements of what the relay is used for. Each
relay will be at minimum DPDT or one spare pole per relay.
   e. Contacts shall be rated 5 amps at 240 volts.
   f. Minimum time range shall be adjustable from 1 second to 10 minutes.
Other ranges as required by function and as indicated on the Drawings or
within the Specifications.
      i. Final settings shall be indicated on the O&M drawings.
   g. Off Delay Time Delay Relays shall be:
      i. IDEC RTE Series
      ii. Square D RE Series
      iii. Magnecraft TDR Series
      iv. Allen Bradley 700 Series
      v. Or Equal
16. Automatic Transfer Relays (ATR)
   a. Scope: ATRs shall be Contactors or IEC control relays are used for the
ATR circuit. Devices shall be IEC listed.
   b. Relays shall be 4NO and 4NC at a minimum and have an auxiliary contact
to indicate to the PLC the ATR fail status. The number of poles required
shall be the responsibility of the system integrator.
   c. Relay coil shall be actuated via 120VAC except as noted otherwise on the
Drawings.
   d. Contacts shall be thermally rated for 16A continuously at 120VAC and
shall be mechanically linked. Auxiliary contacts shall be rated for 5A at
120VAC.
   e. Relay shall provide positive safety for the N.O. and N.C. contacts which
assure that the N.O. contacts will not close before any N.C. contact opens
   f. Equal to:
      i. Allen Bradley 700-CF series
      ii. ABB N44 series
      iii. Or equal
17. Terminal Blocks
   a. Field terminal strips with box type connectors shall be supplied to make
all power and control connections to and from each control panel.
b. All terminals shall be clearly marked for easy identification. A ground terminal strip shall also be provided.
c. Field terminal blocks shall be single tier for ease of installation and maintenance.
d. At least 20 percent of terminals supplied shall be spare. All wiring in and out of a control panel shall be terminated on field terminal blocks.
e. All spare PLC I/O (including interposing relays) shall be wired to terminal blocks.
f. Prewired terminal blocks from the control manufacturer as also acceptable, Allen Bradley IFM or equal. The prewired terminal blocks shall also meet the specifications herein.
g. Field Terminal Blocks shall be:
   i. Phoenix Contact UT Series
   ii. Allen-Bradley 1492 Series
   iii. Or equal

18. DIN Rail
   a. Size: 35mm
   b. Material: Aluminum or Bronze
   c. All field terminal blocks shall be mounted on 2” raised DIN rail

19. Spare Parts and Test Equipment:
   a. The System Integrator shall furnish the following spare parts:
      i. 2 surge suppressors of each type
      ii. 1 24 VDC Power Supply
      iii. 5 of each type lamp, unless otherwise specified herein
      iv. 2 of each color indicator light lens.
      v. 1-time delay relay (of each type)
      vi. 5 control relays (of each type)
      vii. 1 complete selector switch of each type.
      viii. 1 complete push-button of each type.
      ix. 1 of each different contact block for control units.
      x. 2 of every type of fuse.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. General: Refer to Section 13410 PART 3 - EXECUTION.
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<th>Description</th>
<th>Abbreviation</th>
<th>Type</th>
<th>NEMA Rating</th>
<th>Panel Width</th>
<th>Mounting</th>
<th>Shelf &amp; Keyboard</th>
<th>Marshaling Shelf</th>
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<td>Wall</td>
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<td>698</td>
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END OF SECTION
SECTION 15050

PIPE & PIPE FITTINGS – GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install, support, and test pipe and pipe fittings of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere (When Applicable):
   1. Excavation and backfill are specified in Division 2.
   2. Concrete cradles, arches, and encasements are specified in Division 3.
   3. Painting and Pipe Identification are specified in Section 09900.
   4. Surface Preparation and Shop Coatings are specified in Section 09905.
   5. Valves, gates, pipe hangers, pipe supports, pipe and equipment insulation, heating, and plumbing are specified in the appropriate Sections in Division 15.
   6. Pipe materials are specified in the appropriate sections of Division 2 and/or Division 15.
C. Other Trades: Cooperate with all other trades whose work is to be coordinated with piping work.

1.2 REFERENCES
A. American National Standards Institute (ANSI)
   1. ANSI B31.1 – Power Piping
   2. ANSI B31.3 – Process Piping
   4. ANSI B31.5 – Refrigeration Piping
   5. ANSI B31.9 – Building Services Piping
   7. ANSI B31.8 – Gas Transmission and Distribution Piping Systems

1.3 SUBMITTALS
A. Submit shop drawings in accordance with Section 01340 and the General Conditions of the Construction Contract.
B. Submit manufacturer's "Certification of Conformance" that pipe and fittings and other piping appurtenances meet or exceed the requirements of these Specifications.
C. Submit other documents as specified in the appropriate Sections of this Division.
D. Coordinate piping support arrangements to eliminate interference with similar systems to be installed under HVAC, Plumbing, Fire Protection and Electrical; to account for structural expansion joints and to maintain access for both personnel and for removal of equipment.
E. After the work is installed, but before it is filled for start-up and testing, the support system design engineer shall inspect the work and certify its complete adequacy. Each system shall be inspected and certified in the same way. Submit a report, including all field modifications and all certificates.
1.4 **SEISMIC CONTROL**
   A. Not applicable.

1.5 **DELIVERY, STORAGE AND HANDLING**
   A. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.
   B. Do not drop pipe and fittings.
   C. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations and as required by the Engineer.
   D. Assure that materials are kept clean and dry.
   E. Do not store materials directly on the ground.
   F. Follow manufacturer's specific instructions, recommendations and requirements.
   G. Store in a manner to protect items with epoxy shop coatings from exposure to UV light which can cause chalking of the epoxy. Length of acceptable exposure prior to providing UV protective measures shall be in accordance with coating manufacturer’s recommendations. This includes protection from UV light after installation while awaiting covering or filling of tanks, or prior to field painting for items scheduled to be topcoated as specified in Section 09900.

**PART 2 - PRODUCTS**

2.1 **MATERIALS**
   A. Materials are specified in the following Sections in this Division.

2.2 **BOLTS, ANCHOR BOLTS AND NUTS**
   A. Furnish all necessary bolts, anchor bolts, nuts, washers, lock washers or locking nuts, plates and bolt sleeves in accordance herewith. Anchor bolts shall have suitable washers, lock washers and, where so required, their nuts shall be hexagonal.
   B. All bolts, anchor bolts, nuts, washers, lock washers, plates, and bolt sleeves shall be carbon steel unless otherwise indicated below or as specified elsewhere.
      1. Stainless steel hardware (minimum of Type 304, unless otherwise indicated) is required in all corrosive atmospheres, exterior areas, and/or areas with NEMA 4X or NEMA 7 rating.
      2. Stainless steel hardware (minimum of Type 316, unless otherwise indicated) is required in all submerged applications as well as in wetwells, headworks, dewatering rooms, chemical rooms, clarifiers, aeration basins, splitter structures, equalization or storage tanks, etc. For additional description and definition of submerged surfaces refer to Specification Section 09900.
   C. Unless otherwise specified, stud, tap, and machine bolts shall be of the best-quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to AN Standard B 1.1-1974 for Unified Inch Screw Threads (UN and UNR Thread Form).
   D. All bolts shall be suitable size for the intended purpose, with direct input from the product manufacturer.
2.3 SURFACE PREPARATION AND SHOP COATINGS
   A. Provide surface preparation and shop coatings in accordance with Specification Section 09905.

PART 3 - EXECUTION

3.1 INSPECTION
   A. Provide all labor necessary to assist the Engineer to inspect pipe, fittings, gaskets, and other materials.
   B. Carefully inspect all materials at the time of delivery and just prior to installation.
   C. Carefully inspect all pipe and fittings for:
      1. Defects and damage.
      2. Deviations beyond allowable tolerances for joint dimensions.
   D. Examine areas and structures to receive piping for:
      1. Defects, such as weak structural components that adversely affect the execution and quality of work.
      2. Deviations beyond allowable tolerances for pipe clearances.
   E. All materials and methods not meeting the requirements of this Contract will be rejected.
   F. Immediately remove all rejected materials from the project site.
   G. Start work only when conditions are corrected to the satisfaction of the Engineer.

3.2 INSTALLATION
   A. General:
      1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations and as specified herein.
      2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
      3. Install adapters, acceptable to the Engineer, when connecting pipes constructed from different materials.
      4. Support all piping not being installed in trenches in accordance with the "Pipe Hangers & Supports" Section in Division 15.

3.3 CLEANING AND TESTING
   A. Cleaning & Testing Piping - General:
      1. Thoroughly clean all piping prior to testing. Remove all dirt, dust, oil, grease and other foreign material. Exercise care while cleaning to avoid damage to linings and coatings.
      2. When the installation is complete, test all pipelines in the presence of the Engineer and the plumbing or building inspector in accordance with the requirements of the local and state plumbing codes and the appropriate Sections of these Specifications, at no additional cost to the Owner. When requested by the Engineer or local plumbing inspector, building gravity drains shall be tested prior to backfilling or concealing. All other piping must be tested after backfilling.
3. **Equipment:** Supply all labor, equipment, materials, taps, gauges, and pumps required to conduct the tests.

4. **Retesting:** Perform all retesting required by the Engineer at no additional cost to the Owner.

B. **Outside Sewer Lines (CLASS II):** CLASS II pipe testing shall be performed in accordance with Section 02755.

C. **All Other Piping Systems:**
   1. **CLASS IV and CLASS V Hydrostatic Pressure Test:**
      a. The section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe. If blowoffs are not available at high points for releasing air the Contractor shall make the necessary excavations, backfilling and taps at such points and shall plug said holes after completion of the test.
      b. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied.
      c. **CLASS IV -** Perform pressure and leakage test at the test pressure shown on the Pipe Schedule. If no test pressure is indicated, perform pressure and leakage test at 1-½ times the maximum system pressure or 100 psi whichever is greater (based on the elevation of the lowest point of the section under test and corrected to the gauge location).
      d. **CLASS V -** Perform pressure and leakage test at the test pressure shown on the Pipe Schedule. If no test pressure is indicated, perform pressure and leakage test at 1-1/2 times the maximum system pressure or 20 psi whichever is greater (based on the elevation of the lowest point of the section under test and corrected to the gauge location).
      e. While maintaining this pressure, the Contractor shall make a leakage test by metering the flow of water into the pipe. If the average leakage during a two-hour period on buried pipelines exceeds a rate calculated by the equation in paragraph 3.3,B,1,e of this Specification Section, the section shall be considered as having failed the test. All pipes within structures and chambers and all flanged joints shall have no visible leakage.
      f. If the section fails to pass the pressure and leakage test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at their own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test.

2. **Connection to Work by Others.**
   a. If work involves connection of pipe lines to pipes or structures provided by others, pressure tests pipe line prior to making the connection.
   b. After successfully passing the pipe line pressure test, make the necessary connections to the work by others, and pressure test the connection.
   c. The connection shall be pressurized to the pipe line test pressure, for a minimum of 4 hours. The connection shall have no visible leakage.
   d. Correct any leakage at no cost to the Owner and retest until connection passes.

3. **Cleaning:** Perform all specialized cleaning as specified or required by system.
### 3.4 PIPE SCHEDULE

<table>
<thead>
<tr>
<th>TAG</th>
<th>DESCRIPTION</th>
<th>LOCATION(1)</th>
<th>SIZE</th>
<th>MATERIAL(2)</th>
<th>JOINT SYSTEM</th>
<th>PRESSURE TEST CLASS(3)</th>
<th>DELEGATED PE DESIGN OF PIPE SUPPORTS (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/DR</td>
<td>DRAIN</td>
<td>BURIED &amp; EXPOSED</td>
<td>ALL</td>
<td>SCH 40 PVC</td>
<td>SOLVENT WELD</td>
<td>CLASS V</td>
<td>NO</td>
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<tr>
<td>FM</td>
<td>FORCE MAIN</td>
<td>BURIED</td>
<td>≤6&quot;</td>
<td>CLASS 52 D.I.</td>
<td>MJ OR PUSH-ON</td>
<td>CLASS IV</td>
<td>N/A</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>&gt;6&quot;</td>
<td>SDR 17 HDPE</td>
<td>BUTT-FUSION</td>
<td>CLASS IV</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXPOSED</td>
<td>≤6&quot;</td>
<td>CLASS 53 D.I.</td>
<td>FLANGED</td>
<td>CLASS IV</td>
<td>NO</td>
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<tr>
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<td>SEWER</td>
<td>BURIED</td>
<td>ALL</td>
<td>SDR 35 PVC</td>
<td>PUSH-ON</td>
<td>CLASS II</td>
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<tr>
<td></td>
<td></td>
<td>EXPOSED</td>
<td>ALL</td>
<td>CLASS 250 D.I.</td>
<td>PUSH-ON</td>
<td>CLASS II</td>
<td>N/A</td>
</tr>
</tbody>
</table>

(1) PIPE CONTAINED WITHIN TANKAGE SHALL BE CONSIDERED “EXPOSED” OR “INTERIOR” PIPING FOR THE PURPOSES OF THE PIPE SCHEDULE (UNLESS OTHERWISE SPECIFICALLY DESIGNATED).

(2) TYPE L COPPER MAY BE USED IN LIEU OF D.I. FOR 3" DUCTILE IRON PIPE.

(3) IF A SPECIFIC PRESSURE IS NOT INDICATED IN PARENTHESES AFTER THE PRESSURE TESTING CLASS, USE THE TEST PRESSURE INDICATED IN THE SPECIFICATION WRITE UP FOR THAT GENERAL PIPE PRESSURE TESTING CLASS.

(4) REFER TO SECTION 15094 FOR PIPE SUPPORT REQUIREMENTS AND SUBMITTALS. ALL EXPOSED PIPES REQUIRE SUPPORTS; SOME PIPES REQUIRE PIPE SUPPORTS, BRACING OR RESTRAINTS DESIGNED BY A PROFESSIONAL ENGINEER.
SECTION 15051

POLYVINYL CHLORIDE (PVC) DRAINAGE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish and install PVC drainage pipe and fittings of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere: "Pipe & Pipe Fittings - General" is specified in this Division.

1.2 QUALITY ASSURANCE
A. Standards:
   1. Pipe and fittings (interior) shall conform to ASTM D-2665.
   2. Pipe and fittings (exterior) shall conform to ASTM D-3034.
   3. Solvent cement shall meet the requirements of ASTM D-2564.
   4. Shall have NSF seal of approval.
B. Acceptable Manufacturers:
   2. Harvel
   3. Cabot
   4. Or approved equal.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Pipe Outside Buildings:
   1. Pipe and Fittings:
      a. Virgin Type I, Grade I, or Type I, Grade 2 or as shown on the Drawings.
      b. Pipe and Fittings: Gasketed style utilizing twin gasket coupling or single gasket bell and spigot type.
      c. Pipe Lengths: Laying length of 20 feet minimum.
B. Piping Inside Building:
   1. Pipe and Fittings:
      a. Solvent weld type with drainage type fittings.
      b. Type I, Grade I, or Type I, Grade 2 or as shown on the Drawings.
   2. Joints:
      a. Solvent weld using approved pipe manufacturer’s solvent.
      b. Couplings: Same schedule as pipe.
C. Adaptors: When applicable, provide adaptors for connecting PVC to pipe constructed from other materials.

PART 3 - PART 3 - EXECUTION
3.1 INSTALLATION
A. Jointing:
   1. Clear each pipe length, coupling and fitting of all debris and dirt before installing.
   2. Provide and use coupling pullers for joining the pipe.
   3. Shove home each length of pipe against the pipe previously laid and hold securely in position.
   4. Do not pull or cramp joints.
B. Fabrication:
   1. Cutting:
      a. Use a hand saw or pipe cutter with blades (not rollers).
      b. Examine all cut ends for possible cracks caused by cutting.
   2. Connecting:
      a. Solvent weld connections as recommended by the manufacturer.
      b. Connect pipe and fittings only when temperature is above the minimum recommended by the manufacturer.
      c. Threaded adapters shall be connected only with plastic male into metal female.

END OF SECTION
SECTION 15062

DUCTILE IRON PIPE & FITTINGS
(INTERIOR/EXPOSED APPLICATIONS)

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Provide and install ductile iron pipe and fittings of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere:
   1. Pipe and Pipe Fittings - General is specified in Section 15050.
   2. Surface Preparation and Shop Coatings are specified in Section 09905.
   3. Ductile Iron Pipe & Fittings for Buried Applications is specified in Section 02615.
   4. Pre-Insulated Ductile Iron Pipe & Fittings is specified in Section 02615B.

1.2 QUALITY ASSURANCE
A. Standards (As Applicable):
   4. Ductile iron pipe centrifugally cast in metal or sand lined molds: ANSI A21.51 (AWWA C151).
B. Acceptable Manufacturers:
   1. Griffin
   2. Tyler
   3. Union
   4. US Pipe
   5. Victaulic Company (fittings only)
   6. Or equivalent.

1.3 SUBMITTALS TO THE ENGINEER
A. In accordance with the requirements specified in Section 01340 and 11000. Submit such shop drawings, manufacturer’s literature, short-term and long-term storage requirements, and operations and maintenance manuals.
B. Additional specific information for submittal is listed below:
   1. Submit Manufacturer’s “Certification of Conformance” that pipe and fittings meet or exceed the requirements of these specifications.
   2. Submit Manufacturer’s installation instructions for all pipe and fittings.
1.4 DELIVERY, STORAGE & HANDLING
A. Exercise extra care when handling cement lined pipe because damage to the lining will render it unfit for use.
B. Protect the spherical spigot ends and the plain ends of all pipe during shipment by wood lagging securely fastened in place.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS
A. General:
   1. Unless otherwise shown on the Drawings, the minimum thickness of ductile iron pipe shall be Class 53.
   2. Pre-insulated ductile iron pipe and fittings shall be Class 250. Refer to Section 02615B for additional requirements.
   3. Pipe for use with sleeve type couplings shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
   4. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the manufacturer of the couplings and AWWA C606.
   5. The outside of all interior pipe shall be coated in accordance with Section 15050.
B. Pipe Interior Lining:
   1. Pipe shall be double thickness cement lined and seal coated unless noted otherwise on the Drawings.
C. Joints (as shown on Drawings or as specified):
   1. Flanged:
      a. Provide specially drilled flanges when required for connection to existing piping or special equipment.
      b. Flanges shall be flat face, long-hub screwed tightly on pipe by machine at the foundry prior to facing and drilling.
      c. Gaskets:
         i. Full face gaskets only.
         ii. Thickness of gaskets - Use standard 1/8-inch thickness gaskets, unless thinner gaskets are required for tight retrofit installations.
      d. Fasteners:
         i. Make joints with bolt, studs with a nut on each end, or one tapped flanged with a stud and nut.
         ii. The number and size of bolts shall meet the requirements of the applicable ANSI standard.
         iii. Nuts, bolts, and studs shall be Grade B meeting the requirements of ASTM A307.
      e. When applicable, provide and install flange clamps as shown on the Drawings.
   2. Grooved Joint Couplings: Couplings shall consist of two or more ductile iron housing segments to ASTM A536, pressure responsive FlushSeal gasket to ASTM D2000, and zinc electroplated steel bolts and nuts to ASTM A449 or stainless steel to ASTM F593.
a. For direct connection to grooved end IPS/steel pipe sizes transition couplings may be used. The coupling housings shall be cast with offsetting angle-pattern bolt pads for joint rigidity.
b. Split ring couplings, sleeve couplings, flexible joints and couplings, shall be supplied as specified in "Couplings and Connectors" Section.
c. All grooved joint couplings, fittings, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
d. All castings used for coupling housings, and fittings shall be date stamped for quality assurance and traceability.

3. Joint Bracing:
a. Provide joint bracing to prevent the piping from pulling apart under pressure as required and as shown on the Drawings.
b. Types of bracing:
   i. Pipe and fittings furnished with approved lugs or hooks cast integrally for use with socket pipe clamps, tie rods, or bridles. Bridles and tie rods shall be a minimum of 3/4 inch diameter except where they replace flange bolts of a smaller size, in which case they shall be fitted with a nut on each side of the pair of flanges. The clamps, tie rods, and bridles shall be coated with bituminous paint in buried installations and shall be coated with the same coatings as the piping system in interior installations after assembly or, if necessary, prior to assembly.
   ii. Other types of bracing as shown on the Drawings.

2.2 FITTINGS
A. Standard Fittings:
   1. Either gray cast iron or ductile iron fittings may be furnished.
   2. Pressure rating of 250 psi unless indicated otherwise on the Drawings or as specified.
   3. Flange fittings shall be ANSI B16.1, Class 125 unless indicated otherwise. Flanges shall be flat faced, with full face gaskets.
   4. Grooved end fittings shall comply with ANSI A21.10/AWWA C110 for center-to-end dimensions, and ANSI A21.10/AWWA C110 or AWWA C153 for wall thickness. Ends shall comply with AWWA C606, and the fittings shall be of the same manufacturer as the grooved components.
   5. Joints the same as the pipe with which they are used or as shown on the Drawings.
   6. Provide fittings with standard bases where shown on the Drawings.
   7. Cement lining and seal coat unless noted otherwise on the Drawings.
   8. All interior fittings shall receive coating in accordance with Section 15050.
B. Non-Standard Fittings:
   1. Fittings having non-standard dimensions shall be subject to the Engineer's review and acceptance.
2. Non-standard fittings shall have the same diameter and thickness as standard fittings and shall meet the specification requirements for standard fittings.
3. The lengths and types of joints shall be determined by the particular piping to which they connect.
4. Flanged fittings not meeting the requirements of ANSI A21.10 (i.e., laterals or reducing elbows) shall meet the requirements of ANSI B16.1 in Class 125.

C. Wall Castings:
1. Size, type and location as shown on the Drawings.
2. Dimensions shall conform to ANSI A21.10 except where required. A flange substantially flush with the face of a concrete or masonry wall shall be drilled and tapped for studs.
3. Other dimensions shall be identical to the corresponding parts of standard bell and spigot fittings.
4. A central fin not less than 1/2 inch thick and of the same diameter as a flange shall be cast on the barrel at a point that will locate it midway through the wall to form a waterstop.
5. Alternate wall sleeve system as manufactured by Omni Sleeve, Malden, MA can be utilized as approved by Engineer, in place of above specified wall casting system.

PART 3 - EXECUTION

3.1 INSPECTION
A. Provide all labor necessary to assist the Engineer to inspect pipe, fittings, gaskets, and other materials.
B. Carefully inspect all materials at the time of delivery and just prior to installation.
C. Carefully inspect all pipe and fittings for:
1. Defects, such as weak structural components, that adversely affect the execution and quality of work.
2. Deviations beyond allowable tolerances for pipe clearances.
D. Immediately remove all rejected materials from the project site.

3.2 INSTALLATION
A. General:
1. Install in strict accordance with the pipe and fitting manufacturer's instructions and recommendations and as specified or as shown on the Drawings.
2. Acceptable thrust resistant system is required at all fittings on pressure pipe.
B. Assembling Joints:
1. Flanged Joints:
   a. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
   b. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.
2. Grooved Joints:
   a. Grooved joint shall be installed in accordance with the manufacturer’s written recommendations.
   b. Grooved ends shall be clean and free from indentations, projections, or roll marks.
   c. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service.
   d. The coupling manufacturer’s factory trained representative shall provide on-site training for the contractor’s field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor’s representative is not considered qualified to conduct the training.)

3. Bolted Joints:
   a. Remove rust preventive coatings from machined surfaces prior to assembly.
   b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.
   c. All stainless steel fasteners for piping and supports shall be hand tightened to limit the potential for galling.

C. Fabrication:
   1. Tapped Connections:
      a. Make all tapped connections as shown on the Drawings or as required by the Engineer.
      b. Make all connections watertight and of adequate strength to prevent pullout.
      c. Drill and tap normal to the longitudinal axis of the pipe.
      d. The maximum sizes of taps in pipes and fittings without busses shall not exceed the sizes listed in the appendix of ANSI A21.51 based on 3 full threads for ductile iron.
      e. Taps in fittings shall be located where indicated by the manufacturer for that particular type of fitting.

D. Castings in Masonry:
   1. Accurately set and align castings to be encased in masonry.
   2. Thoroughly clean castings immediately prior to being set in place. Remove all rust, scale and other foreign material.

END OF SECTION
SECTION 15088

COUPLINGS & CONNECTORS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish and install couplings and connectors of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere: "Pipe & Pipe Fittings - General" is specified in this Division.

1.2 QUALITY ASSURANCE
A. Minimum pressure rating equal to that of the pipeline in which they are to be installed.
B. Couplings and connectors, other than those specified herein, are subject to the Engineer's approval.

PART 2 - PRODUCTS

2.1 MATERIALS
A. All Couplings and Connectors:
   1. Gasket Materials: Composition suitable for exposure to the liquids to be contained within the pipes.
   2. Diameters to properly fit the specific types of pipes on which couplings and connectors are to be installed.
B. Sleeve Type Couplings (When Applicable):
   1. Exposed Couplings (When Applicable):
      a. Steel middle ring,
      b. Two steel follower rings,
      c. Two wedge-section gaskets,
      d. Sufficient steel bolts to properly compress the gaskets,
      e. Acceptable Manufacturers:
         i. Smith-Blair – Style 411
         ii. Romac – Style 400
         iii. Baker Hughes (GE Company) – Style 38
         iv. Or equal
   2. Buried Couplings (When Applicable):
      a. Cast iron or epoxy coated steel middle rings with pipe stops removed,
      b. Two malleable iron or epoxy coated steel follower rings with ribbed construction,
      c. Two wedge-section gaskets,
      d. Sufficient AWWA C-111 or galvanized steel nuts and bolts to properly compress the gaskets,
      e. Acceptable Manufacturers:
         i. Smith Blair – Style 411
         ii. Romac – Style 501
         iii. Or equal.
C. Split Type Couplings (When Applicable):
   1. Constructed from malleable or ductile iron.
   2. For use with grooved or shouldered end pipe with minimum wall thickness as required so as not to weaken pipe.
   3. Cast in two segments for 3/4 inch through 14 inch pipe sizes, four segments for 15 inch through 24 inch pipe sizes, and six segments for pipe sizes over 24 inch.
   6. All gaskets shall be Manufacturers Standard or as required for intended service with respect to fluid, temperature and pressure.
   7. Acceptable Manufacturers:
      a. Victaulic Company of America, Style 77 for IPS Pipe, Style 31 for Ductile Iron Pipe.
      b. Star Pipe Products,
      c. Or equal.

D. Flanged Adapters (When Applicable):
   1. For joining plain end or grooved end pipe to flanged pipes and fittings.
   2. Adapters shall conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150 pound standard unless otherwise required for connections.
   3. Exposed Sleeve Type:
      a. Constructed from steel.
      b. Coating: Enamel.
      c. Bolts: Carbon steel or ASTM A588 steel.
      d. Acceptable Manufacturers:
         i. Dresser Manufacturing Co. - Style 128 for cast iron, ductile iron and steel pipes with diameters of 2 inches through 96 inches,
         ii. Smith Blair
         iii. Or equal.
   4. Buried Sleeve Type:
      a. Constructed from cast iron.
      b. Bolts: ASTM A588 steel or galvanized steel.
      c. Acceptable Manufacturers:
         i. Dresser Manufacturing Co. - Style 127 locking type for cast iron, ductile iron, asbestos cement and steel pipes with diameters of 3 inches through 12 inches,
         ii. Smith Blair
         iii. Or equal.
   5. Split Type:
      a. Constructed from malleable or ductile iron.
      b. For use with grooved or shouldered end pipe.
      c. Coating: Enamel.
      d. Acceptable Manufacturers:
         i. Victaulic Company of America - Style 741 for IPS pipe, or Style 341 for Ductile Iron Pipe, for pipe diameters of 2 inches through 12 inches,
ii. Victaulic Company of America - Style 742 for IPS pipe, or Style 342 for Ductile Iron Pipe, for pipe diameters of 14 inches through 16 inches,
iii. Star Pipe Products,
iv. Or equal.

E. Flexible Joints:
1. Expansion Joints (Liquid Service):
   a. Materials shall be capable of withstanding the temperature, pressure and type of material in the pipeline.
   b. Shall be the filled arch type that will prevent sediment build up for all sludge, sewage, and other lines with similar service.
   c. Supplied with control rods to restrict elongation and compression.
   d. Metal retaining rings shall be split and beveled galvanized steel for placement against the flange of the expansion joint.
2. Deflection Joints:
   a. Joints designed to permit a nominal maximum deflection of 15 degrees in all directions from the axis of the adjacent pipe length, will prevent pulling apart, and will remain watertight at any angle of deflection under 15 degrees.
   b. Material to be manufactured from a composition material suitable for exposure to the liquid, pressure and temperature to be contained within the pipe.
   c. Supplied with control rods as required.

F. Dismantling Joints:
1. Service: Provide flexibility for installation and dismantling of flanged pipe interfaces with valves, pumps, blowers, meters, compressors and various appurtenances.
2. Restraint: Tie rods.
3. Size: 4" to 24"
4. Finish: Epoxy
5. Double-ended flange adapter capable of 2 to 20 inches longitudinal adjustment.
6. Pressure: Minimum 150 pound design working pressure, or match pipe rating, whichever greater.
7. Fabricated steel body, welded construction.
8. Materials: flange carbon steel, body carbon steel; follower ductile iron for 12" and less and carbon steel for 14" and larger; wedge gasket Buna-S or Buna-N and suitable for fluid.
10. Acceptable Manufacturer:
    a. Dresser Style 131
    b. Smith Blair Model 975
    c. Or equal
PART 3 - EXECUTION

3.1 INSTALLATION

A. Sleeve Type Couplings (When Applicable):
   1. Thoroughly clean pipe ends for a distance of 8 inches from the ends prior to installing couplings, and use soapy water as a gasket lubricant.
   2. Slip a follower ring and gasket (in that order) over each pipe and place the middle ring centered over the joint.
   3. Insert the other pipe length into the middle ring the proper distance.
   4. Press the gaskets and followers evenly and firmly into the middle ring flares.
   5. Insert the bolts, finger tighten and progressively tighten diametrically opposite nuts uniformly around the adapter with a torque wrench applying the torque recommended by the manufacturer.
   6. Insert and tighten the tapered threaded lock pins.
   7. Insert the nuts and bolts for the flange, finger tighten and progressively tighten diametrically opposite bolts uniformly around the flange to the torque recommended by the manufacturer.

B. Split Type Flange Adapters (When Applicable): Install in the same manner as Split Type Couplings.

C. Buried Cast Iron Couplings, Adapters and Connectors (When Applicable): Thoroughly coat all exterior surfaces, including nuts and bolts, after assembly and inspection by the Engineer with a heavy-bodied bituminous mastic as approved by the Engineer.

D. Buried Epoxy Coated Steel Couplings: Thoroughly coat all exterior surfaces, including nuts and bolts after assembly and inspection by the Engineer with a coal tar approved by the Engineer. Prior to coating, roughen the epoxy with emery paper and follow with a solvent cleaner (aeromatic similar to xylol). Dry film thickness of the coal tar is to be 12-16 mils.

E. Install thrust rods, supports, and other provisions to properly support pipe weight and axial equipment loads.

F. All interior sleeve type couplings shall be restrained with tie rods when used on pressurized lines. All buried couplings on pressure lines shall be restrained (solid sleeve) type.

END OF SECTION
SECTION 15092

PIPE SLEEVES & SEALS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish and install wall sleeves and seals of the type(s) and sizes(s) and in the location(s) shown on the Drawings and specified herein.
B. Related Work Specified Elsewhere:
   1. Pipe and Pipe Fittings - General is specified in Section 15050

1.2 QUALITY ASSURANCE
A. Provide and install all sleeves of the types specified herein, as shown on the Drawings and as directed by the Engineer.
B. Provide sleeves that are airtight, gastight or watertight as required.

PART 2 - PRODUCTS

2.1 TYPES AND LOCATIONS
A. General
   1. Refer to details on Process Drawings.
B. Penetrations through New Construction (Where Applicable):
   1. Interior Concrete Partitions - Air to Air:
      a. Schedule 40 galvanized steel pipe with 1 inch x 1/8 inch thick welded sealing and anchoring collar in middle, hot-dip galvanize after fabrication. Pipe sleeve thicknesses for sizes larger than 24-inch diameter shall be the standard 0.375-inch thickness.
      b. Minimum 1/4 inch annular space between sleeve and pipe or insulation.
      c. Firmly pack with oakum and seal both ends with polyurethane sealant, per Section 07920 for standard penetrations.
      d. Refer to details on Process Drawings.
   2. Concrete Floor Penetrations - Air to Air; and Air to Ground:
      a. Same as “Interior Concrete Partitions - Air to Air”.
      b. Pipe sleeve to extend 2 inches above finished floor.
      c. Pipe sleeve bottom to be set flush with underside of slab.
      d. Galvanized steel pipe riser clamp with threaded rod embedded into concrete floor to be installed on topside of penetration to support the pipe vertically.
      e. Refer to details on Process Drawings.
   3. Exterior Concrete Walls - Air to Air; and Air to Ground:
      a. Schedule 40 galvanized steel pipe with 1 inch x 1/4 inch integrally cast sealing and anchoring collar in middle, hot-dip galvanize after fabrication. Pipe sleeve thicknesses for sizes larger than 24-inch diameter shall be the standard 0.375-inch thickness.
      b. Size of pipe sleeve as required by seal manufacturer.
c. Seal with rubber link compression seal.
d. Alternate wall sleeve system as manufactured by Omni Sleeve, Malden, MA can be utilized as reviewed and accepted by Engineer, in place of above specified wall sleeve system.
e. Refer to details on Process Drawings.

4. Concrete Tank Walls - Liquid Containing Structures to Air, Ground, or Liquid
   a. For ductile iron and steel piping systems, utilize wall castings, or sleeve and double rubber link compression seal. Materials, schedule, class and size to match pipe.
   i. For galvanized steel piping systems, use SCH 40 galvanized steel pipe with 1-inch x 1/4-inch welded sealing and anchoring collar in middle, hot-dip galvanized after fabrication. Pipe sleeve thicknesses for sizes larger than 24-inch diameter shall be the standard 0.375-inch thickness.
   ii. For stainless steel piping systems, use Schedule 40 stainless steel pipe with 1-inch x 1/4-inch welded sealing and anchoring collar in middle. Pipe sleeve thicknesses for sizes larger than 24-inch diameter shall be the standard 0.375-inch thickness.
   iii. For ductile or cast iron piping systems, use wall casting with 1-inch x 1/4-inch integrally cast sealing and anchoring collar in middle; or sleeve with 1-inch x 1/4-inch welded sealing and anchoring collar in middle, hot-dip galvanized after fabrication.
   iv. Refer to details on Process Drawings.
   b. For plastic piping systems, sleeve and seals to be in accordance with “Exterior Concrete Walls - Air to Ground” requirements noted above. These type penetrations will be allowable only in those locations specifically depicted on the drawings.

5. Foundation Walls Below Grade - Ground to Ground:
   a. Schedule 40 or max. 3/8 inch thick wall galvanized steel sleeve. Pipe sleeve thicknesses for sizes larger than 24-inch diameter shall be the standard 0.375-inch thickness.
   b. Minimum 1/2 inch annular space.
   c. Firmly pack with oakum and seal both ends with polyurethane sealant, per Section 07920 for standard penetrations.

6. Other conditions shall be sleeved or as reviewed and accepted by the Engineer.

C. Penetrations Through Existing Construction (Where Applicable):

1. Interior Concrete Partitions - Air to Air:
   b. Sleeves to be as required for “New Construction - Interior Concrete Partitions - Air to Air”.
   c. Holes cored with equipment leaving a smooth hole, less than 1/2 inch larger than the pipe will not require a sleeve, unless otherwise specified.
   d. Minimum 1/4 inch annular space between cored opening or sleeve and pipe or insulation.
e. Firmly pack with oakum and seal both ends with polyurethane sealant, per Section 07920 for standard penetrations.

2. Interior Concrete Partitions - Air to Air:
   a. Same as “Exterior Concrete Wall”.

3. Interior Concrete Partitions - Air to Air (Unclassified to Classified):
   a. Same as “Concrete Tank Wall”.

4. Concrete Floor Penetrations - Air to Air:
   a. Same as “Interior Concrete Partitions - Air to Air”, except that sleeve will not be required.
   b. Stainless steel pipe riser clamp with stainless steel threaded rod embedded into concrete floor to be installed on topside of penetration to support the pipe vertically.
   c. Install rubber link compression seal, as shown, covered by self-leveling sealant (SikaFlex or equivalent).
   d. Refer to details on Process Drawings.

5. Concrete Exterior Walls - Air to Ground:
   b. Size of cored opening as required by seal manufacturer.
   c. Seal with rubber link compression seal.

6. Concrete Tank Walls - Liquid Containing Structures to Air or Ground:
   b. Size of cored opening as required by seal manufacturer.
   c. Seal with two, back to back rubber link compression seals.

7. Other conditions shall be installed as reviewed and accepted by the Engineer.

D. Pipe openings in and penetrations through precast concrete structures shall be as specified in Division 2 and 3.

E. Rubber Link Compression Seals:
   1. Acceptable Manufacturers:
      a. Link Seal
      b. Flexicraft
      c. Or equivalent.
   2. Multi-rubber link type with pressure plates, bolts, nuts and sealing element providing a leak proof seal. Model numbers provided below are based on Link Seal and are to establish type and level of quality.
   3. General Service (Model C):
      a. Glass Reinforced Nylon Pressure Plate.
      b. Carbon steel zinc-dichromate nut and bolt.
      c. Sealing element: EPDM rubber.
      d. Temperature Rating: -40°F to 250°F.
   4. Corrosive Service: (Model S-316):
      a. Use in the following locations: Wetwells and manholes as shown on the Drawings.
      b. Glass Reinforced Nylon Pressure Plate.
      c. Bolt and nut, 18-8 stainless steel.
d. Sealing element: EPDM rubber.
e. Temperature Rating: -40°F to 250°F.

5. Refer to details on Process Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. New Construction:
   1. Concrete: Set sleeves in proper location prior to placing concrete.

B. Existing Construction:
   1. The location will be reviewed and accepted by the Engineer prior to coring or cutting hole.
   2. For concrete, holes shall be located to avoid the reinforcing steel when possible.
   3. Patch all damaged work as required to maintain a neat and clean appearance.

C. Rubber Link Compression Seals: Install as required and in strict accordance with the manufacturer's instructions and recommendations.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Design, furnish and install prefabricated pipe hangers, supports, and braces to support pipes, maintain the necessary pitch, minimize vibration, prevent movement, and allow expansion and contraction of the pipes shown on the Drawings, as specified in Section 15050, as specified herein and as referenced. Supports shall be designed for all tributary gravity loads and lateral loads from operating pressures, seismic forces, and startup/shutdown water hammer thrust. This Specification covers hangers, supports, and braces for process and mechanical piping systems including ductile iron, carbon steel, galvanized steel, stainless steel, fiberglass, PVC and copper piping.
B. Hangers for electrical conduit, plumbing piping, HVAC ducts, and other utilities are found within their respective Specification sections.

1.2 RELATED SECTIONS
A. Section 03300 - Cast-in-Place Concrete
B. Section 09900 – Painting
C. Division 11 – Equipment
D. Section 15050 – Pipe and Pipe Fittings – General
E. Pipe, pipe fittings and valves are specified in respective sections of Division 15.

1.3 REFERENCES
A. This section contains references that are applicable to this Specification section. The applicable edition of the indicated references shall be the version that was the most current at the time of the Advertisement of Bids.
B. Manufacturer’s Standardization Society of the Valve and Fittings Industry (MSS).
1. MSS SP-58 Pipe Hangers and Supports – Materials, Design and Manufacture
2. MSS SP-69 Pipe Hangers and Supports – Selection and Application
3. MSS SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices
4. MSS SP-90 Guidelines on Terminology for Pipe Hangers and Supports
C. ASTM A123/A123M - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
D. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
E. ASTM C881/C881M - Specification for Epoxy-Resin-Base Bonding Systems for Concrete
F. ASCE 7 – Minimum Design Loads for Buildings and Other Structures
H. Maine Uniform Building & Energy Code
1.4 DESIGN REQUIREMENTS

A. Contractor shall provide all necessary hangers, supports and braces as needed to provide a fully functional and adequately supported and restrained system.

B. This Specification requires the delegated design of pipe hangers, supports and bracing. The performance criteria, design requirements and materials of construction are specified herein. The absence of specific pipe support details shall not relieve the Contractor of the responsibility for designing and providing a fully functional system meeting the requirements of this Specification. Specification Section 15050 identifies which piping systems will and will not require a pipe support design by a Professional Engineer.

C. Prefabricated pipe supports shall be provided for all pipes shown on the Contract Drawings. Unless otherwise indicated, the terms “pipe support”, “pipe hanger” and “pipe guide” shall refer to prefabricated pipe supports, hangers, guides, and braces specified herein.

D. The term “Pipe Support Design Engineer” shall refer to the Professional Engineer hired by the General Contractor to design the pipe support system.

E. All structural steel pipe support frames and shop fabricated pipe support assemblies shown on the Contract Drawings are specified elsewhere and not required as part of this Specification.

F. Pipes supports shall be classified as one of the following:
   1. Type 1 – Supported from an overhead structural member using overhead hangers, guides, clevises, rollers, clamps or other means as specified herein.
   2. Type 2 - Supported from a structural member below the pipe using guides, rollers, clamps, saddles or other means as specified herein.
   3. Type 3 – Supported from an adjacent wall or other vertical structural member using brackets with either Type 1 supports or Type 2 supports or other means as specified herein.
   4. Type 4 – Miscellaneous Pipe Hangers, Supports and Braces not specifically identified above.
   5. Additionally, each pipe support shall be classified as one of the following based on function:
      a. Type S - Simple Support
      b. Type G - Guide Support
      c. Type F - Fixed Support

G. Where flexible joints or couplings are indicated on the Contract Drawings at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported, to prevent transfer of system forces to the equipment. No fixed or restraining supports shall be installed between a flexible joint or coupling and the piece of equipment.

H. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain or load from being imparted on the equipment or piping system.

I. Pipe supports shall be provided to minimize forces through valves, split and sleeve type couplings, flexible expansion joints and to minimize all pipe forces on equipment housings. Equipment housings shall not be utilized to support connecting pipes.

J. Unless otherwise indicated on the Drawings, maximum hanger and support spacing shall not exceed the following:
1. Copper Pipe:
   a. 1” diameter and smaller – 5 feet
   b. 1 1/4”, 1 1/2” and 2” diameter – 7 feet
   c. Greater than 2” diameter – 9 feet
2. Steel and Stainless Steel Pipe:
   a. 2” diameter and smaller – 7 feet
   b. 2 ½” - 4” diameter – 11 feet
   c. 5” – 8” diameter – 16 feet
   d. Greater than 10” diameter – 22 feet
3. Ductile and Cast Iron Pipe:
   a. All diameters – 10 feet
4. PVC and FRP Pipe:
   a. Hanger and support spacing shall be as recommended by the pipe manufacturer based on pipe size and service temperature. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed 3-feet.
5. The maximum support spacings listed above are based on the specific pipes being full of liquid without any additional vertical loads or thrusts. The actual required support spacings may be limited to the hangers selected or the presence of additional loads.
6. Supports shall be spaced such that the resulting concentrated load at any suspended (Type 1) support does not exceed 2,000 pound maximum and combined load shall not exceed 25 pounds per square foot over each slab panel the supports extend into, or as indicated on the Structural Drawings.
7. Pipe alignment guides shall not be used as vertical support of the piping.
8. Wall penetration sleeves (link-seal type or equivalent) shall not be used as support of the piping.

K. Contractor shall provide pipe supports at the following locations:
1. At all locations indicated on the Contract Drawings.
2. At all locations such that the maximum support spacing listed above are not exceeded.
3. At all locations such that the allowable load capacity of the prefabricated hangers are not exceeded.
4. At the end of all pipe runs.
5. At all changes in pipe direction greater than 22 degrees.
6. Within 1 foot of all valves, couplings, expansion joints and pipe joints.
7. Spaced such that the deflection in the pipe under operating conditions does not exceed L/360, where L is the distance between supports.

L. All drilled anchors used in suspended Type 1 and Type 3 pipe supports shall meet the following requirements:
1. All supports shall have a minimum of 2 anchors per support.
2. Anchors shall be sized such that the ultimate capacity of the anchor is a minimum of 5 times greater than the anticipated design forces (Minimum Factor of Safety of 5).
3. Anchors shall have a minimum embedment depth of 6 inches, minimum spacing of 6 inches and a minimum edge distance of 6 inches.
4. Concrete anchors shall either be the epoxy adhesive or expansion anchor type.
5. Masonry anchors shall either be the epoxy adhesive or expansion anchor type. Masonry cells shall be grouted at the anchors. Drop-in, Toggle or epoxy anchors with screen tubes shall not be permitted.

M. All pipe supports shall be designed for the following loads:
1. Dead loads (including cement lining, insulation, etc)
2. Liquid Density – use a liquid specific gravity of 1.10 for water, wastewater and sludges and use the appropriate liquid specific gravity for chemicals, unless otherwise noted
3. Operational Thrust – refer to Specification Section 15050
4. Water Hammer Thrust – refer to Specification Section 15050
5. Thermal forces – refer to Specification Section 15050
6. Wind Load – In accordance with ASCE 7. Refer to the Structural Drawings for wind design parameters
7. Snow Load – In accordance with ASCE 7. Refer to the Structural Drawings for snow design parameters
8. Ice Load – In accordance with ASCE 7

1.5 SUBMITTALS
A. Submit a complete set of shop drawings of all items to be furnished under this Section and as required by Section 01340 and 15050.
B. Technical submittals for all projects shall include the following information:
1. Layout drawings with all pipe supports clearly labeled, located, and coordinated with the tabulated list noted below. Layout drawings shall include both Plan and Section views with the pipe supports clearly labeled in each view. All pipe layout changes proposed by the General Contractor shall be incorporated in the layout and identified as a proposed modification. Layout drawings shall address gravity loads and dynamic loads including thermal effects, pressure thrusts and seismic forces.
2. Summary of Pipe Hangers, Supports and Bracing: Submit a tabulated list of pipe support information which includes the following information at a minimum:
   i. Hanger/Support/Brace Number
   ii. Location
   iii. Pipe Diameter (nominal ID)
   iv. Pipe centerline elevation
   v. Pipe material
   vi. Additional dead weight (Cement lining, insulation, etc)
   vii. Lineal foot dead weight of pipe
   viii. Contents of pipe
   ix. Total lineal foot weight (dead weight and live weight)
   x. Length of pipe tributary to support
   xi. Total gravity and dynamic load at support
   xii. Type of support (as identified in Section 1.4.B above)
   xiii. Fixity of support (as identified in Section 1.4.B above)
   xiv. Structure supporting pipe support (Section 1.4.F above)
3. Representative catalog cut for each different type of pipe hanger, brace, or support indicating the materials of construction, material finishes, pipe sleeve or insulation information, protective shields, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers and/or supports are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and/or support.

4. Representative catalog cuts for accessories (e.g., threaded rod, insulation shields and saddles, never-seize compound, etc.)

5. Letter from the General Contractor stating that the following has been coordinated:
   i. Each pipe support system will not interfere with the other pipe support or seismic bracing systems.
   ii. Components from the pipe support systems shall not extend within any means of egress or walking pathways in building spaces or at tanks.
   iii. Components from the pipe support systems shall not interfere with the normal maintenance or operation of a component or equipment.

C. After the installation is completed and certified, submit as-built drawings for record purposes.

PART 2 - PRODUCTS

2.1 GENERAL

A. All uninsulated non-metallic piping such as PVC, CPVC, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by pipe insulation shields or other methods after review with no exceptions taken by the Engineer. All shields shall cover the pipe where it is in contact with the support.

B. All insulated pipe shall be furnished with a pipe insulation shield and/or saddle at each pipe support location as specified herein.

C. Where pipe hangers and supports come in contact with copper piping, provide protection from galvanic corrosion by wrapping pipe with 1/16-inch thick neoprene sheet and galvanized protection shield; isolators similar to Eleen, Figure No. 228; or PVC-coated hangers and supports. All stainless steel piping shall be isolated from all ferrous materials, including galvanized steel, by use of neoprene sheet material and protection shields, similar to above methods.

D. Pipe supports PVC piping:
   1. Pipe supports for multiple PVC plastic piping shall be continuous wherever possible.
   2. Multiple, suspended, horizontal plastic PVC pipe runs, where possible, shall be supported by ladder type cable trays.
   3. Ladder shall be of galvanized steel construction.
   4. Rung spacing shall be 12 inches.
   5. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs.
   6. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required by a complete support system.
7. Acceptable manufacturers:
   a. Electray Ladder by Husky-Burndy;
   b. Globetray by the Metal Products, a division of United States Gypsum,
   c. Or equal.
8. Individual plastic pipes shall be secured to the rungs of the cable tray by strap
   clamps or fasteners similar to Globe, Model M-CAC; Husky-Burndy, Model
   SCR or equal.
9. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide
   continuous support along the length of the pipe. Individual clamps, hangers
   and supports in contact with plastic PVC pipe shall provide firm support but not
   so firm as to prevent longitudinal movement due to thermal expansion and
   contraction.
E. All vertical pipes shall be supported at each floor or at intervals of not more than 12
   feet (whichever is less) by approved pipe collars, clamps, brackets, or wall rests and
   at all points necessary to ensure rigid construction. All vertical pipes passing through
   pipe sleeves shall be secured using a pipe collar.
F. Link-seal compression type wall penetration sleeves shall not be used to support static
   or dynamic loads. Additional supports shall be provided such that static gravity loads
   and horizontal dynamic loads are not transferred to these penetration sleeves.

2.2 MATERIALS
A. Unless otherwise specified herein, pipe hangers and supports shall be standard
   catalogued components, conforming to the requirements of MSS-SP-58, MSS SP-69
   and MSS SP-89.
B. Pipe hangers, supports, braces and accessories shall be standard catalogued
   components as manufactured by Anvil International, Inc, Carpenter & Peterson, Inc.
   or equivalent (metallic pipe) or Jove (non-metallic pipe). Any reference to a specific
   figure number of a specific manufacturer is for the purpose of establishing a type and
   quality of product and shall not be considered as proprietary.
C. Materials of all prefabricated pipe hangers, supports, braces and accessories
   (including bolts, nuts, washers) shall be as follows:
   1. For steel, stainless steel, ductile iron, HDPE, FRP and PVC piping:
      a. Exposed interior or exterior and all other spaces not otherwise defined
         below shall be hot-dipped galvanized steel conforming to ASTM A123
         and ASTM A152.
      b. Submerged or within/directly above tanks shall be Type 316 stainless
         steel.
   2. For copper piping: shall be copper plated steel.
D. Type 1
   1. Metallic pipe (Steel, stainless steel and ductile iron):
      a. Adjustable Clevis Type (Type S) (Pipes greater than 4” diameter):
         i. Anvil International, Inc. (Fig 260)
         ii. Carpenter & Patterson Inc. (Fig 100)
         iii. Or equal
      b. Adjustable Clevis Type (Type S) (Pipes 4” diameter or less):
         i. Anvil International, Inc. (Fig 65)
         ii. Carpenter & Patterson Inc. (Fig 200)
iii. Or equal

c. Adjustable Steel Yoke Pipe Roll (Type S):
   i. Anvil International, Inc. (Fig 181)
   ii. Carpenter & Patterson Inc. (Fig 140)
   iii. Or equal

d. Adjustable Pipe Roll (Type S):
   i. Anvil International, Inc. (Fig 177)
   ii. Carpenter & Patterson Inc. (Fig 142)
   iii. Or equal

e. Pipe Clamp (Type F):
   i. Anvil International, Inc. (Fig 212, Fig 216 or Fig 295 Clamp w/ Fig 272 Eyerod)
   ii. Carpenter & Patterson Inc. (Fig 175, Fig 298 or Fig 304 Clamp w/ Fig 93 Eyerod)
   iii. Or equal

f. U-Bolt (Type S)
   i. Anvil International, Inc. (Fig 137)
   ii. Carpenter & Patterson Inc. (Fig 283)
   iii. Or equal

2. Non-Metallic pipe (HDPE, FRP and PVC):
   a. Adjustable Clevis Type (Type S):
      i. Jove (Model FS-11)
      ii. Or equal
   b. Pipe Clamp (Type F):
      i. Jove (Model FS-4)
      ii. Or equal

3. Copper Pipe:
   a. Adjustable Clevis Type (Type S)
      i. Anvil International, Inc. (Fig CT-65)
      ii. Carpenter & Patterson Inc. (Fig 100CT)
      iii. Or equal
   b. Adjustable Swivel Ring Type (Type S)
      i. Anvil International, Inc. (Fig CT-69)
      ii. Carpenter & Patterson Inc. (Fig 1ACT)
      iii. Or equal

E. Type 2

1. Metallic pipe (Steel, stainless steel and ductile iron):
   a. Pipe Roll Stand (Type S) (Non Adjustable)
      i. Anvil International, Inc. (Fig 271)
      ii. Carpenter & Patterson Inc. (Fig 39)
      iii. Or equal
   b. Pipe Roll Stand (Type S) (Adjustable)
      i. Anvil International, Inc. (Fig 274)
      ii. Carpenter & Patterson Inc. (Fig 40)
      iii. Or equal
   c. Pipe Roll Chair (Type S)
i. Anvil International, Inc. (Fig 175)
ii. Carpenter & Patterson Inc. (Fig 67)
iii. Or equal

**d. Adjustable Pipe Roll (Type S)**

i. Anvil International, Inc. (Fig 177)
ii. Carpenter & Patterson Inc. (Fig 109)
iii. Or equal

**e. Pipe Alignment Guide (Type G)**

i. Anvil International, Inc. (Fig 255 or 256)
ii. Carpenter & Patterson Inc. (Fig 1006 or 1007)
iii. Or equal

**f. Pipe Slide Assembly (welded to pipe) (Type G or F)**

i. Anvil International, Inc. (Fig 257 or 436)
ii. Carpenter & Patterson Inc. (Fig 1010)
iii. Or equal

**g. Pipe Slide Assembly (w/ welded clamp) (Type G or F)**

i. Anvil International, Inc. (Fig 257 or 436 w/ Fig 432 clamp)
ii. Carpenter & Patterson Inc. (Fig 1010 w/ Fig 158 clamp)
iii. Or equal

**h. Floor Mounted Stanchions w/ Adjustable Saddles (Type S)**

i. Anvil International, Inc. (Fig 63 Stanchion w/ Fig 264 or Fig 265 Saddle)
ii. Carpenter & Patterson Inc. (Fig 138 Stanchion w/ Fig 101 or Fig 101U Saddle)
iii. Or equal

i. Concrete cradles
   i. Provide as detailed on the Structural Drawings

2. **Non-Metallic pipe (HDPE, FRP and PVC):**

   **a. Pipe Slide Assembly (w/ welded clamp) (Type G or F)**

   i. Jove (Model FS-8)
   ii. Or equal

   **b. Floor Mounted Stanchions w/ Adjustable Saddles (Type S)**

   i. Jove (Model FS-7 with stanchion)
   ii. Or equal

   **c. Concrete cradles**
   i. Provide as detailed on the Structural Drawings

F. **Type 3 (Type S) (all pipes)**

1. **Wall Bracket**

   a. Anvil International, Inc. (Fig 194, Fig 195 or Fig 199)
   b. Carpenter & Patterson Inc. (Fig 69, Fig 84 or Fig 139)
   c. Or equal
   d. Fabricated brackets may be used in lieu of pre-fabricated brackets.

   Material shall conform to Part C above.

G. **Accessories:**

1. **Threaded Rods**

   i. Anvil International, Inc. (Fig 140, 142 or 146)
ii. Carpenter & Patterson Inc. (Fig 94 or 133)
iii. Or equal

2. Pipe Insulation Shield
i. Anvil International, Inc. (Fig 167 or Fig 168)
ii. Carpenter & Patterson Inc. (Fig 265GS or Fig 265P)
iii. Or equal

3. Pipe Insulation Saddle
i. Anvil International, Inc. (Figs 160-166A)
ii. Carpenter & Patterson Inc. (Figs 351-357Z)
iii. Or equal

4. Anti-seize compound
i. Never Seez by Bostik, Inc.
ii. Or equal

H. Miscellaneous Pipe Hangers, Supports and Braces (Type 4 or Custom):
1. Contractor shall provide additional hangers, supports and braces as required that are not classified as Types 1, 2 or 3 above.
2. Materials shall conform to Part C above.

I. Concrete Anchorage:
1. Epoxy anchors. ASTM C881, non-expanding, two-component epoxy resin with AISC Type 316 Stainless Steel threaded rod with washer nut. Manufactured by Hilti Fastening Systems (HIT RE500SD); Ramset Fastening Systems (Chemset Capsule Series); Power Fasteners (T308 Plus); or equivalent.
2. Expansion anchors. Stainless steel AISI Type 316 for galvanized and aluminum fabrications; cadmium plated for painted steel fabrications. Manufactured by Hilti Fastening Systems (Kwik Bolt III); Ramset Fastening Systems (Tru Bolt Stud Anchor); Power Fasteners (Power Stud); or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install prefabricated hangers and supports in accordance with the pipe support shop drawings, in accordance with MSS SP-89 and as specified herein.
B. Hangers shall be used for their intended purpose only. They shall not be used for rigging or erection purposes.
C. General Contractor shall coordinate the installation of field run conduit, piping and other utilities to avoid interference with the pipe supports.
D. All pipe supports shall include features to permit adjustments of pipe elevations. Once all piping is properly aligned and at the correct elevations, the supports shall be locked into place. Locking nuts, cotter pins, temporary locking devices and other locking means should be properly engaged. Tack welding shall not be utilized to lock supports in place.
E. Type 1 hangers using threaded rods shall be attached to the building structure or supplemental framing. Connections to the building structure shall be with beam clamps, welded angles or embedded concrete weld plates or threaded inserts.
F. Install all drilled anchors in accordance with the anchor Manufacturer’s instructions.
G. Secure Type 2 pipe support to structural supporting member. All pipe supports shall be rigidly anchored to their structural supporting members.
H. PVC Piping and Fiberglass Piping: Support in strict accordance with the manufacturer's instructions and recommendations for the conditions of operation, temperature and size of pipe. Support in a manner which will prevent subsequent visible sagging of the pipe between supports due to plastic deformation.

I. All surfaces of steel and aluminum in contact with or embedded in concrete or masonry shall be coated with epoxy paint (min 5 mils dry film thickness).

J. Drain, waste, and vent piping: Support by adjustable hangers.

K. Valves, Fittings & Specialties: Independently support pipe connected to pumps, equipment and piping systems.

L. Temporary pipe supports:
   1. General Contractor shall be responsible for providing all temporary pipe supports and rigging.
   2. Lay out each section of pipeline and make connections while the pipe is held in temporary supports.
   3. After the completion of connections in each section of pipeline, hold the section in place with temporary clamps.
   4. Do not remove the temporary clamps until the piping is correctly installed on the permanent supports.

3.2 TESTING
A. All permanent pipe supports shall be installed prior to testing.
B. Demonstrate compliance with the requirements of this section with respect to support, pitch, vibration, movement, and expansion and contraction during start-up testing of the equipment and associated piping systems as indicated in Section 01800.
C. Systems which do not meet the requirements of this section with respect to support, pitch, vibration, lateral movement, and expansion and contraction shall be supplemented with additional braces as required and re-demonstrated until compliance is achieved.

3.3 COATINGS
A. Provide shop coatings in accordance with Section 09905.
B. Provide field coatings for steel items in accordance with Section 09900.
C. Provide touch-up field galvanizing for hot dipped galvanized items in accordance with Section 09900.
D. Provide field coatings on surfaces with dissimilar metals. Utilize epoxy paint (minimum 5 mil thickness) in accordance with Section 09900.
E. Provide temporary support or bracing as necessary to allow complete and continuous coats.

END OF SECTION
SECTION 15100
VALVES & SPECIALTIES – GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install, support, and test valves, gates, hydrants, cocks, stops, and faucets, when applicable, (hereinafter referred to as "valves") in the location(s) and of the size(s) and quantities shown on the Drawings and/or as specified herein.
B. Related Work Specified Elsewhere (When Applicable):
   1. Surface preparation and shop coatings are specified in Section 09905.
   2. Field painting is specified in Division 9.
   3. Pipe, fittings, pipe hangers and supports, and piping insulation are specified in the appropriate Sections in this Division.
   4. Valves for plumbing, heating and air conditioning are specified in the appropriate Sections in this Division.
   5. Instrumentation and Controls are specified in Division 13.
   6. Electrical is specified in Division 16.

1.2 QUALITY ASSURANCE
A. Provide valves of proven reliability manufactured by reputable manufacturers.
B. Acceptable manufacturers are listed in each section of this Division. Substitute or "or-equal" valves will be allowed only when indicated.

1.3 SUBMITTALS
A. Provide shop drawings in accordance with the requirements of the General Conditions, Section 01340 and as specified herein. Shop drawings shall contain the following information at a minimum:
   1. Completed Submittal Certification Form. Shop drawing submittals will be returned unreviewed without this form.
   2. Certified shop drawings.
   3. Manufacturer's literature and illustrations for all equipment to be installed to supplement certified shop drawing information.
   4. Short-term and long-term storage requirements.
   5. Seismic analysis, design and calculations as specified herein.
   6. Shop preparation and shop coatings.
   7. Proposed valve identification tag information
B. Provide Operation and Maintenance Manuals in accordance with the requirements of Section 01340.

1.4 DELIVERY AND HANDLING
A. Shipping:
   1. Prepare valves and accessories for shipment as required for complete protection.
2. Seal valve ends to prevent entry of foreign matter into valve body.
3. Box, crate, completely enclose, and protect valves and accessories from accumulations of foreign matter.

B. Storage:
1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
2. Do not store valves or accessories directly on the ground.

C. Handling: Handle valves and accessories to prevent damage of any nature to the interior and the exterior surfaces.

1.5 INSPECTION
A. Carefully inspect all materials for:
   1. Defects in workmanship and materials.
   2. Removal of debris and foreign material in valve openings and seats.
   3. Proper functioning of all operating mechanisms.
   4. Tightness of all nuts and bolts.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Materials are specified in appropriate Sections in this Division.
B. The specifications direct attention to certain required features of the valves and gates but do not purport to cover all details entering into their design and construction. Nevertheless, the Contractor shall furnish the valves and gates complete in all details and ready for operation for the intended purpose.

2.2 SURFACE PREPARATION AND SHOP COATINGS
A. Provide surface preparation and shop coatings in accordance with the applicable section of Division 9.

2.3 VALVE LOCK-OUT/ TAG-OUT HARDWARE
A. Provide accessory hardware for the purpose of locking out valves utilizing standard padlock. Lockout hardware shall be provided for specific valves, where indicated on the Drawings or specified elsewhere.

2.4 VALVE ACTUATORS
A. Unless otherwise specified or shown on the Drawings, all valves shall be manually actuated. All valves shall have an operating handwheel or a handle/lever mounted on the operator. Valves with operating nuts shall be of non-rising stem design and be provided with an AWWA 2 inch square operating nut. The valves shall be provided with handwheel actuators on all manually actuated valves larger than 6 inches in size unless otherwise specified or shown on the Drawings.

B. The valve Manufacturer shall supply and factory mount all actuators; including any type of manual or powered actuators. The valves and actuators shall be shipped as a single unit. All valve actuators shall be sized to operate the associated valve for the full range of pressures and velocities. Position indicators shall be provided for interior NRS valves.
C. The force in a manual actuator shall not exceed 40 pounds of rim-pull under any operating condition, including initial breakaway. The actuator shall be equipped with gear reduction when force exceeds 40 pounds of rim-pull. All manual actuators shall be self-locking type or shall be equipped with a self-locking device. The actuators shall be capable of moving the valves from a fully open to a fully closed position and a fully closed position to a fully open position. The actuator shall be capable of holding the valve at any position in between the fully open and fully closed positions. A position indicator shall be supplied on quarter-turn valves. Each actuating device shall have the word "OPEN" permanently cast as well as an arrow indicating the direction of operation.

D. Unless otherwise specified or shown on the Drawings chainwheel actuators shall be provided for all valves 3 inches and larger; with the valve center line located 6 feet or greater above the operating floor. All chainwheel actuators shall be provided complete with chain guides and hot dipped galvanized or cadmium-plated steel chain. The chain shall loop within a minimum of four (4) feet from the operating floor level. Where chains hang in normally traveled areas, appropriate "L" type tie-back anchors shall be used.

E. All chainwheel actuators of the same type, style, and duty shall be supplied by a single Manufacturer. Where applicable and whenever possible, chainwheel actuators shall be provided by the Manufacturer of the valve being served.

2.5 GEAR ACTUATORS
A. Unless otherwise specified or shown on the Drawings, all valves larger than 6 inches shall be provided with gear actuators. All manually actuated valves with a rim pull greater than 40 ft-lbs shall also be provided with gear actuators. Worm and gear actuators shall be a one-piece design with worm-gears of gear bronze or machine cut steel material. Worm shall be hardened alloy steel with the thread ground and polished. Traveling nut type actuators shall have threaded steel reach rods with an internally threaded bronze or ductile iron nut.

B. The output shaft shall be perpendicular to the valve shaft and be provided with a removable handwheel. Unless otherwise noted or specified all gear actuators shall conform to AWWA C504 standards. All gear actuators shall be removable from the valve without removing the valve from the line or dismantling the valve.

C. All gear actuators shall indicate the valve position and have adjustable stops. The maximum handwheel size shall be 24 inches in diameter. All position indicators shall be of the embossed, stamped, engraved, etched, or raised types.

D. Unless otherwise specified or shown on the Drawings, all gear actuated valves 3 inches and larger shall be provided with position indication at the point of operation. Valves smaller than 3 inches shall have position indication on their respective handwheels or lever actuators.

2.6 FLOOR STANDS
A. Provide floor stands where required on the Drawings.

B. Floor stands shall be of the non-rising stem, indicating type, and designed for counterclockwise operation. The distance from the base flange to the handwheel shall not be less than 34”.

C. The pedestal shall be cast of ductile iron grade 65-45-12 and meet ASTM-A536.
The pedestal shall have a vertical indicating slot. The word “OPEN” shall be cast in the pedestal at the top of the indicating slot. A “CLOSED” tag will be field mounted to the pedestal, to indicate the closed position of the valve. A bronze indicator shall travel on a carbon steel threaded stem to indicate the position of the valve.

D. The stem shall be Xylan coated to prevent corrosion.

E. The floor stand shall be coated in a two-part epoxy for corrosion resistance.

F. Where a floor is not directly over the valve and extension stem, the floor stands shall be supported by a ductile iron wall bracket mounted to the side wall. Wall brackets shall contain a carbon steel plate designed to support the floor stand.

G. Stem guides with corrosion resistant bushing shall be provided as recommended by the floor stand manufacturer.

H. The floorstand shall be operated by a cast iron handwheel of no less than 12” in diameter.

I. Floorstands shall be as manufactured by:
   1. Trumbull Industries, Youngstown, Ohio.
   3. Or Equivalent

2.7 VALVE IDENTIFICATION TAGS

A. All valves in piping including individual valves provided with equipment shall be tagged in accordance with that shown on the Drawings. The tags shall be provided with identifying numbers and letters to match those shown on the Drawings. Identification tag numbering shall be reviewed/confirmed with the Engineer and Owner through the submittal process prior to ordering any tags. Refer to Section 11000 for additional information regarding valve tagging.

B. All identification tags shall be provided with sufficient lengths of chain for attachment to the respective valve.

C. Tags shall conform to the following specifications:
   1. The tags shall be 2.5-inch diameter, 1/16" thick, rigid, multi-layered sandwich laminate with contrasting inner and outer colored acrylic plastic layers. Top hole size is 5/32" for hanging tags.
   2. Tags shall be available in 7 different outside colors. Owner and Engineer shall select up to 4 different colors for the project.
   3. Tags shall have up to three lines engraved on a side and eight characters per line of identification information. Tags shall be engraved one side.
   4. Tags shall be secured to valves with nylon cable ties or adjustable metal bead chain. Securing method shall be selected by the Owner and Engineer.
   5. Tags secured to equipment shall be fastened to a flat visible surface by a minimum of two SS screws or SS pop rivets.
   6. Tags shall have a service temperature of -40°F to 175°F
   7. Manufactured by Seton Name Plate Corporation, New Haven, CT, Brimar Industries, Garfield, NJ or equal.

D. All buried valves shall be provided with tags embedded in a concrete pad surrounding the valve box.
PART 3 - EXECUTION

A. INSTALLATION

B. Install valves and accessories in strict accordance with manufacturer's instructions and recommendations, as shown on the Drawings and/or as specified herein. Install valves with stems pointed up in vertical position, or horizontally on high valve for chain wheel use, but in no case with stems pointed downward of the horizontal plane. Allow sufficient room for maintenance, removal and proper operation. All valves shall be located and oriented to permit easy access to the valve operator, and to avoid interferences.

C. Valve Orientation: The stem of a manual valve shall be installed in a vertical position when the valve is installed in horizontal runs of pipe having centerline elevations of 4.5 feet or less above finished floor, unless otherwise shown on Contract Drawings. The stem of a manual valve shall be installed in a horizontal position in horizontal runs of pipe having centerline elevations between 4.5 feet and 6 feet above the finish floor, unless otherwise shown on Contract Drawings. All manually actuated valves 3 inches and smaller shall have the valve indicators and operators located to display toward the normal operational locations.

D. Carefully erect all valves and support them in their respective positions free from distortion and strain.

E. Independently support all valves connected to pumps and equipment, and in piping systems that cannot support valves.

F. Repair any scratches, marks and other types of surface damage etc. with original coating as supplied by the factory.

G. Install valves such that "open" and "close" position indicators are easily visible.

H. All valves (and actuators where specified) shall be installed in a manner that will provide for proper clearances and ease of operation. In addition, valve actuators must be capable of being rotated in 90° increments to facilitate field installation.

I. Check and adjust all valves and accessories for smooth operation.

3.2 TESTING

A. The Contractor shall test all valves and gates in the presence of the Engineer to demonstrate that each valve and gate complies with specified requirements and allowable leakage rates.

B. The contractor shall test all valves visually for leaks and proper operation under pressure. The contractor shall also test the valves to ensure proper valve function and actuation.

C. Valves may either be tested while testing pipelines, or as a separate step. It shall be demonstrated that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. The Contractor shall count and record the number of turns required to open and close each valve and account for any discrepancies with the Manufacturer's data.

D. Air and vacuum relief valves shall be examined as the associated pipe is being filled to verify venting and seating is fully functional. The Contractor shall set, verify, and record set pressures for all relief and regulating valves. Self-contained automatic valves shall be tested at both maximum and minimum operating ranges, and reset upon completion of test to the design value.
E. The contractor shall take care not to overpressure any valve and appurtenances during testing.

3.3 RETESTING
A. If the equipment does not successfully pass the tests listed above, the Manufacturer/Contractor shall repair the equipment and perform the tests again until passing the tests successfully. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be re-conducted at no additional cost to the Owner.

3.4 CLEANING
A. All items, including but not limited to all valves and valve interiors, shall be thoroughly cleaned prior to installation, testing, and final acceptance. All dirt, debris, and other foreign materials shall be removed.

3.5 FIELD COATINGS
A. In accordance with Section 09900.

END OF SECTION
SECTION 15101
GATE VALVES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install and test gate valves of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified.
B. Related Work Specified Elsewhere: "Valves and Specialties - General" is specified in this Division.

1.2 QUALITY ASSURANCE
A. All gate valves of same type and style shall be manufactured by one manufacturer.
B. Acceptable Manufacturers: as noted herein.
C. All valves for drinking water projects or applications shall be compliant with NSF 61 and NSF 372.

PART 2 - PRODUCTS

2.1 VALVE, LOCATION AND USE
A. As shown on the Drawings.
B. General Service Piping (liquids containing solids):
   1. Includes wastewater, and liquids containing solids.
   2. 2-1/2 inches and smaller: 125 bronze.
   3. 3 inches and larger: Non-rising stem; resilient wedge.
C. Accessories: As shown on the Drawings and required for proper operation.

2.2 MATERIALS
A. General Service - 2-1/2 inch and smaller:
   1. Bronze construction - 125 pound stem.
   2. Union bonnet.
   3. Inside screw, rising stem.
   4. Solid disc, taper wedge.
   5. End connections:
      a. Threaded.
      b. Or solder ends for copper pipe systems.
   6. 200 psi non-shock WOG.
   7. Malleable iron, or steel handwheel.
   8. Acceptable Manufacturers:
      a. Stockham B-105.
      b. Craine 428-UB.
      c. Powell 2700S.
      d. Jenkins 47U.
      e. Kennedy/McWane 525.
      f. Or approved equal.
B. General Service NRS - 3 inches and larger:
   1. Wedge shall be constructed of ductile iron, fully encapsulated in synthetic rubber, except for guide and wedge nut areas.
   2. Non-rising stem (NRS).
   3. Bolted bonnet (stainless steel Type 18-8, ASTM F593, GP1 bolts and nuts).
   4. 125 class body.
   5. Meet or exceed AWWA C-509.
   6. All valves shall be fitted with a resilient wedge.
   9. Water working pressure:
      a. 12 inches and smaller: 200 psi.
      b. 14 inches and larger: 150 psi.
   10. End Connections
      a. Buried valves – gasketed and bolted mechanical joints in conformance with AWWA standards for appropriate pipe material.
   11. Operation:
      a. Buried valves – 2-inch square nut, cast iron, ASTM A126, C1B or ductile iron, ASTM A536
      b. Exposed valves - Handwheel, cast iron or cast aluminum with direction arrow; except when 2-inch square operating nut when shaft extension, floor box, valve box or floor stand is required or shown on the Drawings.
      c. Opening Direction – counterclockwise (open left)
   12. Buried Valves:
      a. All mechanical joint gate valves shall meet ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.
      b. Mechanical joint type coated inside and out with fusion bonded epoxy meeting AWWA C550.
      c. 2-inch square operating nut securely fastened to shaft.
      d. Gate box required.
      e. Sufficient quantity of tee-handle valve wrenches for operating valves of various depths.
      f. Opening Direction – counterclockwise (open left)
   13. Acceptable Manufacturers:
      a. American Flow Control
      b. Kennedy/McWane
      c. Clow/McWane
      d. Mueller
      e. Or equal.
PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install and test in accordance with Section 15100, AWWA C500 and AWWA C-509, latest revision.
   B. For horizontal piping, install valves with stem position between horizontal to vertical upward.

END OF SECTION
SECTION 15110
CHECK VALVES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish and install check valves of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.
B. Related Work Specified Elsewhere: "Valves & Specialties - General" is specified in this Division.
C. Requirements Specified Elsewhere: Additional requirements that affect the work of this Section are specified elsewhere including, but not limited to General Conditions, Supplementary Conditions and:
   1. Section 01340 - Submittals
   2. Section 01400 - Quality Control
   3. Section 01630 - Substitutions and Product Options
   4. Section 01800 - Equipment Startup, Certification and Operator Training
   5. Section 09905 - Surface Preparation and Shop Coatings
   The General Contractor is responsible for conveying the appropriate information from these sections to the supplier.
D. Related Work:
   1. Field painting is specified in Section 09900.
   2. Section 15100 – Valves & Specialties - General

1.2 QUALITY ASSURANCE
A. All check valves of same type and duty shall be by one manufacturer.
B. All valves in contact with potable water shall be constructed of “Lead free” material in compliance with NSF 372 (formerly NSF 61 Annex G and Safe Drinking Water Act Section 1417). Lead free materials shall contain less than 0.25% lead on a weighted average, and installed using flux and solder containing not more than 0.2% lead.
C. Interior coatings shall be NSF-61 certified for contact with potable water.

PART 2 - PRODUCTS

2.1 SWING CHECK VALVES - 2-½ INCHES AND SMALLER – GENERAL USE
A. Standard, all brass or bronze, swing check with screwed ends.
B. Suitable for 150 psi working steam pressure.
C. Shall meet MSS SP-80 standards, Class 125, cast-bronze body and cap conforming to B62.
D. Acceptable Manufacturers:
   1. Watts
   2. Apollo
   3. Or equal.
2.2 SWING TYPE CHECK VALVES – 3 INCH AND LARGER – GENERAL USE
A. The check valve shall conform to the materials of construction, pressure rating and test requirements of AWWA C508 and be suitable for installation in a horizontal or vertical flow up pipe.
B. The body shall be made of cast iron conforming to ASTM A126 Class B with a bolted steel cover allowing complete access to and removal of all internal components while the valve is in the line.
C. The valve body shall have integral flanges, flat faced and drilled per ANSI B16.1 Class 125 or Class 250, as required.
D. The valve body shall have a removable Type 316 stainless steel body seat held in place with stainless steel pins.
E. The disc arm shall be ductile iron and the disc shall be cast iron with a replaceable Buna-N (or other suitable material) disc seat held in place by a type 316 stainless steel follower ring and stainless steel screws. The disc shall be attached to the disc arm by means of a center pin, disc nut and washer providing 360 degree angular articulation but not rotation.
F. The disc arm shall be suspended from and keyed to a stainless steel shaft that is supported at each end by stainless steel or no-lead bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing.
G. Bosses shall be provided on check valves which may be tapped for draining or used for by-pass. The inside and outside of all valves together with the working parts, except bronze and machined surfaces, shall be coated in accordance with AWWA C-550.
H. Marking shall be in accordance with AWWA C-508 and shall include size, working pressure, and cast arrow to indicate direction of flow, name of manufacturer, and year of manufacture.
I. The valve shall be supplied with an outside lever and adjustable counterweight. The lever and weight shall be on the right hand side of the valve (looking in the direction of flow) but shall be field convertible to the left hand side without additional parts. Fitted with an adjustable dashpot or snubber to control speed of valve closure.
J. The valve shall also be provided with a single, side mounted air-cushion assembly directly mounted to the valve body. The amount of cushioning shall be adjustable without the need for pre-charged air chambers.
K. Acceptable Manufacturers:
   1. Val-Matic Series 7800LW
   2. GA Industries Figure 220
   3. Or equal.

2.3 DUCK-BILL TYPE CHECK VALVES
A. Duck-Bill type check valves shall be of the flow operated check type designed to allow passage of flow in one direction while preventing reverse flow.
B. Valves shall be all rubber construction with reinforcement as necessary.
C. Valve shall be either slip-on type with 316 stainless steel clamps or flanged as indicated on the Drawings.
D. Anchor bolts shall be 316 stainless steel.
E. Maximum allowable headloss and end connections for each size of valve shall be as indicated in the Table below.

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Line</th>
<th>End Connection</th>
<th>Maximum Allowable Headloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>S</td>
<td>Flanged</td>
<td>7.5&quot; at 300 gpm (2 psi back pressure)</td>
</tr>
</tbody>
</table>

F. Valve materials shall be compatible with service indicated.

G. Acceptable Manufacturers:
   1. Red Valve/ Tideflex Series 35
   2. EVR Products
   3. Proco
   4. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION
A. In accordance with Section 15100.
B. Install check valves in horizontal sections of pipeline unless otherwise indicated on the Drawings.

END OF SECTION
SECTION 15127
AIR RELEASE VALVES

PART 1 - GENERAL

1.1 DESCRIPTION
A. Work Included: Furnish, install and test air release valves of the size(s) and the type(s) and in the location(s) shown on the Drawings and specified herein.
B. Related Work Specified Elsewhere: "Valves and Specialties - General" is specified in this Division.

1.2 QUALITY ASSURANCE
A. All air release valves, for the same service, shall be manufactured by one manufacturer.
B. The valve manufacturer shall have ISO 9001 and ISO 14001 certifications.
C. All air valves shall be provided with a written five-year warranty.
D. Acceptable Manufacturers:
   1. A.R.I.
   2. Or equivalent.

PART 2 - PRODUCTS

2.1 MATERIALS
A. General:
   1. All valves shall be suitable for the wastewater service.
   2. Valve sizing shall be as shown on the Drawings.
   3. The valve manufacturer shall furnish installation and maintenance manuals with each valve.
B. Sewage Service:
   1. Combination Valves:
      a. Combination Air Valves shall be float operated valves designed to release accumulated air or gas from a piping system while the system is in operation and under pressure. In addition, the valves shall discharge large quantities of air during pipe filling operations and intake large quantities of air during pipe draining and water column separation.
      b. The valve body shall be conical in shape to maintain maximum air gap between the wastewater and the sealing mechanism. Wastewater shall not come in contact with the sealing mechanism at any time during normal operation at the valve’s working pressure. The valve shall have a single float design. The float shall be located in the main body of the valve. The valve shall be designed to ensure a drip tight sealing at back pressure as low as 3 psi.
      c. A spring cushioned joint between the sealing mechanism and float/stainless steel rod assembly shall perform without jamming or allowing air escape under vibrations or float bouncing related to the
turbulence from pump start and stop or flow fluctuations. High velocity air will not shut the valve.

d. The resilient seal shall provide smooth positive opening, closing, and leak free sealing over the range of pressures 3 psi and higher, that the system will experience including static system pressure.

e. The valve shall have a 3-inch female NPT connection at its outlet for connection of a vent pipe or for use in valve flushing or cleaning. The valve shall be designed for two directional venting.

f. The valve shall have a 1-inch ball valve connected to the lower valve body to relieve internal pressure for cleaning and for use in flushing the valve.

g. The valve shall have a funnel shaped lower body to automatically drain wastewater and other debris from the valve.

h. The working pressure shall range from 3 to 250 psi and the valve shall be tested to 360 psi.

i. The valves shall be manufactured with flanged ends to meet requested flange standards or with NPT threaded ends. Contractor to coordinate end connection type.

j. The float shall operate in concert with a spring/lever guided seal design that creates the closure of the valve preventing water from escaping the valve at system operation under pressure of 3 psig and higher, while being able to automatically adjust its position to allow for controlled intermittent air release.

k. Materials of construction:
   i. The body and lower flange shall be constructed of 316 stainless steel.
   ii. The cover shall be constructed of 316 stainless steel.
   iii. The float shall be constructed of 316 stainless steel and shall have a minimum clearance of 1” from each side wall to prevent blockage of the float.
   iv. All metal hardware shall be 316 stainless steel. The sealing disc shall be E.P.D.M. All O-rings shall be of BUNA-N with pressure ratings equivalent to the overall working pressure of the valve.

**PART 3 - EXECUTION**

3.1 **INSTALLATION**

A. Install valves in accordance with manufacturer's instructions and recommendations and as shown on the Drawings.

B. Install all valves in the vertical position and allow sufficient clearance around valve for proper maintenance and removal.

C. Provide piping and valves between air valve and pipeline as shown on the Drawings.

**END OF SECTION**
SECTION 16000
ELECTRICAL - PUMP STATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all labor, materials, equipment, operations, methods and procedures as specifically noted herein these specifications and as indicated in the Contract Documents, together with all items necessary for or incidental to the completion of the work.

B. All systems or additions to existing systems indicated in the Contract Documents shall mean all necessary supervision, labor, equipment and materials required to provide complete, properly functioning systems.

C. All systems shall be adjusted, tested, inspected and turned over to the Owner in perfect working order.

D. The words "provide", "supply", "supply and install", "install", "furnish" or "furnish and install", as used in DIVISION 16 or as indicated on the Drawings related to DIVISION 16 shall mean a complete and properly functioning Electrical installation performed by the Contractor.

E. References:

1. Refer to each individual drawing within the Contract Documents in order to coordinate material and equipment locations and electrical requirements.

2. Applicable portions of DIVISION 0 and DIVISION 1 are part of DIVISION 16. Refer to these sections for additional information on bidding requirements, general requirements, Section 01800 for equipment start-up, and product substitution.

F. Work Specified Herein:

1. Visit and examine the project site and become familiar with all existing conditions pertinent to the work to be performed thereon. No additional compensation will be allowed for failure to be so informed.

2. The following scope of work is a brief generalization of the type and extent of the work specified under DIVISION 16. Detailed requirements are indicated on the Drawings and in related sections of the Specifications. The work specified under DIVISION 16 includes, but is not necessarily limited to the following:
   a. The work specified under Division 16 is inclusive of the electrical work for this project as indicated on the Drawings and in related sections of the Specifications.
   b. Provide Electrical Service and Distribution System as indicated on the "Single-Line Diagram", related drawings and schedules, and as specified herein.
   c. Contractor shall be responsible for obtaining temporary power to conduct work as required. Temporary power may be obtained from the local power company or by a temporary generator as required in order to maintain continuous operation of the pump station during the schedule of the
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ELECTRICAL - PUMP STATIONS

construction period. The generator and all required fuel are to be supplied by the electrical contractor.

G. The work shall also include, but not be limited to, the furnishing and installing of the following:
   1. Underground electrical service to the pumping station building and electrical equipment.
   2. Raceways and fittings.
   3. Wires and cables.
   4. Service distribution equipment.
   5. Miscellaneous electrical distribution equipment.
   6. Grounding system.
   7. Installation of existing SCADA telemetry system RTU equipment and connections (equipment provided by Owner).
   8. Power and control wiring between standby generator and service distribution equipment.
   9. Metering and service disconnect equipment.
   10. Underground power and control wiring to submersible pumps.
   11. Power conduit, wiring and equipment for connections to a portable generator as indicated on the Drawings.
   12. Emergency standby power system equipment and installation.
   13. Complete demolition of existing systems as shown on the drawings for all complete removals and disconnections, removals, relocations, and installations.
   14. All required electrical work for the proposed pump station building as shown on the drawings.

H. Make all required connections to the pumping station and for the electric service and utilities at the pump station building.

I. Removals and Relocations:
   1. Examine the existing site, structure(s) and installation(s) for the work of all trades which will influence the cost of the work under DIVISION 16. This work shall include removals and relocations relating to the work of all trades which may interfere with, disturb or complicate the performance of the work under DIVISION 16; and relating to the work involving systems, equipment and related service lines which shall continue to be utilized as part of the finished project.
   2. Provide all associated labor, material and costs to include all removals, relocations, and reconnections herein specified, necessary or required to provide operation and coordination of the combined new and existing systems and equipment.
   3. Demolition:
      a. Disconnect and remove existing equipment, devices, boxes, conduit, and associated electrical equipment as shown on the contract drawings.
      b. Any demolition or relocation work performed which results in unused openings in control panels, instrument panels, control stations, pull or junction boxes, etc., which are to remain, shall be plugged by appropriate means such that it maintains the integrity of the NEMA classification of the area, as defined on Drawing E-1.
c. Any demolition or relocation which results in unused openings shall be sealed.

d. The work of this Contract involves demolition work. Review all Contract Documents and coordinate with all disciplines for a complete understanding of this demolition work. Provide all new work required to modify these changes along with all requirements for installation of the new work, as shown on the Contract Drawings.

e. There are areas where the demolition shall require that existing equipment such as pullboxes, conduit, and wiring, and associated devices be disconnected, removed, or relocated in order for the new equipment to be constructed and installed. In most cases, the detail of these existing conditions has not been shown. This Contractor will be responsible for performing all work necessary to demolish all devices associated with equipment in their entirety for the noted and intended demolition. The Contractor shall visit the site locations and become familiar with the areas where this work is to be performed. Any concerns or issues regarding this work need to be addressed and submitted to the Engineer for clarification prior to submission of the final bid price for the work of this Contract. All costs associated with this work are the responsibility of this Contractor and shall be included as part of the overall costs for the electrical work of this project. No additional costs shall be allowed by this Contractor for any demolition work.

f. Disconnect and remove all abandoned conduits, wiring, boxes, equipment, controls, hangers, etc., shown or not shown, which are located within the area of construction under this contract.

J. Request for Information:

1. When there is a conflict or coordination issue, or if additional information is necessary for the contractor to proceed with the intended work, a Request of Information (RFI) form shall be submitted through the General Contractor to the Engineer. The specific issue shall be described in the RFI and shall be sent to the engineer for review and a response provided in an appropriate time period. RFI form shall be available via the General Contractor through the Engineer. This process shall be used as part of the work of this contract.

K. Bid Allowance:

1. A bid allowance has been established for estimated cost by the power company for the work required by them under this contract. Refer to General Conditions and Bid Forms including Measurement and Payment for exact requirements and costs to be carried as part of the work required under this section. Actual amounts shall be invoiced and submitted by the respective utility company for payment with any credits for this allowance will be returned to the Owner under this contract.

1.2 QUALITY ASSURANCE

A. In general, the workmanship of the electrical installation shall be as described in the N.E.C.A. Electrical Design Guidelines. All methods of construction, details of workmanship, etc., that are not specifically described therein or indicated in the
Contract Documents, shall be subject to the control and no exceptions to the Engineer.

B. Equipment and materials shall be of the quality and manufacture indicated in their respective description within the specifications.

C. Work determined by the Engineer to be unsatisfactory according to industry standards shall be redone at the Contractor's expense, with no additional compensation.

D. Safety and care of equipment and electrical installations to remain the responsibility of the subcontractor until final acceptance by owner. Any cost associated due to damages or loss prior to owner acceptance to be covered by subcontractor.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit Shop Drawings, O&M Documentation, and manufacturer certificates in accordance with Section 1340. The requirements below are in addition to the standards therein.

B. Submittals required under this section include, but are not limited to the following for each of the locations specified:

1. Conduit
2. Wiring and Cables
3. Service distribution equipment
4. Main circuit breaker
5. Meter socket
6. Lightning arrester and line surge protection
7. Receptacles
8. Automatic transfer switch
9. Mounting hardware and materials
10. Lighting fixtures and switches
11. Electrical distribution equipment
12. Miscellaneous electrical equipment
13. Pullboxes
14. Expansion fittings
15. Motor starting equipment as required for the installation
16. VFD parameter settings, VFD software and digital copy of parameters
17. Conduit seal fittings
18. Emergency Standby Systems and Equipment
19. Equipment test results
20. Conduit Layout Plans
21. Megger test results for cables and equipment prior to putting equipment into service
22. Submit all other equipment as required by the Contract

C. Operations and Maintenance Manual

1. Requirements
   a. Provide a complete bill of material for each piece of equipment.
   b. Provide a preventative maintenance section for all applicable equipment including recommended schedule and spare parts.
c. Panels which require customized schematics shall be updated with changes made in the field and submitted on 11" x 17" size drawings. Also internal and front elevation drawings shall be included identifying all equipment.

d. All equipment shall include a troubleshooting section with common symptoms and recommended solutions.

e. All equipment shall include emergency operations instructions particularly to Emergency Generators and Automatic Transfer Switches on how to operate the equipment when the automatic function of the equipment fails.

D. Submittals:

1. Shop Drawings Shall Consist Of:
   a. Project name and location.
   b. Contractor's name.
   c. Index Sheet - Listing the equipment being submitted utilizing equipment designations, or symbols, indicated on the Contract Documents together with the proposed manufacturer, style/ type and catalog number.
   d. Manufacturer's scale or dimensioned drawings along with standard catalog "cut" sheets.
   e. Equipment ratings, service clearances and configuration.
   f. Listing of accessories to be furnished.
   g. Single-line and schematic diagrams where applicable.
   h. Refer to related sections of the specifications for special shop drawing requirements for individual equipment types.

2. Provide samples of such items as lighting fixtures and wiring devices upon request of the Engineer.

3. Standard manufacturer's catalog cut sheets are acceptable; however, they shall be modified to indicate equipment and options to be provided for this project. Any listed equipment, options, or features which are not to be provided shall be properly indicated in the submittal. Failure to properly indicate project-specific equipment, options, and features will result in the submittal being returned without being reviewed.

4. Submit test results as listed in Section 3.4

1.4 PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out of doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, or shall be replaced at no additional cost to the Owner.
1.5 **DESIGN CRITERIA**

A. Service and Metering
   1. The project site location has existing utility company services for power and telephone. There will be no requirements for the scope of work which will impact these existing services. Therefore, there will be no need for coordination and contact with the respective utility company regarding any shutdowns, energizations, modifications, or interface with the present services which shall effect the work of this contract.

B. Service and Metering
   1. The power company serving this project is Central Maine Power. The service representative this project is as follows:
      2. Representative: Jon Deschenes
      
      Contact information:
      
      Phone Number : (207) 629-1423
      Email: Jon.Deschenes@cmpco.com
   3. Work Request Number: 103-008-34308
   4. Service will be obtained at 480/277V, 60 Hertz, from three new pole-mounted service transformers located at the site, as shown on the drawings. The existing account number is 3051-4636-639.
   5. Coordinate with power company for assistance in extending new secondary service conduit and wires from the existing service riser pole and new service transformers to the new electrical equipment structure as shown on the drawings. Installation of conduits and supports per local utility requirements. Provide number and size of conduits per local utility requirements.
   6. The power company it to remove the existing service and replace the pole and transformers.
   7. Furnish and install the metering cabinet and meter socket per power company requirements.
   8. Coordinate all shutdowns and activations of the services with the power company as part of this work.
   9. Make all arrangements with the power company for obtaining service and pay all charges and furnish all labor and material for the service. An allowance has been established for this work. Refer to General Conditions for these specifications for specific bid allowance to be carried as part of the work of this contract.
   10. Provide all demolition and removals of existing secondary electrical service conduit and cables at the existing service riser pole and at the existing pumping station and as shown in the Contract Drawings.
   11. Provide all service disconnections and re-energizations required by the Power Company during the work of this contract and include these costs as part of the work of this contract as part of the allowance establish for this electrical service work.

C. Codes, Inspection and Fees
   1. All material and installation shall be in accordance with the latest edition of the National Electrical Code and the codes and ordinances of the Town or City of which the work is being performed.
2. Pay all fees required for permits and inspections. All power utilization fees incurred prior to owner’s acceptance to be paid by subcontractor.

D. Tests and Settings
1. Test all systems furnished under DIVISION 16, ELECTRICAL and repair or replace all defective work.

PART 2 - PRODUCTS

2.1 GENERAL
A. Materials and equipment used shall be Underwriters Laboratories, Inc. listed.
B. Refer to Drawing E-1 for specific references to NEMA ratings for equipment specified unless otherwise noted.

2.2 RACEWAYS AND FITTINGS
A. Rigid steel conduit shall be hot dipped galvanized as manufactured by Republic Steel Corp., Allied Tube and Conduit Corp., Wheeling Pittsburg Steel Corp., or equal.
B. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., Appleton Electric Co., or equal.
C. PVC coated rigid steel conduit as manufactured by Rob-Roy "Plasti-Bond", Ocal, or equal.
D. PVC Schedule 40 shall be extra heavy wall and UL Listed for the use intended. Acceptable Manufacturers: Carlon, Rob-Roy, or equal.
E. Aluminum conduit shall be rigid, heavy wall aluminum. Acceptable manufacturers: Anaconda, Kaiser, VAW, or equal.
F. Flexible Metal Conduit
   1. Flexible Metal Conduit shall be constructed of one continuous length of U. L. Approved electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges.
   2. Flexible metal conduit shall be "liquid-tight" with PVC jacket. Acceptable Manufacturers: Alflex - a division of Southwire, Electri-Flex, Thomas & Betts - a division of ABB, or equivalent.
   3. Flexible metal conduit installed in hazardous, NEMA 7, Class I Div 1 areas shall be UL Listed, and shall have a bronze or stainless-steel braid covering over a flexible brass inner core. Packing shall be woven cotton braid impregnated with asphalt. Acceptable manufacturer: Crouse-Hinds - a division of Eaton, Killark, Thomas & Betts - a division of ABB -XP Series, or equal.

2.3 WIRES AND CABLE
A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper. All conductors installed below grade shall be XHHW stranded. All conductors #8 and larger shall be XHHW.
B. Power wiring shall be 600V, Type XHHW. Type XHHW shall be cross linked polyethylene, as manufactured by Pirelli Cable Corp., Collyer Insulated Wire Company, The Okonite Company, or equal.
C. Control wiring shall be 600V, Type THHW/THHN No. 14 AWG stranded. Type THHW/THWN shall be cross linked polyethylene, as manufactured by the Pirelli Cable Corp., Collyer Insulated Wire Company, The Okonite Company or equal.
D. Signal wiring shall be 600V, individual shielded twisted pair, No. 16 AWG stranded with polyethylene jacket. Provide Belden Catalog No. 8719, Alpha Wire & Cable, or equal.

E. Ground wires shall be THW and color-coded green.

F. Variable frequency drive (VFD) motor supply cables shall be provided where indicated on Drawings. VFD cables shall be four (4) conductor tinned stranded copper, with cross-linked polyethylene insulation, overall foil (100% coverage) / tinned copper braid (85% coverage) shields, No. 12 AWG tinned copper drain wire, and outer PVC jacket. Cables shall conform to UL specification for 1000 Volt flexible motor supply cable. Acceptable Manufacturers: Belden, Olflex, or equal.

G. Ethernet wiring shall be Category 6, 4-pair 24 AWG solid bare copper conductor, unshielded, FEP insulated, plenum rated. Acceptable manufacturers shall be Belden, Omni, or equal.

H. Wire markers shall be "OMNI GRIP" as manufactured by W.H. Brady Company, or equal.

I. All wires and cables specified and installed underground shall be U.L. Listed and Labeled for underground use for all installations.

2.4 METERING SOCKET AND METERING CABINET

A. Meter socket shall be of the type as recommended by the power company.

B. Metering cabinet shall be of the type as recommended by the power company.

C. Acceptable manufactures are Milbank, Square D, or equal.

2.5 AUTOMATIC TRANSFER SWITCH

A. GENERAL

1. The automatic transfer switch shall be designed for an emergency and normal source with ratings as indicated on the drawings. The automatic transfer switch shall be as manufactured by Caterpillar or Asco, no equal and shall be provided by the generator manufacturer under Specification Section 16620.

2. The transfer switch manufacturer shall have been regularly engaged in the production of UL (Underwriters Laboratory) Standard 1008 Listed transfer switches. The transfer switches shall be documented, and have been offered for sale on the open market for a minimum of five (5) years. The manufacturer shall provide factory trained parts and service support through a factory authorized distributor that is regularly doing business in the area of the installation.

3. The manufacturer shall supply literature containing diagrams, parts lists and descriptions sufficient for the owner's personnel, or subcontract supplier to install, operate and perform normal maintenance on the equipment.

4. Testing: To provide proven reliability of the system, transfer switches shall be completely tested as follows:

   a. Representative production samples of the transfer switches supplied, shall be demonstrable, through tests, the ability to withstand at least 10,000 mechanical operating cycles. An operating cycle shall consist of one (1) electrically operated transfer from normal to emergency and back to normal.
b. During the development of the original transfer switching mechanism for this family of transfer switches, a prototype of the transfer switching mechanism shall have passed the environmental tests listed in Military Standard, Mil-Std-202E. These tests shall include Method 101D-Condition B, Salt Spray-Corrosion; Method 103B-Condition B, Humidity; Method 107D-Condition A, Thermal Shock; Method 110A Sand and Dust.

c. Transfer switches shall be UL Listed per Standard 1008. The minimum WCR (Withstand and Closing Current Ratings) shall meet the requirements of UL Standard 1008 and shall be obtained without contact welding. Where the line side overcurrent protection is provided by circuit breakers at 480 volts AC or less, the short circuit WCR shall be as follows:

<table>
<thead>
<tr>
<th>TRANSFER SWITCH</th>
<th>K &amp; J/L FUSES</th>
<th>WITHSTAND AND CLOSING RATINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTINUOUS CURRENT RATINGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40A, 70A, 100A</td>
<td>125A/200A*</td>
<td>14,000A RMS</td>
</tr>
<tr>
<td>150A, 260A</td>
<td>400A/600A*</td>
<td>30,000A RMS</td>
</tr>
<tr>
<td>400A, 600A</td>
<td>1200A/1200A*</td>
<td>42,000A RMS</td>
</tr>
<tr>
<td>800A, 1000A</td>
<td>2000A/2000A*</td>
<td>65,000A RMS</td>
</tr>
</tbody>
</table>

* Class J and L Fuses WCR = 200,000A RMS

i. The RMS (root Mean Square) symmetrical fault current ratings shall be verified by UL witnessed tests on representative test samples. All WCR tests shall be performed with the overcurrent protective devices located external to the transfer switch. Tests conducted with overcurrent protective devices internal to the transfer switch, in such a manner that the transfer switch interrupts the current rather than withstanding the current, are not acceptable under this definition of withstand.

ii. Where the line side overcurrent protection is provided by current-limiting fuses, the fuses shall be UL Class RK1, RK5, J, or L (with the fuse sizes being no larger than the UL listed maximum ratings or component recognition procedures for the transfer switches supplied). The transfer switch closing rating shall be suitable for 200,000A available fault current, as verified by UL witnessed tests on representative test samples.

d. Provide testing as specified herein.

5. Ratings: All transfer switches shall be UL Listed per Standard 1008. All transfer switches shall be suitable for use on emergency and legally required standby systems in accordance with ANSI-C1 and NFPA-99, rated for total system load. These loads shall include motors, electric discharge lamps, resistive loads, and tungsten lamps as described in Section 1 of UL 1008 Standard.
6. Transfer switches shall be 60 HZ. Refer to drawings for the number and locations of transfer switches, number of phases, number of poles, voltage, and ampere ratings.

7. Transfer switches shall be rated to carry 100 percent of their rated current continuously when in an enclosure. Refer to enclosure requirements as shown on the Drawings for each specific project location. Transfer switches which must be derated when installed in an enclosure (due to integral overcurrent devices or any other reasons) do not meet this specification. Transfer switches shall be rated for continuous operation in ambient temperatures of -40°C (-40°F) to 67°C (142°F).

8. Construction: Transfer switches shall be over center operation, double-throw construction, center neutral position type positively electrically and mechanically interlocked by a simple mechanical beam to prevent simultaneous closing (for break before make operation), and mechanically held in both normal and emergency positions.
   a. Transfer switches shall be quick-break, quick-make operation so that the speed of opening and closing is not controlled by an operator during manual operation. Transfer switches shall be a center neutral position type switch and shall provide a center "Programmed Transition" position for manual switching.
   b. Transfer switches shall be approved for manual operation under full load by integral mounted, permanently attached, high dielectric, manual operating handles. Manual operating handles, which are normally stored and must be installed for manual operation, do not meet this specification.
   c. The electrical operating means shall be a direct-acting, center neutral position, constant force in both directions, bi-directional linear induction motor to provide minimum friction, straight-line switch action. Motor shall be attached directly to the switching mechanism without the use of gears, cams, or other complex mechanical linkage methods.
   d. Transfer switches shall not contain any integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
   e. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching.
   f. Manual operating handles and controls (other than key-operated switches) shall be accessible to authorized personnel only by opening the keylocking cabinet door. Transfer switches located on the outside of the cabinet do not meet this specification.
   g. Unless noted or specified otherwise, each transfer switch shall be mounted in separate cabinet enclosures with key-locking front doors and no mechanical clips or fasteners located around the outside of the enclosure door as specified herein.
   h. Maximum transfer time in either direction shall be six (6) cycles, except where the "Programmed Transition" feature is furnished.
i. All transfer switches shall have transparent protective covers to protect operating personnel during manual operation, and to allow an operator to visually determine that the main contacts are "Open" or "Closed".

j. The main switch contacts shall be of the no maintenance type and high pressure silver cadmium oxide to resist burning and pitting for long life operation. All switches shall have arc chutes of heat absorbing material and metal leaves for positive extinguishing of arcs quickly and effectively; arc chutes shall have insulating covers to prevent interphase flashover.

k. Transfer switches shall have one (1) S.P.D.T. (Single Pole Double Throw), auxiliary dry switch contacts on both the normal and emergency-sides, operated by the transfer switch. These auxiliary switch contacts shall be factory wired to an easy access terminal block and may be used to monitor transfer switch position for controlling indicator lamps or other peripheral equipment. Contacts shall be rated 1200 VA.

l. Complete AL-CU (Aluminum-Copper) lugs, UL listed and CSA certified, shall be provided for both normal and emergency load positions. Provide all required lugs/phase for each switch based on cable sizes shown on the Contract Drawings. For 150A and larger transfer switches, top or bottom feed for load connections shall be provided for slimmer design, requiring less wall space. Load connections shall be field changeable either from top-to-bottom or bottom-to-top. Wiring space at normal, emergency, and load lugs inside the transfer switch cabinet shall comply with the latest edition of NEC. Full rated neutral bar with lugs for normal, emergency, and load neutral conductors shall be provided inside the cabinet.

m. Relay, with 2 N.O. and 2 N.C. contacts, which is energized whenever the normal source is available regardless of switch position.

n. Relay with 2 N.O. and 2 N.C. contacts, which is energized whenever the emergency source is available regardless of switch position.

9. Controls: Control accessories, either electronic or relay, shall be mounted in a separate smaller cabinet mounted on the inside of the main cabinet door. This is to allow for ease of service when the main cabinet lockable door is opened, but to prevent access by unauthorized personnel. Controls shall be microprocessor based type with operator interface panel for monitoring, viewing and setting of system parameters.

a. Control circuit disconnect plugs shall be provided to reenergize control circuits to avoid the hazards of electrical shock to personnel while making adjustments.

b. The Power Sentry electronic control, undervoltage and time delay modules, shall be a printed circuit board for ease of service. The solid-state undervoltage sensors shall simultaneously monitor all phases of the normal and emergency power sources to provide field adjustable range sensors for specific applications.

i. Voltage pickup settings shall be adjustable from a minimum of 85% to a maximum of 100% of nominal voltage. Voltage dropout settings shall be adjustable from a minimum of 74% to a maximum of 98% of the pickup setting with a fixed dropout time delay of 0.5
ii. Voltage sensors shall be of the temperature compensated type, for maximum deviation over the temperature range of -32°C (-25°F) to 79°C (175°F). Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of the normal or emergency power source, even where motor feedback voltages exist.

iii. Provide phase failure (loss of any phase) phase unbalance and phase rotation type sensing for protection of all phases of the system.

c. The Overvoltage and Frequency Sensing control, overvoltage and frequency sensing module, shall be a printed circuit board for ease of service. The solid-state overvoltage sensor(s) shall simultaneously monitor all phases of the source(s) to provide field adjustable ranges of voltage pickup and dropout and time delays. Frequency sensor(s) shall simultaneously monitor all phases of the source(s) to provide field adjustable ranges of frequency pickup and dropout and time delays.

i. Under/over frequency and over voltage sensing for the emergency source.

d. Controls shall signal the emergency power system to start upon signal from normal source voltage sensors. Solid-state adjustable time delay (0-90 sec) start shall avoid nuisance engine-generator set start-ups on momentary voltage dips or interruptions. Initial setting shall be 5 seconds.

e. The transfer switch shall transfer the load to the emergency power system after the engine-generator set reaches proper voltage and frequency and has stabilized.

f. The transfer switch shall control the engine-generator set to allow the set to start and transfer the load within 10 seconds (adjustable from 2 to 120 sec) after a normal source power failure. It shall be the responsibility of the transfer switch supplier to meet this requirement.

g. The transfer switch shall retransfer the load to the normal source after normal source power is restored, allowing normal source to stabilize before retransfer and shall allow staggered retransfer of loads in multiple transfer switch systems. Retransfer time delay shall be adjustable from 0-30 min. Initial setting shall be 3 minutes.

h. The controls shall signal the engine-generator set(s) to stop after load retransfer to the normal source but shall maintain the availability of the emergency source in the event that the normal source fails shortly after retransfer. The controls shall allow the engine-generator set(s) to run unloaded for a cooldown period prior to shut down (adjustable from 0 to 10 min). Initial setting shall be 5 minutes.

i. The controls shall provide an automatic retransfer of the load from the emergency source to the normal source if the emergency source fails when the normal source is available.
j. The transfer switch operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred.

k. Controls shall provide built-in "Control Mode Status" indicators, mounted on the interior of the enclosure, consisting of L.E.D.s (Light Emitting Diodes) to indicate a sequence of functions such as the following:
   i. Source 1 OK
   ii. 2-Wire Run
   iii. Source 2 Ok
   iv. Timing for Transfer
   v. Transfer Command
   vi. Timing for Retransfer
   vii. Retransfer Command
   viii. Timing for Stop

l. The indicators shall allow the operator to determine that the controls are properly sequencing and shall assist in determining the sequence of any malfunctions that might occur.

m. Main cabinet front door mounted controls and indicator lamps shall consist of oil-tight, neon position indicator lamps (NORMAL - White and EMERGENCY - Amber) and key-operated Test and Selector switches to provide the following functions:
   i. TEST - Simulated normal source power loss to control unit for testing engine-generator set capability. Provide selector switch inside cabinet to allow for choice of load transfer or test without transfer.
   ii. NORMAL - Normal operating position and also restores the system to stand by operation; and if load was transferred, retransfers load from emergency to normal source after test and time delays.
   iii. RETRANSFER - Spring-loaded momentary position of switch, that overrides retransfer time delay to cause the immediate return to the normal source after a test or actual power outage.

n. Transfer switch shall be provided as a delayed transition, center neutral position switch. This feature shall be provided to allow for delay residual voltage of connected load. The time delay shall occur during switching in both directions, during which time the load is isolated from both normal and emergency sources. This will allow residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle.

o. The center neutral, delayed transition shall be connected in a manner that will not cause the time delay in switching, where the time delay has already been established by the loss of voltage to the load during normal source power interruptions.

10. Switches shall be equipped with the following items:
   a. Provide microprocessor based controller and Exerciser clock to set day-of-week (one week dial minimum), time-of-day, and duration-of-time of engine-generator set(s) exercise. A period with/without load selector switch.
b. Provide Manual-Automatic retransfer selector switch. After normal source is restored, this switch provides either manual or automatic retransfer after the retransfer time delay has expired in the automatic position, or manual retransfer at a time selected by an operator.

c. Frequency reading of 45-65 HZ.

d. Generator running time meter reading in hours.

e. Multi-position AC readings and phase selection to read line current and line-to-line and line-to-neutral voltages in each phase with off position.

f. Meter(s) shall read whichever source is connected to the load.

2.6 MAIN CIRCUIT BREAKER

A. Circuit breaker shall be molded case, 600 Volts, sized as indicated on the Drawings with not less than 35,000 Amperes, RMS interrupting capacity. Circuit breaker shall be installed within an enclosure with neutral and ground lug kit factory installed and provided in the enclosure. The operating handle shall be side mounted and pad lockable in the "On" and "Off" position. The breaker should still provide overload and short circuit protection when locked in the "ON" position.

B. Circuit breaker shall be UL listed and labeled as being suitable for use as service entrance equipment.

C. Acceptable manufacturers are Square D, Cutler Hammer, or equal.

2.7 GROUND ROD

A. 10 foot long by 3/4 inch diameter copper clad steel ground rods shall be provided, arranged and installed as shown on the drawings. Provide all required Cadwelds, grounding clamps and hardware as required for a complete installation per NEC and as shown on the drawings.

B. Acceptable manufacturers are Erico, AB Chance Co., or equal.

2.8 EXOTHERMIC CONNECTION

A. The contractor shall be responsible to furnish and install exothermic connections as required and shown on the contract drawings.

B. The mold shall be new and clean and shall provide all required connection molds for different required types.

C. All connections shall be industry standards in a complete, continuous, and properly installed connection. Any connections not properly installed as inspected shall be removed and re-formed at the contractor's expense.

2.9 LIGHTNING AND SURGE PROTECTION

A. Lightning and surge protection units shall be Square D Model Number SDSA 3650, three phase for 600 VAC phase-to-ground voltage. Provide a separate unit at all locations shown on the drawings. Provide a spare lightning and surge protection unit to the Owner for spare parts.

B. Lightning and surge protection units shall be Square D Model Number SDSA 1175, single phase for 250 VAC phase-to-ground voltage. Provide a separate unit at all locations shown on the drawings. Provide a spare lightning and surge protection unit to the Owner for spare parts.
2.10 **WIRING DEVICES**
A. Receptacles shall be duplex, 20 Ampere, industrial grade and shall be ground fault type. Outdoor receptacles shall be provided with weatherproof, while in use type covers.
B. Light switches shall be rated 20 Ampere, single pole type.
C. Duplex receptacles shall be duplex, 20 ampere, industrial grade type.
D. Light switch covers shall be weatherproof.
E. Acceptable manufacturers are Cooper, Hubbell, or equal.

2.11 **POWER DISTRIBUTION PANEL PDP**
A. Provide power distribution panel board with bolt-on breakers and copper busses. Panelboard shall be rated as shown on the drawings, but not less than 22,000 Amperes RMS Symmetrical. Panel board shall be provided as shown and noted on the contract drawings. Acceptable manufactures are Square D, Cutler Hammer, or General Electric, or equal.
B. Submit complete documentation for coordination, short circuit, and arc flash study and report immediately upon approval of equipment and prior to start-up and testing of any equipment. Submit reports prior to release of equipment in order to make any necessary changes based on the study's findings before the equipment is approved. No start-up will be allowed without this study and report and without the final recommended system settings being implemented and tested in the field. If equipment needs to be ordered prior to receiving the study, all necessary changes will be the responsibility of the contractor at no additional costs.

2.12 **LIGHT FIXTURES**
A. Install two 2VRVT3-LD5-4-G-UNV-L835-CD1-U or equal lighting fixtures under equipment mounting structure canopy.
B. Acceptable manufactures are Cooper Lighting, Holophane, or equal.

2.13 **EXPANSION FITTINGS**
A. Expansion fittings shall be watertight expansion type, designed to compensate for conduit movement. Expansion fittings shall be provided to allow movement of 4 inches in both directions for a total of 8 inches. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless-steel bands. Acceptable Manufacturer: O.Z./Gedney Type EX, Thomas & Betts, or equal.

2.14 **PULLBOXES AND JUNCTION BOXES**
A. Junction boxes shall be cast malleable iron or aluminum type and gasketed type FS series with hubs.
B. Pullboxes other than explosion proof shall be seamless weld type, galvanized with flush type screw-on covers and no hinges or side clamps all around. Use Myers hubs for conduit termination and entry into pullboxes. Acceptable manufactures are Rittal, Hoffman, or equal.
C. Explosion-proof pullboxes shall be NEMA 4/7, Class I, Division 1, Group C & D or NEMA 4/7, Class I, Division 2, Group C and D for hazardous rated areas. Provide conduit sealing fittings inside and outside of explosion proof areas for all conduits per NEC. Acceptable manufacturers are Appleton, Crouse Hinds, or equal.
D. Boxes for concealed work shall be used only for concealed installations.

2.15 MOUNTING SUPPORTS AND HARDWARE
A. Provide 316 stainless steel uni-strut and 4” channel angle supports and stainless-steel mounting plates as shown and required for equipment mounting. All legs for stanchion mounting structures shall be channel angle support, no exceptions.
B. All bolts, washers and mounting hardware shall also be 316 stainless steel for the entire installation.
C. Acceptable manufactures are B-Line Systems, Inc., Thomas & Betts-Super Strut, Unistrut, or equal.

2.16 LINK SEAL
A. Furnish and install link seal fittings at all areas of buildings and structures both above and below grade for conduit entry. Refer to the contract drawings for additional requirements.
B. Acceptable manufactures are Innerlynx, Crouse Hinds, or equal.

2.17 DISCONNECT SWITCHES
A. Furnish and install heavy duty type lockable disconnect switches as shown on the drawings. Switch NEMA ratings shall be as required and noted on the drawings. Ampacity shall be noted on the drawings and as required by NEC.
B. Disconnect switches, indicated on the drawing to be used for motors controlled by variable frequency drives shall be 4 pole type switches. The fourth pole shall be wired directly to the control circuit, in series with the safety e-stop, in order to lock-out and immediately shutdown the drive control circuit. The auxiliary 4th pole shall open prior to any of the other three power poles and shall be specifically designed for proper use with VFD type load circuits. The Contractor shall be responsible for providing a separate control conduit for required wiring from the VFD to the disconnect switch.
C. Acceptable manufactures are Square D, Cutler Hammer, or equal.
D. Disconnect switches shall have side mounted handle operators that are lockable in both the on and off position.
E. Disconnect switch shall lock out and immediately shutdown the drive control circuit. The auxiliary 4th pole shall open prior to any of the other three power poles and shall be specifically designed for proper use with VFD type load circuits. The Contractor shall be responsible for providing a separate control conduit for required wiring from the VFD to the disconnect switch.
F. Acceptable manufactures are Square D, Cutler Hammer, or equal.

2.18 MOTOR CONNECTIONS
A. Provide all required flexible conduit liquid tight or explosion proof to meet the NEMA rating as noted on the drawings. Limit lengths to 24” or less. Moved to cable section.

2.19 RELAYS
A. Industrial Control Relays - Relays provided with 10 Ampere contact rating shall be Square D, Class 8501 type X or equal. Relays with 30 Ampere contact rating shall
be Square D, Class 8501, type C or equal.

B. Pilot Duty Relays - General purpose relays shall be IDEC RH Series, 10A contact rating, 4 Form "C" contacts or equal, provided with internal indicating light. Pilot duty control isolating relays for PLC inputs and outputs shall be suitable for the application and shall be submitted with no exceptions by Engineer.

C. Relays shall be electrically operated with 120 Volt coils except as noted otherwise on the Drawings. Contacts shall be rated 600 Volt, 10 Ampere.

D. Interposing relays used for telemetry inputs or other low current inputs shall be Potter and Brumfield type KHAU-17A16 - 120 Volt, or equal.

E. Timing Relays:
   1. Delay timing relays shall be general purpose, solid state type rated for use at 120 Volts. Contacts shall be rated 5 Amperes (minimum). Minimum time range shall be adjustable from 1 second to 1 minute. Time delay relays shall be IDEC RTE or equal.

2.20 TERMINAL STRIPS
   A. Terminal strips shall be supplied to make all power and control connections. All terminals shall be numbered and clearly marked for easy identification. Acceptable manufacturers are Allen Bradley, Phoenix Contact, or Equal.

2.21 WIRE IDENTIFICATION
   A. All individual conductors shall be identified using unique numerical tags corresponding to conductor designations indicated on approved shop drawings of schematic diagrams for all terminations. This includes all process- and non-process-related wiring done as part of the work, such as fire alarm panels. Conductors shall be clearly identified at each terminal block, equipment connection and junction. Markings shall utilize the equipment designation and terminal block number in the device higher upstream in the system hierarchy.
   B. For Conductors No. 6 and smaller, color coding shall correspond to the color of the conductor insulation. For color coding of wire larger than No. 6, use self-adhesive, wrap-around type markers. These markers shall be used at all panelboards, junction boxes, disconnect switches, circuit breakers, etc.

2.22 CONTROL POWER TRANSFORMERS
   A. Supply all control power transformers necessary to make panel functional. All transformers shall have both primary legs and all "hot" secondary legs fused. One secondary leg shall be grounded.
   B. Acceptable manufacturers are Square D, Siemens, or equal.

2.23 CONTROL CIRCUIT FUSES
   A. Fuses shall be rated for at least 125 Volts at the current ratings shown on the Drawings.
   B. Fuses shall be Littlefuse, Bussmann, or equal.

2.24 CONDUIT SEALS
   A. Provide Class I, Div. 1, Groups C & D conduit seals as required by the N.E.C. and as shown on the Drawings or required by the NEC.
B. Provide Class I, Div. 2, Groups C & D conduit seals as required by the N.E.C. and as shown on the Drawings or required by the NEC.
C. Acceptable manufacturers: Appleton, Killark, O-Z/Gedney, or equal.

2.25 DRY-TYPE TRANSFORMERS
A. Furnish and install dry-type transformers with ratings as shown on the drawings.
B. Transformers shall be of the energy efficient type and shall be non ventilated type.
C. Acceptable manufactures: Cutler-Hammer, Square D, Siemens, or equal.

2.26 LIGHTING PANELBOARD
A. Provide panelboard with main circuit breakers center mounted separate from the feeder breakers sized as shown on the drawings. Panelboard shall have bolt on breakers and copper busses rated as shown on the drawings but shall not be less than 10,000 ampere RMS symmetrical. Provide circuit breakers as noted on the drawings.
B. Acceptable manufactures are Square D, Cutler Hammer, General Electric, equal.

2.27 VARIABLE FREQUENCY DRIVE CONTROL PANEL
A. Furnish and install a variable frequency drive (VFD) control panel for the submersible pump. VFD control panel shall be installed in a vented type enclosure with the following equipment:
   1. 2-75 HP constant torque variable frequency drives as manufactured by AS3, Toshiba, Model AS3, Eaton, Allen Bradley, or equal.
   2. Matrix Filter/RFI/EMI Filter/See Drawings
   3. Single free-standing, floor mounted dead front stainless steel enclosures rated NEMA 3R. All associated equipment located within this panel which shall operate the respective sewage pump. No separately mounted devices outside this panel will be acceptable.
   4. Passive harmonic filter is to be horsepower rated as manufactured by TCI, MTE or equal.
   5. Through the door disconnect switch.
   6. Front panel mounted keypad.
   7. The application shall provide for a 480 volt three phase input under normal electrical service to the VFD control panel and a 480 volt three phase input during emergency standby electrical service to the VFD control panel. The sewage pump is rated 75 HP at 460 volt 3 phase with the following parameters:
      a. Full Load Current = 78 Amperes
      b. Maximum Full Load Current at Service Factor = 90 Amperes
      c. Locked Rotor Current = 550 Amperes
   8. The application in this project is for the 75 HP, 3 phase submersible sewage pump. Therefore, the VFD to be supplied for this shall be rated a minimum of 75 HP or greater based on the submersible motor current requirements previously noted. The contractor is to coordinate the motor amperage with the VFD being supplied to verify a functioning system.
   9. Refer to contract drawings for specific requirements and number of VFD units required.
10. Provide all programming and setup for the VFD. Provide VFD Parameter Setup and Verification.
B. Provide a complete and operational VFD control panel for the submersible pump motor.

C. Provide a total of one (1) day of startup for the VFD equipment after confirmation of pre-startup has been completed. Reference Section 01800 for coordination of startup requirements.

D. Provide 1 day of separate training.

E. Refer to drawings for wiring requirements.

F. System Analysis

1. The VFD supplier shall perform a computer simulated power system study to verify compliance with the parameters as stated herein. The results of this study shall be submitted to the engineer. At a minimum the submitted results of this study shall include:
   a. A brief summary of the equations and calculation procedures used in the study.
   b. A results summary sheet which briefly describes the power system configuration analyzed and which states the calculated values of total harmonic distortion, notch depth and notch area.
   c. Computer generated graphs which illustrate the voltage and current waveforms of the power system with the VFD’s operating. These waveform graphs shall directly illustrate the results of the power system computer model study.
   d. Detailed list of the amplitude of harmonic currents and voltages to the 50th harmonic.

2. The contractor shall supply the VFD supplier with all power system data required to perform the above described study. These data may include but are not limited to:
   a. A complete one-line diagram of the subject electrical distribution system. The diagram must show the lengths of all bus and cable runs, impedance values of all types of bus and cable used, and number of conductors per phase.
   b. Complete electrical data on all equipment shown on the one line diagram is required. At a minimum this data shall consist of: Transformers - kVA, Primary voltage, Secondary voltage, Short circuit capacity or impedance. Motors - Stator resistance, No load RMS current, No load kVA, No load kW, Locked rotor RMS current, Locked rotor kVA, Locked rotor kW, Horsepower, Base speed, Number of poles, Efficiency at relevant speeds, Power factor at relevant speeds, Full load RMS current. Generators - Short circuit capacity or Subtransient reactances (Xd), Power factor, kW, X/R Ratio.
   c. If the distribution system can function in more than one configuration, the configuration(s) to be analyzed shall be clearly defined. Any other information which may affect the behavior of the distribution system shall also be provided.

2.28 CABLE SEALS

A. Conduit sealing bushings to seal the ends of conduits entering enclosures from below grade shall be OZ Gedney Co., Type CSB Series or equal.
2.29 **ELECTRICAL HAND HOLES**
   A. Electrical hand holes shall be Composolite as manufactured by Strongwell Corporation or equivalent. Precast concrete hand holes as detailed on the Drawings shall also be acceptable. Hand holes shall be sized per the N.E.C. according to number and sizes of entering conduits. All hand holes shall be rated for H2O wheel loading. Separate hand holes and conduit systems shall be provided for power, control, and instrumentation systems.

2.30 **FINAL AS-BUILT RECORD DRAWINGS**
   A. During the ongoing construction the contractor shall maintain a clean set of full size drawings for markup. The drawings shall be red lined and marked up with all appropriately noted changes noting the as-built condition. Upon completion of the project the set of as-built markups shall be provided to the Engineer for final AutoCAD revisions.

2.31 **COMPLETE ELECTRICAL DISTRIBUTION EQUIPMENT SUPPLIER**
   A. All electrical distribution equipment submitted for this project shall be by a single equipment manufacturer. Multiple suppliers of this equipment shall not be acceptable. The following manufactures shall be acceptable:
      1. Square D Company
      2. Cutler-Hammer
      3. or Equal.

**PART 3 - INSTALLATION**

3.1 **RACEWAYS AND FITTINGS**
   A. Unless otherwise indicated on the Drawings, install all wiring in the following applicable raceway system:
      1. Wiring 600 volts or less in outdoor, below or above grade locations (NEMA 4X): Aluminum or galvanized rigid galvanized steel.
      2. Wiring 600 volts or less in hazardous locations (NEMA 7 or 9): PVC coated galvanized rigid steel conduit.
      3. Underground Raceways
         a. Underground raceways shall be Schedule 80 extra heavy wall PVC conduit except for signal conduit raceways which shall be rigid steel conduit.
         b. Refer to drawings for specific concrete encasement duct bank details and requirements. Service underground duct banks shall be completely concrete encased. Schedule 40 PVC allowed for conduit runs other than Signal conduits. All other conduits are to be sand encased.
   
   B. Where conduit extends out from underground or enters a structure/building or utility pole, it shall be installed as galvanized rigid steel conduit. This shall remain galvanized rigid steel to its final destination.
   
   C. Where conduits are installed concealed within or below concrete slab and extend up through concrete shall be PVC coated galvanized rigid steel conduit sweeps shall be installed at all locations and shall remain galvanized rigid steel conduit for all
exposed areas.
D. No wire shall be pulled until the raceway system is complete in all details.
E. The ends of all raceways shall be tightly capped to exclude dust and moisture during the construction period. Caps shall be of a UL Listed type specifically used for this purpose. Rags, papers, etc. shall not be used.
F. Raceways terminating in gasketed enclosures shall be terminated with conduit hubs.
G. Raceways installed underground shall be encased in concrete and laid on trenches on mats of bank gravel or sand not less than six inch thick and well graded.
H. Provide long radius rigid steel conduit sweeps at entrances to equipment from underground.
I. Provide conduit expansion fittings as required. Install per manufacturers recommendation.

3.2 WIRES AND CABLES
A. All conductors shall be carefully handled to avoid kinks or damage to insulation.
B. Alarm wires shall be uniquely identified at each end with wire markers. A typed list of the numbers used and their function (alarm served) shall be submitted to the Engineer by the Contractor.
C. All wiring shall be continuous without splices with the exception of instrumentation and pump wiring where required to make equipment connections.
D. After installation of service conductors seal conduits in pump station with duct seal.
E. Grouping of Conductors
   1. Contractor may group certain wiring with the approval of the Engineer, as follows.
      a. Power 120V may be grouped with power 120V
      b. Control 120V may be grouped with control 120V
      c. Control 24V may be grouped with control 24V
      d. Instrumentation may be grouped with instrumentation
      e. Specialty wiring may be grouped with like systems
      f. Power wiring at 480V shall not be grouped

The installation shall be installed in accordance with all requirements of the NEC (including wire ampacity derating factors), manufacturer's requirements, and the Engineer. Excessive grouping which interferes with functionality and reliability will not be allowed. The wiring configuration as shown on the drawings is the baseline requirement for the work.

3.3 GROUNDING
A. Provide grounding conductors from ground electrodes to equipment as shown on the Drawings.
B. Do not use conduit as the ground and/or bonding conductor.
C. Bond ground terminal of receptacles to outlet boxes with #12 AWG green insulated wire.
D. Ground conduit system and neutral conductor of wiring system with a connection at the main electrical service breaker.
E. The grounding network shall be connected to metallic water piping system, at two or more locations, with stranded copper, AWG, Green Insulated Conductor of the
same size as grounding electrode conductor shown on the drawings or required by the National Electrical Code (NEC).

F. Make connections to ground rods with an exothermic welding process. Mechanical connections may be made at equipment only.

G. Ensure that a ground loop is not formed between equipment ground in electrical conduit and grounding electrode conductors directly connected to ground electrodes.

H. Group and bond ground wires to panel boxes, light fixtures, receptacles, etc., not to system neutral.

I. Make connection to water pipe with a suitable ground clamp or lug connection. If flanged pipes are encountered, make connection with lug bolted to flange connections.

J. Bond and ground all conduit systems.

3.4 EQUIPMENT

A. The inside of all equipment and enclosures shall be checked for tools and vacuumed cleaned of any debris.

B. The Contractor shall be responsible to ensure that all connections to motors, distribution equipment, and control panels are tightened to manufactures recommendations.

3.5 TESTS

A. The entire grounding network resistance to be meggered and certified results recorded and submitted with no exceptions to the Engineer. Resistance shall not exceed 25 Ohms.

B. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform the function for which they are designed.

C. Adjust all settings on protective equipment and verify, check and establish with the power company that the secondary voltage is within 2% of rated voltage.

D. Test and set all motor circuit protectors, motor overload heaters to the nameplate horsepower of the equipment; and all circuit breaker settings in all electrical equipment shall be tested and verified operational.

E. Three phase panelboard’s line currents shall be balanced to within 10% of each other.

F. For all feeder wiring rated 600 volts or less, provide 1,000 volt "Megger" insulation test prior to energizing feeders. Use a motor-driven megger for all tests. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors. Document test results and submit to engineer. There shall be no exceptions taken by the Engineer before conductors are to be energized. See attached table at end of this section for recording data and submission to the Engineer.

G. Three phase motors shall be checked for rotation and, if necessary, reverse the connections at the starter. Single phase and DC motors at motor connection box.

H. VFD START UP, TESTING AND VERIFICATION

1. Responsibility and Coordination: The VFD manufacture, supplier and electrical subcontractor are responsible for adjusting all of the VFD parameters for a fully functional system integrated with the instrumentation and control.
systems for this project. The VFD supplier and electrical subcontractor are responsible for coordinating with the instrumentation subcontractor and the instrumentation programmer so the control systems function as intended as described in the instrumentation control descriptions.

2. VFD Parameter Setup: Complete the VFD Parameter Setup Checklist and Verification below in the presence of the specifying engineer.

3. The electrical subcontractor shall be responsible to coordinate an onsite meeting with the VFD manufacturers technician and the specifying engineer. This meeting shall take place prior to the initial startup of the equipment.
VFD PARAMETER SETUP CHECKLIST

[ENTER NAME OF FACILITY]

☐ 1. Ramp up speed
☐ 2. Ramp down speed
☐ 3. Min speed (Hz)
☐ 4. Max speed (Hz)
☐ 5. 4-20mA setting at min speed (mA)
☐ 6. 4-20mA setting at max speed (mA)
☐ 7. Output scale calibration
☐ 8. Auto restart after power failure (yes/no)
☐ 9. Auto restart after overcurrent fault (yes/no)
☐ 10. Speed reference (internal/external)
☐ 11. If external - signal source
☐ 12. If external - signal type
☐ 13. Restart after E-Stop (yes/no)
☐ 14. Discrete outputs - Run (yes/no)
☐ 15. Discrete outputs - Fault (yes/no)
☐ 16. Analog outputs - Amps (absolute units)
☐ 17. Analog outputs - KW (absolute units)
☐ 18. Analog outputs - Speed (Hz)
☐ 19. Analog outputs - Speed (RPM)
☐ 20. Analog inputs - 4mA set to 0Hz (yes/no)
☐ 21. Analog inputs - 20mA set to 60Hz (yes/no)
☐ 22. Analog inputs - min speed limit set (yes/no)
☐ 23. Analog inputs - max speed limit set (yes/no)
☐ 24. Voltage boost (%)
☐ 25. Starting frequency (Hz)
☐ 26. PMW carrier frequency (Hz)
☐ 27. Acceleration time (sec)
☐ 28. Deceleration time (sec)
☐ 29. Forward run (yes/no)
☐ 30. Reverse run (yes/no)
☐ 31. Overload (60%-100%)
VFD PARAMETER SETUP VERIFICATION

[ENTER NAME OF FACILITY]

Date: 

General Contractor:

Electrical Subcontractor:

VFD Supplier:

This certifies that the VFD parameters have been coordinated per the specifications and the requirements of this section.

____________________________________________      ____________________
(Authorized Representative of the General Contractor) Date

____________________________________________      ____________________
(Authorized Representative of the Electrical Subcontractor) Date

____________________________________________     ____________________
(Authorized Representative of the VFD Supplier)  Date
# PUMP STATION "NAME"
## MEGGER TEST RESULTS

**Project:**

**Temperature:**

**Date:**

**Weather:**

**Location:**

**Test Equipment:**

**Equipment / Feeder Under Test:**

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**Make:**

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**Test Voltage:**

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**Notes:**

Megger test only should record 5 minute value

Polarization Index (P.I.) is 10 min reading divided by 1 min reading

**END OF SECTION**
PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a complete standby power system as indicated in the Contract Documents. The system shall be a factory built, prototype tested, production tested, field tested, complete and operable emergency / standby electric generating system, including all devices and equipment specified herein, shown on the Drawings, and/or as required for the service. Materials and equipment shall be new and current, delivered to the site completely wired, tested, and ready for installation. This system shall include the following:

1. An outdoor diesel engine driven electric plant with an integrated fuel tank to provide standby electric power.
2. Engine-generator control console resiliently mounted on each generating set shall include complete engine start-stop control and monitoring system.
3. Starting batteries with battery charger for each engine-generator set.
4. Automatic load transfer controls are to be provided by the generator equipment supplier. Refer to section 16000 for additional information.
5. Mount any and all loose accessories, control devices, and other equipment as specified herein and/or as shown on Drawings.
6. Such other components, accessories, parts, tests, documents, and services, as needed, to meet the performance requirements of this specification.
7. All necessary interconnecting wiring and connections to provide proper system operation.
8. Field testing, start up, and automatic transfer switch parameter set up as specified in Section 3 of this section. Refer to requirements of Section 01800 for startup, testing and operator training.

B. This equipment, including engine-generator sets shall be manufactured by a single manufacturer who has been regularly engaged in the production of engine-generator sets for a minimum of ten years.

1. The electric generating system described herein, including these components shall be factory built, factory tested, and shipped by this single manufacturer, so there is one source of supply and responsibility for warranty, parts, and service. This manufacturer shall have a representative based 150 miles who can provide factory trained servicemen on a 24-hour per day basis, required stock of replacement parts, and technical assistance.
2. Different manufacturers for the engine-generator set and the automatic load transfer controls will be acceptable providing that the equipment is completely coordinated, reviewed, integrated and written verification is provided that this system equipment is completely compatible before shipment and the engine-
generator set manufacturer is the source of responsibility for a complete and operational system interface between this equipment.

3. The responsibility for performance to this specification in its entirety cannot be split up among individual suppliers of components comprising the system, but must be assumed solely by the supplier of the system. The manufacturer shall furnish schematic and wiring diagrams for the engine-generator set(s).

4. All controls shall be the standard of the manufacturer, who is engaged in the manufacture of generators and has them available for sale on the open market. Control parts shall be identified by part numbers of this manufacturer and shall have second source listing where applicable. Control systems that are supplied by a sub-vendor or subcontractor of the vendor and not incorporated within the documentation drawings of the generator manufacturer are not acceptable.

5. Complete load bank, building load testing, sound level testing and system equipment checkout will be required to be performed as part of the overall acceptance of this equipment.

C. The work of this section shall also include the overall supervision, start-up and testing of an owner-furnished, existing, diesel-fueled, emergency standby generator. The responsibility of the generator manufacturer is to provide services and oversight for re-connection of the existing generator for the intended application as outlined within the guidelines of the contract documents. Refer to specific requirements noted under this section of the work.

1.2 QUALITY ASSURANCE

A. The electric generating system must meet all requirements of NFPA 110 (Level 2) including design specifications, prototype tests, one-step full-load pickup, and installation acceptance.

B. The performance of the electric plant shall be certified by the manufacturer verifying the electric plant's full power rating, stability and voltage and frequency regulation.

C. The complete standby power system installation, start-up and operating instructions shall be performed under the supervision of a factory-trained engineer/representative of the system manufacturer.

D. Provide sound attenuation to meet local ordinances.

E. Acceptable Manufacturers:

1. Electric Plant:
   a. Caterpillar
   b. No equal

2. Automatic Load Transfer Controls:
   a. Specified under Section 16000. Refer to this related section for additional requirements.

3. The equipment spacing, mounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around the D80GC model.

F. Service:

1. Replacement parts and competent service shall be available within the New England states.
1.3 **SUBMITTALS TO THE ENGINEER**

1. Submittals shall be provided in accordance with Sections 01340, 16000 and as specified in this section: Complete typewritten description of system operation(s), and ratings, including a listing of all auxiliary devices.

2. Manufacturer's data sheets and detailed dimensioned drawings for all pieces of equipment and auxiliary devices.
   a. Dimensioned drawings of the fuel tank as applicable shall include interior and exterior dimensions. The fuel shut-off and alarm levels shall be called out graphically or as a note.
   b. Cutsheets for fuel tank appurtenances, including level sensors, alarm floats, fill valve, tank gauge, etc.
   c. Detailed shop drawings for access platforms indicating design criteria stamped by a Professional Engineer registered in the Project state.

3. Complete interconnecting wiring diagrams, cross referenced with equipment designations indicated in the Contract Documents, indicating all required wiring between the electric plant control panel, the automatic load transfer controls and all auxiliary devices.

4. Independent testing laboratory reports indicating the performance test results of the electric plants including power rating, stability and voltage and frequency regulation.

5. Unless specified otherwise herein, all performance data and other information shall be as on the manufacturer's printed literature. Performance data shall be the result of test procedures in accordance with nationally recognized standards, plus such other procedures that are judged necessary by the manufacturer to ensure maximum service reliability for emergency systems, and shall be available for inspection by the Engineer upon request.

6. Equipment supplier shall submit complete detailed step load program and calculations as part of the shop drawing submittal to demonstrate compliance with the motor starting and performance criteria as specified elsewhere in this Section.

7. All testing data sheets for load bank testing results, building load testing and sound level testing shall be submitted for final acceptance.

8. The supplier shall submit an engineered product for the specific application noted herein. Therefore, if the load equipment consists of a non-linear type application the supplier is required to perform a harmonic analysis of the generator determining both current and voltage distortion levels along with total harmonic distortion (THD) for the system based on the step loads assigned under this Section.

9. Layout plans and wiring diagrams of day tank and components of fuel transfer pumping system.

10. Qualifications of the ICC certified installer.

11. The system manufacturer’s authorized local dealer shall furnish copies each of the manuals for each generator (total of 4 complete sets) and books listed below to be kept inside the enclosure and one set for the Owner's files for each unit under this contract. The manufacturer shall also provide four CD's with each
of the manuals, instructions, lists, procedures, charts, wire diagrams, and schematics on them.

a. OPERATING INSTRUCTIONS - with description and illustration of all switchgear controls and indicators; and engine and generator controls and indicators.

b. PARTS CD - that illustrates and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).

c. PREVENTATIVE MAINTENANCE INSTRUCTIONS - on the complete system that cover daily, weekly, monthly, biannual, and annual maintenance requirements and include a complete lubrication chart.

d. ROUTINE TEST PROCEDURES - for all electronic and electrical circuits and for the main AC generator.

e. TROUBLESHOOTING CHART - covering the complete Genset showing description of trouble, probable cause, and suggested remedy.

f. RECOMMENDED SPARE PARTS LIST - showing all consumables anticipated to be required during routine maintenance and test.

g. WIRING DIAGRAMS AND SCHEMATICS - showing function of all electrical components, corrected as required showing as-built conditions.

1.4 TESTING

A. The intent of this specification is to provide equipment of proven reliability and compatibility. Three separate series of tests shall be performed: Factory Prototype Model Tests, Factory Production Model Tests, and Field Tests.

1. Factory Prototype Model Tests: The electric generating system consisting of prime mover, generator, governor, coupling and all controls must have been tested as complete unit on representative engineering prototype model as required by NFPA 110. The tests, being potentially damaging to the equipment tested, must not be performed on equipment to be sold, but on separate prototype models as specified by NFPA 110, paragraph 3-2.1 thru 3-2.1.2 and their accomplishment certified by means of documentation of the tests accompanying submittal data. These tests shall have included:

a. Maximum power level (maximum kW).

b. Maximum motor starting capacity (maximum KVA) and voltage dip recovery within seven (7) cycles of applied load.

c. Structural soundness (Short-Circuit and Endurance Tests).

d. Torsio graph Analysis: The manufacturer of the engine-generator set shall verify that the engine-generator combination, as configured, is free from harmful torsional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype unit. The empirical data must include spectrum analysis of the torsional transducer output within the critical speed range of the engine-generator set. Results of this analysis shall be made available to the specifier on request. Calculations based on engine and generator separately are not acceptable.

e. Engine-generator cooling and combustion air requirements.

f. Transient response and steady-state speed control and voltage regulation.

g. Generator temperature rise per NEMA MG1-22.40.
h. Harmonic analysis and voltage waveform deviation per MIL-STD-705B, method 601.4 and as specified and required under this section. Refer to previously noted requirements.

i. Three-phase short-circuit test for mechanical and electrical strength. With system operating at rated volts, amps, power factor, and speed, the generator terminals must be short circuited ten times on all three phases for a duration of thirty seconds. Engine-generator set must build up and perform normally without manual interventions of any kind such as resetting of circuit breakers or other tripping devices when the short circuit is removed.

j. Failure mode test for voltage regulator. With engine-generator set operating at no load, rated speed and voltage, the AC sensing circuit to the regulator must be disconnected for a period of at least one hour. The engine-generator set must be fully operative after the test, and without evidence of damage.

k. Endurance testing is required to detect and correct potential electrical and mechanical problems associated with typical operation.

l. Paralleling Test: For paralleling applications the manufacturer shall have performed and certified that the engine-generator set(s) can withstand 180° out-of-phase paralleling from full rated voltage and speed without sustaining any mechanical or electrical damage.

2. Factory Production Model Tests: Before shipment of the equipment, the engine-generator set(s) shall be tested under rated load and power factor for performance and proper functioning of control and interfacing circuits. Testing at unity power factor only (resistance banks only) is not acceptable, since kW output is affected by the higher generator efficiency at unity power factor, and the KVAR for motor starting and regulation loads varies with power factor. Tests shall include:
   b. Transient and voltage dip responses and steady state voltage and speed (frequency) checks.

   A summary of these test results shall be submitted a minimum of one month before the date of substantial completion.

1.5 LOADS AND REQUIREMENTS

A. The specific loads and requirements have been provided for the generator starting, running and shutdown requirements. Therefore, all responsibility for proper operation and regulation shall be provided by the supplier of this equipment. If this is not completely understood or included for the performance of this equipment then it shall be grounds for rejection of this equipment. The submittal requirements have been specifically noted in order to avoid any possible issues regarding improper operation of the standby power system. It shall be clearly understood and noted that the supplier will be responsible to provide all documentation and requirements set forth under this section for review and approval.
1.6 **WARRANTY**

A. The complete standby electric power system, including 1800 r/min engine-generator set shall be warranted for a period of five (5) years or fifteen hundred (1,500) operating hours, whichever occurs first, from the date of Substantial Completion. Multiple warranties for individual components (engine, generator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. This warranty shall be detailed in available written documents. In the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. **General:**

1. This system shall include an engine-generator set at each site meeting or exceeding the minimum ratings as tabulated below, on a continuous standby basis. The sizing and selection of the specified generator has been based upon the specific manufacturer based upon the software design of this product.

<table>
<thead>
<tr>
<th>Maximum Allowable Starting Voltage Dip</th>
<th>Maximum Allowable Peak Voltage Dip</th>
<th>Maximum Allowable Freq. Dip</th>
<th>Maximum Surge kW Capability</th>
<th>Maximum Surge kVA Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>20%</td>
<td>10%</td>
<td>Per Manufacturer</td>
<td>Per Manufacturer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KW</th>
<th>KVA</th>
<th>Power Factor</th>
<th>Hz</th>
<th>Volts</th>
<th>Phase/Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>100</td>
<td>0.8</td>
<td>60</td>
<td>480/277</td>
<td>3 Phase, 4 Wire</td>
</tr>
</tbody>
</table>

2. The engine generator set shall be capable of reliably starting the connected loads in the order listed in the table below. This shall be accomplished without exceeding the voltage and frequency dip specifications, and without causing unacceptable operation of electrical equipment. These load steps shall be coordinated with the Division 13 Integrator for proper staging of loads upon a power loss.

<table>
<thead>
<tr>
<th>Load Name:</th>
<th>Load Rating (HP / kVA)</th>
<th>Starting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base load</td>
<td>5 KVA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Step 2:</strong></th>
<th>Load Rating (HP / kVA)</th>
<th>Starting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump 1 or Pump 2</td>
<td>1-75 HP</td>
<td>VFD PWM</td>
</tr>
</tbody>
</table>

*FVNR = Across the Line*

*VFD PWM = Variable Frequency Drive, Pulse-Width-Modulated*
3. The Standby Power System supplier shall have a complete understanding of the loads to be started and operated on emergency power, and the generator shall be properly sized and configured to perform the intended function.

4. Each engine-generator set shall be mounted on a heavy duty steel base to maintain proper alignment between components, and each set shall incorporate vibration isolators of the type and quantity as specified by the set manufacturer, whether mounted internally or externally to the set.

5. The total loading on the standby generator shall not exceed 90%. Any submitted generator program submitted which does not meet this criteria are terms for automatic rejection based on discretion of the Engineer.

B. Engine:

1. Each engine shall be certified to U.S. EPA Emergency Only Use Emission regulations at the time of installation/commissioning in the state where being installed. Each engine shall be certified to U.S. EPA Non-Road Source Emission Standards, 40 CFR 89 and 310 CMR7.26, in effect as of January 1, 2012 proposed generator set shall be EPA Tier 3 certified and in compliance with the state of Maine, Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier emissions standards per ISO 8178 - D2 Emissions Cycle at specified ekW /bHP rating. Utilization of the “Transition Program for Equipment Manufacturers” also known as “Flex Credits” to achieve Tier certification will not be accepted.

3. Engine shall be liquid-cooled, diesel for use with ultra low sulfur diesel fuel. Design shall be turbocharged and intercooled where required by engine manufacturer.

4. Engine shall be certified by the engine manufacturer as capable of driving a generator yielding a kW rating as specified herein. Engine shall be capable of driving the generator of this rating on a continuous standby basis for the duration of normal utility source interruptions per SAE J1349 conditions.

5. Fuel injection and valves shall not require adjustment while in service.

6. Maximum ambient air temperature 113°C.

7. Engine equipment shall include the following:
   a. An electric starter(s) as required by the manufacturer.
   b. Positive displacement, mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements and dipstick oil level indicator.
   c. Fuel filter with replaceable element, and an engine driven, mechanical positive displacement fuel pump, all mounted on the engine. Replaceable dry element air cleaner.
   d. Engine speed isochronous electronic governing system to control generator frequency within ±0.25% of rated frequency under steady state load conditions, and capable of parallel operation with load sharing controls.
   e. Engine protection devices shall have sensing elements located on the engine to initiate the following preliminary alarms and engine shutdowns:
i. Low coolant temperature alarm
ii. Low lubrication oil pressure alarm
iii. High coolant temperature alarm
iv. Low lubrication oil pressure shutdown
v. High coolant temperature shutdown
vi. Overspeed shutdown
vii. Overcrank lockout
viii. Low coolant level shutdown

f. Engine starter battery charging alternator with solid-state voltage regulator.

g. Engine mounted thermostatically controlled water jacket heater(s) for engine to aid in quick starting. Heater(s) shall be rated 1500W, 120V, single, 60 HZ for the proper sizing and requirements of this unit.

8. Cooling System:
a. Engine shall be radiator cooled by engine mounted radiator system including belt-driven pusher fan, coolant pump, coolant level sensor, and thermostat temperature control. Performance of components shall be as required by set manufacturer.
b. Radiators shall be provided with a duct adapter flange permitting the attachment of air discharge duct directing the discharge of radiator air through the wall.
c. The cooling system shall be sized to operate at full load conditions and 113°F ambient air entering the room.

9. Engine Exhaust System:
a. Exhaust muffler shall be provided for each engine of size as recommended by the set manufacturer. Muffler shall be of the side inlet, end outlet type and critical grade type. Provide support for the muffler so its weight is not supported by the engine.
b. Stainless steel flexible exhaust connection shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.
c. All components shall be properly sized to assure proper operation without excessive back pressure when installed as shown on drawings.
d. Provide guards or insulation as required by UL2200 at all "hot" locations of the generator including exhaust manifolds, flexible connections, etc., for a complete installation. Where not recommended or required for this application, the supplier is required to meet all safety and protective requirements of this section for alternative methods.
e. Exhaust system shall be insulated and installed as specified in Division 1

10. Diesel Fuel System:
a. Provide a sub-base fuel tank with level gauge. The tank shall be new, unused, and shall not be galvanized. Tank shall be UL listed for secondary containment, dual wall, with rupture basin switch. The manufacturer shall size the tank to provide a minimum of 24 hours of operation based on 75% loading or actual loading of the generator, whichever is larger.
i. For exterior installations, fuel tank shall include tanks markings on
all approachable sides indicating tank number, product type, NFPA 704 diamond, safe fill height. Labels shall have 2-inch high letters.

ii. For interior installations, also include NFPA 704 diamond at all room entry points.

iii. For interior installations, provide a remote level gauge, overfill valve, and fill point secondary containment at fill station.

b. A low fuel supply sensing device shall be installed on the fuel tank for monitoring a low fuel level and also for sending a low level alarm.

c. Provide a high level fuel alarm for 90% and 95% full.

d. Provide a secondary containment leak detection device.

e. Provide an overfull protection valve and spill box at fill station.

f. The fuel tank shall be provided with a [2-inch] exterior fill line with lockable cap (“tight fill type”), a [2-inch] exterior vent line with approved vent cap, and a [2-inch] emergency vent line with approved vent cap. The fill line, vent line, emergency vent line, etc. shall be located outside the generator building to meet local code requirements and approval. Piping shall be sloped 1/8-inch/ft minimum. Provide complete details along with fuel tank drawings and assembly.

C. Generator

1. Generator shall be single-bearing, 2/3rd pitch, self-aligning, four-pole, synchronous type, revolving field, with amortisseur windings, with direct drive centrifugal blower for proper cooling and minimum noise, with temperature compensated solid-state voltage regulator, with brushless PMG exciter system. No brushes will be allowed. Telephone influence factor less than 50 per NEMA MG1-22.43.

2. Generator shall be directly connected to engine flywheel housing and driven through a flexible coupling to ensure permanent alignment; gear driven generators are not acceptable under this specification.

3. Gear reducers are not acceptable. Maximum speed of generator shall be 1800 RPM.

4. Insulation shall meet NEMA standards for Class H.

5. The maximum alternator temperature rise shall not exceed 125°C above ambient. Generator design shall prevent potentially damaging shaft currents.

6. The three-phase, broad range, reconnectable generator shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit.

7. Voltage regulator shall be solid-state design and shall function by controlling the exciter magnetic field between stator and rotor to provide no load to full load regulation of rated voltage within ±1% during steady-state conditions.

   a. The engine-generator set and regulator must sustain at least 90% of no load voltage for ten (10) seconds with 250 % of rated load at near zero power factor connected to its terminals.

   b. The voltage regulator shall be insensitive to severe load induced waveshape distortion from SCR or thyristor circuits such as those used in battery charging (UPS), solid state reduced voltage starting, surge control
applications, variable frequency drives (VFD's), and motor speed control equipment.

c. A rheostat shall provide a minimum of ±5% voltage adjustment from rated value.

d. Provide subtransient reactance to levels which allow for IEEE 519 harmonic mitigation. The subtransient reactance of this generator shall be set based upon the largest and most efficient alternator which will fit this generator at the maximum alternator temperature riser specified herein. Minimum subtransient reactance shall not exceed 0.012 per unit.

8. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine-generator set manufacturer so that the characteristics shall be matched to the torque curve of the prime mover. This design allows the prime mover to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to provide the fastest possible system recovery from transient speed dips. A system that routinely selects a linear-type (straight line) constant volts/hertz characteristic, without regard for the engine power and torque characteristics, will not meet this specification.

9. PMG Exciter shall be three-phase, full-wave, rectified, with heavy-duty silicon diodes mounted on the common rotor shaft and sized for maximum motor starting loads.

10. Generator design shall be of the self-protecting type, as demonstrated by the prototype short-circuit test as described under "Testing" herein. All other generator performance criteria shall be equal to that of the specified equipment.

D. Engine-Generator Set Control:

1. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The generator set mounted control shall include the following features and functions. The control panel shall be mounted at an accessible height with all controls and screens viewable at eye level.

2. Control Switches
   a. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
   b. EMERGENCY STOP switch. Switch shall be Red “mushroom-head” push-button. Depressing the emergency stop switch shall cause the
generator set to immediately shut down, and be locked out from automatic restarting.

c. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

d. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

3. Generator Set Alarm and Status Display
a. The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
   - low oil pressure (alarm)
   - low oil pressure (shutdown)
   - oil pressure sender failure (alarm)
   - low coolant temperature (alarm)
   - high coolant temperature (alarm)
   - high coolant temperature (shutdown)
   - engine temperature sender failure (alarm)
   - low coolant level (alarm or shutdown—selectable)
   - fail to crank (shutdown)
   - fail to start/overcrank (shutdown)
   - overspeed (shutdown)
   - low DC voltage (alarm)
   - high DC voltage (alarm)
   - weak battery (alarm)
   - low fuel-daytank (alarm)
   - high AC voltage (shutdown)
   - low AC voltage (shutdown)
   - over frequency
   - under frequency (shutdown)
   - over current (warning)
   - over current (shutdown)
   - short circuit (shutdown)
   - ground fault (alarm) (optional—when required by code or specified)
   - over load (alarm)
   - emergency stop (shutdown)
   - generator reverse power (shutdown)
   - loss of excitation (shutdown)
   - instantaneous over excitation (shutdown)
— time over excitation (shutdown)
— loss of sensing (shutdown)
— loss of PMG (alarm)

b. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

4. Engine Status Monitoring
   a. The following information shall be available from a digital status panel on the generator set control:
      i. engine oil pressure (psi or kPA)
      ii. engine coolant temperature (degrees F or C)
      iii. engine oil temperature (degrees F or C)
      iv. engine speed (rpm)
      v. number of hours of operation (hours)
      vi. number of start attempts
      vii. battery voltage (DC volts)
   b. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
   c. Provide auxiliary dry contacts for remote indication for the following:
      i. Generator Run Status
      ii. Generator Failure Alarm
      iii. Generator Warning Alarm
      iv. Low Fuel Alarm
      v. Fuel Rupture Alarm
      vi. Low Battery Alarm

5. Engine Control Functions
   a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
   b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
   c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
   d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components and actual failure conditions.

6. Alternator Control Functions

a. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

b. Controls shall be provided to monitor the output current of the generator set and initiate and alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

c. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
f. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 12VDC or more than 16 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and if DC voltage drops to less than 8 volts for more than two seconds a “weak battery” alarm shall be initiated.

g. When required by National Electrical Code or indicated on project drawings, the Control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

E. Auxiliary Equipment:
1. Starting Battery: Batteries shall be supplied for each engine and shall be mounted in a battery rack within the engine-generator set skidbase. Batteries shall be 12 volt, heavy duty, diesel starting lead-acid type. Provide number of batteries based on starting requirements of generator.

2. Battery Charger(s): A voltage regulated battery charger shall be provided for each engine-generator set. Chargers shall be equipped with float, taper, and equalize charge settings. The battery charger shall provide dry contact alarms for loss of AC power, weak battery, and high battery.

3. External emergency stop station, provide a pad-lockable NEMA 4X cast box with larger red mushroom push off and pull on type device. Depressing the emergency E-Stop shall cause the generator set to immediately shut down and be locked out from restarting. E-Stop to be installed on the outside of the generator enclosure.

F. Auxiliary Equipment:
1. The Generator set housing shall be provided factory-assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified.

2. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable.

3. All sheet-metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating which meets the following requirements:
   a. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
   b. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
   c. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
   d. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
   e. Salt Spray, per ASTM B117-90, 1000+hours
   f. Humidity, per ASTM D2247-92, 1000+ hours
   g. Water Soak, per ASTM D2247-92, 1000+ hours
4. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

5. Sound-attenuation enclosure shall reduce sound levels as follows:

**Sound Level Requirements**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Sound Pressure Levels dBA at Full Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caterpillar</td>
<td>74.9</td>
</tr>
</tbody>
</table>

6. Provide a complete and assembled Level 2, sound attenuated outdoor weather-protective engine generator unit for mounting on a concrete pad as shown on the contract drawings. Provide concrete pad installation requirements to concrete contractor.

7. All equipment located and supplied within the enclosure shall be pre-wired by the generator manufacturer except for the battery charger and block heater which shall be wired in the field by the contractor.

8. The enclosure shall have all vibration isolation and shall be bolted to an outside concrete pad.

9. Refer to drawings for additional information.

10. Provide final field testing of sound levels as specified and as required by each city or town sound level requirements.

**PART 3 - EXECUTION**

3.1 **INSTALLATION**

A. Installation shall be made in complete accordance with manufacturer's recommendations.

B. Install unit on concrete base to provide for servicing access and oil pan removal.

C. Flexible connections shall be used on all connections to unit.

D. Fill the engine cooling system with a solution of 50 percent ethylene glycol and water.

E. Support muffler so that its weight is not supported by the engine. Exhaust pipe sizing shall be as required to maintain exhaust backpressure within the limits established by the generator set manufacturer.

F. Bond steel base, generator and engine frames and all equipment enclosures to main ground electrodes.

G. Provide a minimum of 4 - 3/4” stainless steel epoxy anchors to fasten the generator to the concrete foundation.

H. The external emergency E-Stop switch for remote mounting shall be installed outside of the generator room as shown on drawings.
3.2 FIELD TESTS AFTER INSTALLATION

A. Prior to adding any fuel to the system, the generator shall be inspected, reviewed and approved by the NHDES, including site inspection. Refer to ENV-OR-300 requirements. The fuel tank and piping shall be pressure testing per NFPA 30. The Generator Manufacturer shall be present for this inspection and shall have the credentials of the ICC installer on-hand.

B. The complete installation shall be initially started and checked out for operational compliance by factory-trained representative(s) of the engine-generator set(s) manufacturer. The engine lubrication oil as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the engine-generator set(s) supplier.

C. Upon completion of initial start-up and system checkout, the supplier of the system shall perform a field test in the presence of the Contractor, Engineer and Owner's operating personnel to demonstrate load carrying capability and voltage and frequency stability.

D. The Contractor shall provide all fuel required for start-up and testing. Contractor shall make the necessary arrangements to have the fuel available when needed for start-up and testing. Upon completion of testing, Contractor shall top off the fuel tank.

E. The Contractor shall supply a complete electrical system operating and functional in order to verify that generator will start the connected loads in the order specified and load bank testing.

F. 100% Load shall consist of resistive load bank. Unity power factor is suitable for on-site testing, provided that rated load tests at power factor have been performed by the manufacturer prior to shipment.

G. Record Keeping for resistive load bank and building load tests
   1. Records shall be maintained throughout the resistive load bank and building load tests consisting of:
      a. Time-of-day
      b. Coolant temperature
      c. Cranking time until prime mover starts and runs
      d. Time required to come up to operating speed, voltage and frequency overshoot
      e. Time required to achieve steady-state condition with all switches transferred to the emergency position
      f. Voltage
      g. Frequency
      h. Current
      i. Oil pressure
      j. Ambient air temperature
      k. Kilowatts
      l. Power factor
      m. Battery charger rate at 5 minute intervals for the first 15 minutes
   2. Data shall be recorded at 15 minute intervals throughout the test.
   3. Continue this load test for 2 hours per NFPA 110, observing and recording load changes and the resultant effect on voltage and frequency.
4. Return normal power, record the time delay on retransfer for each switch (set for 15 minutes minimum) and the time delay on prime mover cooldown period and shutdown.

5. Upon completion of the above test, allow the prime mover to cool for 5 minutes. Then apply available building load via Automatic Transfer Switch. A power failure shall be initiated by opening all switches or breakers supplying the normal power to the building or facility. This load pickup shall be in one step immediately upon reaching rated RPM.

H. During or after the tests, the Owner's operating personnel shall be fully instructed by the factory-trained representative in the operation and maintenance of this equipment.

I. Perform a building load test with the actual conditions of the load. This must be coordinated as a separate site visit for each station. Coordinate with Owner and Engineer to setup time and conditions of testing.

J. The manufacturer's representative shall test and verify all protective functions of the generator control by accessing the control system through the use of a laptop computer and simulating failure modes or fault conditions.

K. Perform and test sound level values for each of the sites based on conditions set forth in the specifications.
STANDBY POWER SYSTEM
AUTOMATIC TRANSFER SWITCH SET-UP AND CONFIGURATION

Date: ________________________________

Project: ________________________________________________________________

Contractor: _____________________________________________________________

Equipment Manufacturer: _________________________________________________

Automatic Transfer Switch Model: _________________________________________

PARAMETERS

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Recommended Setting</th>
<th>Actual Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time delay to override momentary normal source outages</td>
<td>*5 Seconds</td>
<td></td>
</tr>
<tr>
<td>Adjustable time delay on retransfer to normal from emergency</td>
<td>*5 Minutes</td>
<td></td>
</tr>
<tr>
<td>Time delay to stop emergency power upon re-transfer to normal source (generator cool down)</td>
<td>5 Minutes</td>
<td></td>
</tr>
<tr>
<td>Time delay on transfer to emergency</td>
<td>*15 Seconds</td>
<td></td>
</tr>
</tbody>
</table>

* Field coordinate time setting to obtain proper operation of equipment

This certifies that the Automatic Transfer Switch has been set up and configured as required to operate according to Section 16620.

(Authorized Representative of the Manufacturer) (Date)
STANDBY POWER SYSTEM - RESISTIVE LOAD BANK TEST

Owner: _____________________________ Date: _____________________________

________________________________________

Project: _____________________________

________________________________________

Contractor: ___________________________

________________________________________

Equipment Manufacturer: ___________________________

________________________________________

Equipment: ___________________________

________________________________________

This certifies that the entire equipment/system has met the RESISTIVE LOAD BANK TESTING requirements of Section 16620, 16950 and all other applicable requirements of the contract documents.

________________________________________ (Authorized Representative of the Manufacturer) (Date)

________________________________________ (Contractor) (Date)

________________________________________ (Engineer) Wright-Pierce (Date)
STANDBY POWER SYSTEM - BUILDING LOAD TESTS

TEST #1 □  TEST #2 □  TEST #3 □

This certifies that the entire equipment/system has met the BUILDING LOAD TESTING requirements of Section 16620, 16950 and all other applicable requirements of the contract documents.

(Authorized Representative of the Manufacturer)  (Date)

(Contractor)  (Date)

(Engineer)  Wright-Pierce  (Date)

END OF SECTION
SECTION 16950

START-UP AND TESTING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION
A. Test and demonstrate, to the satisfaction of the Engineer, all electrical devices in accordance with Division 13, Specification 01800 and the following requirements. All testing and checkout of equipment specified under this Section shall be performed by the electrical contractor.
B. During the checkout and startup period, the electrical contractor shall provide sufficient personnel to aid with the start-up of all electrical equipment, to remove any faults, and to make the necessary adjustments for the proper operation of electrical equipment and installation.
C. A 1000 volt "megger" insulation test shall be available at all times during the testing of power feeders and motor wiring.
D. All electrical equipment, wiring, switches and insulators found to be defective or to have failed due to poor workmanship shall be replaced promptly at no additional cost to the Owner.
E. Provide NETA Acceptance testing of feeder breakers in switchboards, main distribution panels and motor control centers.
F. Provide certificates for all testing equipment that shows calibration has been completed within the past 12 months.

1.2 SUBMITTALS TO THE ENGINEER
A. Shop Drawings are required for all items provided under this section. Submittals shall be provided in accordance with Sections 01340, 16000 and as specified in this section.
B. It should be the Contractors responsibility to provide all required forms/direction as to submittal procedures for this contract and to verify compliance prior to submitting to the Engineer for review.
C. A record of all insulation values shall be properly recorded as listed in worksheet attached to the back of the section. All time intervals shown shall be recorded for each conductor being tested.
D. Ground testing results shall be properly recorded, witnessed, and reported to the Engineer.
E. All circuit breaker settings and testing shall be provided in order to check for proper cable connections, impedance testing and infra-red testing of all connections of all electrical equipment, cables, devices and distribution system equipment for the entire project at all locations.

1.3 TESTING REQUIREMENTS
A. Prior to the start of check out and testing, ensure that all equipment is properly and permanently identified according to Section 16000.
B. Before energizing any electrical equipment or apparatus, thoroughly check all equipment for the following:
1. All equipment and materials shall be clean, dry and free of foreign materials.
2. Vacuum clean to make free from filings, foreign matter or other materials left inside equipment or enclosures. Particular attention shall be given to bus conductors, conductors, terminal blocks, and windings.
3. Check for tools inside equipment or enclosures. All screw, bolt, and terminal connections shall be checked for tightness as specified by the equipment manufacturer.
4. Check the bearings of all rotating electrical apparatus and, if required, have supplier fill with the grease or oil as recommended by the manufacturers.
5. All motors, contacts, relays, bus, insulators and other electrical apparatus shall be cleaned and dried out if required and/or needed. Drying out methods will be such that the insulation temperature of the apparatus does not exceed 90°C.

C. Prior to applying voltage to any apparatus or circuit, make insulation resistance tests and, if necessary, dry the apparatus until resistance values conform to the standards of IEEE.

D. In case of a low resistance circuit insulation, eliminate the problem before the circuit is energized.

E. Provide 1000 volt "Megger" insulation testing on all 600 volt feeder conductors and motor power conductors (480V). This shall include any and all of the existing electrical feeder cables at the facility which shall remain and shall be reconnected. Motors shall be meggered from the starters.

F. Panelboard's line currents shall be balance to within 10% of each other.

G. Three phase motors shall be checked for rotation and, if necessary, reverse the connections at the starter. Single phase and DC motors at motor connection box.

H. The ground resistance of the individual networks shall be measured at two points with the cables at all the test points disconnected.

I. Test the grounding system to assure continuity and to assure that resistance to ground does not exceed specified limits or form any ground loops.

J. The entire grounding network resistance shall be meggered. Resistance shall not exceed 25 ohms. Drive additional ground rods if necessary.

K. The Contractor shall provide load readings for all equipment, switchgear, motor control centers and panelboards.

L. Set all coordination, short circuit and arc fault settings to study provided for this facility for final set up of the electrical system.

M. Test and set all motor circuit protectors, motor overload heaters to the nameplate horsepower of the equipment; and all circuit breaker settings in all electrical equipment shall be tested and verified operational.

N. Adjust all settings on protective equipment and verify, check and establish with the power company that the secondary voltage is within 2% of rated voltage.

O. Provide and check all overload relays settings and sizing for all motors and submit this data to the Engineer for final approval. This shall include settings and adjustments to MCP devices for each motor starter.

P. The contractor shall maintain a complete marked up drawing set and all written documentation of all changes at the job site. These documents shall be made available to the Engineer at all times.
1.4 DEMONSTRATION AND START UP

A. All equipment shall be properly identified as indicated in SECTION 16000.
B. When directed by the Engineer, demonstrate the total system operation and make final adjustments to the system. If any system or piece of equipment within a system fails to function properly, rectify such defects or inadequacies and make a final demonstration as directed by the Engineer.
C. Provide the services of authorized manufacturers' representatives to instruct the Owner's representatives in the proper operation of each partial or complete system installed under this Contract.
D. Pay all charges or fees, including the cost of any special test equipment, factory engineers, etc. necessary for the proper performance of the specified tests, demonstrations, and instructions.
E. All demonstrations and instructions shall be scheduled at the convenience of the Engineer and the Owner and shall be scheduled with at least seventy-two (72) hours written notice.
F. Set all circuit breaker and overcurrent devices based on overall system coordination and short circuit study. Final acceptance will not be allowed until all settings and protective devices are set, checked, tested, and verified in the field in the presence of the Engineer.
G. All control circuits shall be functionally checked to see that their operation and sequence are correct. Any adjustable switches such as float switches, limit switches and timers shall be adjusted for proper operation.
H. System Integrator to provide all revised drawings prior to startup. Drawings to incorporate all red-lined drawings received from electrical contractor
I. Just prior to acceptance of the lighting facilities, clean all lighting fixtures and re-lamp where required at no additional cost to the Owner.
J. All local control stations and control panels for equipment specified in DIVISIONS 11, 13, 14, 15 and 16 shall be demonstrated to function properly of all items under simulated operating conditions unless otherwise specified elsewhere.
## MEGGER TEST RESULTS

**Project:** 

**Temperature:** 

**Date:** 

**Weather:** 

**Location:** 

**Test Equipment:** 

### Equipment/feeder Under Test:

**Start Time:** 

**End Time:** 

**Test Equipment:**

- **Make:**  
- **Serial No.:**  
- **Test Voltage:** 

<table>
<thead>
<tr>
<th>Phase A-Gnd.</th>
<th>0.5 min</th>
<th>1 min</th>
<th>2 min</th>
<th>3 min</th>
<th>4 min</th>
<th>5 min</th>
<th>6 min</th>
<th>7 min</th>
<th>8 min</th>
<th>9 min</th>
<th>10 min</th>
<th>P.I.</th>
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<tr>
<td>Phase B-Gnd.</td>
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<td>Phase A-PhaseC</td>
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<tr>
<td>Phase C-Gnd.</td>
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**Notes:** Megger test only should record 5 minutes value...

*Polarization Index (P.I.) is 10 min reading divided by 1 min reading*

*Note: If a neutral is provided, this will also need to be tested*

**END OF SECTION**
APPENDIX A

MTA Sewer Bridge Crossing Permit and Technical Specifications
Application Package – MTA Work Permit / License

This is Maine Turnpike Authority’s Application for a Work Permit or License to Locate Facilities on MTA Land.

- A Work Permit is required for work on MTA property of a temporary nature where no permanent facility will be installed.

- A License is required for work on MTA property when a facility will be installed on MTA property which is designed to remain when the applicant’s work is complete.

The requirements of the documents are very similar. The MTA will determine which document is appropriate given the nature of the application. Depending on the nature of the work, a contractor may be issued a work permit while the eventual owner / operator of the facility will be issued a license for the facility.

Please review the attached application and the requirements of the sample documents. Any questions on these requirements may be directed to Ben Bolduc of the MTA’s Right of Way Department.

Submit application and all related materials to:

Ben Bolduc
Maine Turnpike Authority
Right of Way Department
2360 Congress Street
Portland, ME 04102
Tel: (207)871-7771 x355
Fax: (207)879-5567
BBolduc@maineturnpike.com
The Maine Turnpike Authority grants permission to ________ (Permittee) to enter upon the property of the Maine Turnpike in ____________________, Maine for the purpose of conducting the following work.

Description of Work (and/or plan reference):

All work shall be subject to the following conditions:

1. Approval of Plans:  The MTA may require that Permittee supply it with plans & specifications of the proposed work prior to any entry onto MTA property. If required, Permittee shall not proceed with any work until said documents have been reviewed and approved in writing by the MTA.

   Required ______  Not Required ______  Special (see below) ________

2. Dig Safe:  If earthwork is a component of the work, proof of location of all utilities in the vicinity of the work must be obtained through Dig Safe, for public utilities, and DigSmart of Maine for private utilities (which includes existing MTA installations that may be present).
   Proof of utility location from both DigSafe and DigSmart must be provided to the MTA and approved before any work will be allowed under this permit.

3. Entry onto Land:  Permittee must provide the MTA with a work plan, including schedule, traffic control plan, and any other documentation requested by the MTA. This documentation must be provided at least two weeks in advance of any work on MTA property. The MTA must approve the documentation, and may decide to have an MTA Inspector present while the work is being completed. Restrictions may be imposed based on MTA operational considerations, including but not limited to time of day restrictions based on time of year and peak travel flow. Weekly schedule updates shall be provided by noon on Thursday for the
following Saturday to Sunday period. Permittee must notify the MTA Traffic Management Control Center (TMCC) (871-7701) each day regarding traffic control installed on the roadway, and must notify the TMCC each time any traffic control device is set up, dismantled, on relocated on the roadway or shoulder.

4. Indemnification: Permittee indemnifies and holds the MTA harmless from any liability or third party claims related to Permittee’s presence on MTA land, regardless of Permittee’s negligence of lack thereof. This includes all losses or expenses related to any third party claim, including attorney’s fees, and specifically includes, but is not limited to, claims that are brought by employees or agents of Permittee. Nothing contained herein is intended to waive any defenses or immunities available to the MTA with respect to third parties including, but not limited to, the defenses and immunities provided under the Maine Tort Claims Act.

Any damages to MTA real or personal property caused by Permittee shall be repaired promptly by Permittee or the MTA shall undertake said repairs, in which case Permittee shall reimburse the MTA for all costs incurred.

5. Insurance & Bonding: Prior to any entry onto MTA land, Permittee will file with the MTA certificates of insurance evidencing general liability insurance, automobile insurance, and workers’ compensation insurance with such limits as the MTA shall require, which in all cases shall be a minimum of one million dollars per occurrence. The amount required, if higher, shall be noted below. Permittee shall maintain this insurance coverage for so long as work continues on MTA property.

The MTA shall be covered as an Additional Insured under the general liability and automobile insurance policies. The workers’ compensation policy shall include an endorsement waiving subrogation in favor of the MTA for all claims relating to work on MTA land. Copies of the endorsements providing this coverage and waiver of subrogation will be provided to the MTA along with the insurance certificates.

The MTA may require performance and/or payment bonds depending on the nature of Permittee’s project. Bonding requirements, if any, will be noted below.

6. Maine Tort Claims Act: Any endorsement adding the MTA as Additional Insured shall include the following provision. An endorsement that does not contain said provision, including endorsements that generally provide additional insured status when required by contract, shall be interpreted as if it did:

“Without limiting in any way Insurer’s obligation to defend, coverage under this policy for actions seeking tort damages pursuant to provisions of the Maine Tort Claims Act is governed by the immunities and limitations on damages contained in the Maine Tort Claims Act.”
7. Costs: Permittee shall fully and promptly reimburse the MTA for any costs incurred by the MTA, including but not limited to the cost of personnel involved in reviewing Permittee’s plans and specifications or supervising Permitee’s work. There is a non-refundable application fee of $250 made payable to the Maine Turnpike Authority for all applications (this application fee does not apply to non-profits or municipalities).

8. Safety & MTA Operations: Permittee must abide by all applicable laws and regulations pertaining to workplace safety, and must also comply with the requirements of the most current MTA Supplemental Specification for construction contracts (http://www.maineturnpike.com/Projects/Construction-Contracts.aspx).

Median openings shall not be used and U-Turns at toll plazas shall not be permitted. Traffic stoppages require MTA approval and must be conducted with participation of the Maine State Police. Shoulder and lane closure times on the turnpike must be approved in advance.

When the speed limit has been reduced to 45 mph due to weather or other conditions, Permittee must remove temporary traffic control devices, stop work, and return the roadway to passable condition. Permittee shall not be allowed to reestablish traffic control devices until speed is restored. During this time, Permittee will not be able to work adjacent to the turnpike unless the work area is protected by concrete barrier.

Permittee shall comply with all other specific instructions of MTA personnel and take all other steps required to avoid or minimize disruption to MTA operations.

9. Contacts: The following are the formal contact persons responsible for administration of this Work Permit. All material that Permittee is required to provide under this Permit must be provided to the MTA Contact listed below. When approval of the MTA is required under this permit, the MTA contact listed below is the only person authorized to grant said approval. Communications and direction addressed to Permittee’s contact below will be binding upon Permittee.

<table>
<thead>
<tr>
<th>MTA:</th>
<th>Permittee:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address: 2360 Congress Street</td>
<td>Address:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone:</td>
<td>Phone:</td>
</tr>
<tr>
<td>E-Mail:</td>
<td>E-Mail:</td>
</tr>
</tbody>
</table>
10. Special Conditions or Requirements:

A. Work requiring a stoppage of traffic on the mainline will require Maine State Police and due to police staffing considerations work requiring a stoppage shall not be permitted unless a request for such work is submitted to the MTA two weeks in advance of the work.

B. The following day and time restrictions are in place for this Work (*but are subject to change at discretion of MTA*):

*Insert Other Special Conditions / Requirements:*

11. **Revocation:** The MTA reserves the right to revoke this permit in the event of any breach of its conditions as well as for any reason whatsoever that, in the sole judgment of the Authority, warrants such a revocation.

<table>
<thead>
<tr>
<th>Maine Turnpike Authority</th>
<th>Permittee</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________________________</td>
<td>_________________________</td>
</tr>
<tr>
<td>Stephen R. Tartre, PE</td>
<td>Name</td>
</tr>
<tr>
<td>Director of Engineering</td>
<td>_________________________</td>
</tr>
<tr>
<td>Maine Turnpike Authority</td>
<td>Title</td>
</tr>
<tr>
<td>_________________________</td>
<td>_________________________</td>
</tr>
<tr>
<td>Company Name</td>
<td>MTA Work Permit (Dec., 2019 Version)</td>
</tr>
<tr>
<td></td>
<td>Page 4 of 4</td>
</tr>
</tbody>
</table>
MAINE TURNPIKE AUTHORITY (MTA)
CONSTRUCTION WORK SCHEDULE RESTRICTIONS
for
Town of Falmouth
Middle Road Sewer Upgrades

The following MTA construction work schedule restrictions for the Middle Road Sewer Upgrades project must be followed at all times during construction on MTA property:

- Work that is performed directly over traffic or within six feet of a travel lane as measured from the painted pavement marking line or a traffic control device shall require a lane closure. Loading/unloading of trucks shall not be closer than six feet from an open travel lane.

- Shoulder and lane closures in the west bound direction of the Falmouth Spur highway may only be set up after 9:00 AM due to the close proximity of the I-295 off-ramp.

- Temporary road shoulder and lane closures shall be removed during inactive periods if work requiring the shoulder or lane closure is not continuous.

- Shoulder and lane closures will not be allowed on Sundays and Holiday Periods. Holiday Periods are defined on page 11 of 233 of the Maine Turnpike 2016 Supplemental Specifications (excerpt below) which can also be found here: https://www.maineturnpike.com/Projects/Construction-Contracts.aspx.

- Please note that the MTA Holidays now include Juneteenth Holiday on June 20th which is observed from 12:01 AM on June 20th to 6:00 AM on June 21st.
<table>
<thead>
<tr>
<th>Holiday</th>
<th>Holiday Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>President's Day</td>
<td>12:01 a.m. (Midnight) preceding Friday to 12:01 p.m. following Tuesday.</td>
</tr>
<tr>
<td>Easter</td>
<td>12:01 a.m. (Midnight) preceding Friday to 12:01 p.m. following Monday.</td>
</tr>
<tr>
<td>Memorial Day</td>
<td>12:01 p.m. preceding Thursday to 6:00 a.m. following Tuesday.</td>
</tr>
<tr>
<td>Labor Day</td>
<td>12:01 p.m. preceding Thursday to 6:00 a.m. following Tuesday.</td>
</tr>
<tr>
<td>Columbus Day</td>
<td>12:01 a.m. (Midnight) preceding Friday to 12:01 p.m. following Tuesday.</td>
</tr>
<tr>
<td>Thanksgiving Day</td>
<td>12:01 a.m. (Midnight) preceding Wednesday to 12:01 p.m. following Monday.</td>
</tr>
</tbody>
</table>

Excerpt from MTA 2016 Supplemental Specifications
SPECIAL PROVISION

SECTION 506

PAINTING STRUCTURAL STEEL

506.01 Description

This specification covers the field cleaning of, and application of protective coatings to, the following surfaces of the west side of the west fascia girder of the Route 9 / Middle Road Bridge (Cleaning and coating the east side of the west fascia girder’s web and flanges is not required):

- West side of the web surface meeting the following conditions:
  - Located within 3” of a sewer line mounting bracket (38 bracket locations).
  - Located within 3” of a bolted field splice (3 splice locations).
  - Located within 3” of areas of blistered and/or loose and flaking paint.
- Underside of the top flange exhibiting rust staining, blistered or loose and flaking paint.
- Topside of the bottom flange (100% of surface area to be cleaned and painted).

All field cleaning and application of protective coatings shall be completed prior to the installation of the proposed sewer line and mounting brackets. The work shall consist of furnishing all supervisory personnel, including competent person(s), labor, tools, equipment, containment, scaffolding, protection of public and private property, Quality Control activities, materials, and incidentals necessary for satisfactory completion of the Work. The termination point(s) of coating application shall be taped off to prevent overrun and overspray.

506.02 General

In the areas identified, the surfaces shall be cleaned of loose debris, rust, paint and other deleterious substances. Cleaning shall meet the requirements of SSPC-SP3, “Power Tool Cleaning”. Removal shall be by vacuum–shrouded power tool cleaning or abrasive blast cleaning. Removal methods shall satisfy the environmental and surface cleanliness requirements specified herein, and mandated by local, State and Federal regulations.

The Authority shall test the existing coating to determine the toxic metal content. The results of these tests shall be made available to the Contractor. Based on these results, the Contractor shall design and implement appropriate measures for containment, environmental protection, waste disposal, and worker safety.

Contractors and Subcontractors involved with the removal of lead based paint and the field application and touch-up of the coating systems shall be qualified in accordance with SSPC QUALIFICATION PROCEDURE NO. 1, Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures) and SSPC QUALIFICATION PROCEDURE NO. 2, Standard Procedure for the Qualification of Painting Contractors (Field Removal of Hazardous Coatings from Complex Structures) prior to Bid opening and shall remain qualified throughout the duration of the Contract. Copies of current certificates issued by the Qualifying Agency shall be submitted with the Bid package.
Perform lead abatement in compliance with all applicable federal, state and local regulations, including the current version of 29 CFR 1926, OSHA Construction Industry Health and Safety Standards, and in particular, the OSHA Lead in Construction Standard (29 CFR 1926.62).

Assure that the latest copies of the following documents are on site and available at all times. Applicable parts of the documents are enforceable as part of the Contract:

- SSPC 05-03 Surface Preparation Specifications and Practices
- SSPC VIS 1, Visual Standard for Abrasive Blast Cleaned Steel.
- SSPC VIS 3, Visual Standard for Power and Hand-Tool Cleaned Steel.
- Maine Authority of Environmental Protection's Hazardous Waste Management Rules.
- SSPC Technical Update TU-7, Conducting Ambient Air, Soil, and Water Sampling During Surface Preparation and Paint Disturbance Activities.
- 29 CFR 1926, OSHA Construction Industry Health Standards.
- Maine Authority of Environmental Protection’s Hazardous Waste Management Rules.
- SW 846, Test Methods for Evaluating Solid Waste – Physical/Chemical Methods
- Method 1311, Toxicity Characteristic Leaching Procedure (TCLP)
- Authority of Environmental Protection’s Handbook for Hazardous Waste Generators.

Supply the Resident with the applicable product data sheets and material safety data sheets (MSDS) before any coating work is performed. Obtain in writing from the coating manufacturer, and provide to the Resident, a chart or table listing minimum and maximum recoat times for the primer and topcoat over the expected range of temperatures and relative humidity.

The primer color and the cleaned surfaces shall be contrasting colors and the primer and topcoat color shall be contrasting colors. The finish topcoat color shall be green and match the following Federal Standard 595C, light green, color number: 14272, or approved equal.

506.03 Submittals

The Contractor shall submit for review by the Resident a materials list and other such details as described within the Plans and the respective subsections of this Specification.
506.034 Surface Preparation/Coating Plan

Surfaces to be field-painted shall be cleaned to meet the requirements of SSPC-SP3 or better. All surfaces to be coated shall be solvent wiped in accordance with SSPC-SP1 following power tool cleaning.

Provide written procedures (preparation plan) for the surface preparation and coating application. The plan shall include a description of the equipment that will be used for surface preparation and coating. The plan shall also identify the type and brand name of any abrasives proposed for use; provide Safety Data Sheets (SDS) for proposed abrasive.

The preparation plan shall identify the methods of protection or work isolation procedures, or specific equipment such as vacuum-shrouded power tool cleaning use, to protect surrounding structures, concrete surfaces, equipment, utilities, etc. and property from exposure to surface preparation and paint debris.

All grease, oil and other foreign matter must be removed prior to removal of any existing paint.

506.035 Containment Plan

The following requirements apply if the Contractor elects to blast clean surfaces prior to paint application.

Provide a containment plan to the Resident for review. Do not begin the erection of containment system(s), or paint disturbance activities until review by the Resident has been completed and approved.

Prepare detailed drawings and structural analysis of any containment structures stamped by a Professional Engineer (PE) licensed in the State of Maine. Install the containment in accordance with the drawings stamped by the Contractor's Engineer. Do not begin surface preparation until the Contractor's Engineer has field verified the proper installation of the containment system(s). Perform all surface preparation and painting in the approved containment system, conforming to the latest SSPC Guide 6, Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations.

The Contractor is responsible for ensuring the containment meets all OSHA, federal and state regulations. Throughout the entire Project, work shall only be conducted within approved containment enclosures. The plan shall be sufficiently detailed to show conformance with the requirements of SSPC Guide 6, Class 1A containment specifications. The Containment Plan shall also describe, in detail, the Contractor's methods of protecting galvanized bridge members, existing utilities, etc. The Contractor shall be responsible for all damage incurred. The Containment Plan shall include the following information and requirements, at a minimum:

A. Detailed drawings and structural analysis, prepared and stamped by a PE licensed in the State of Maine.

B. Detailed design calculations stamped by a PE licensed in the State of Maine for the Contractor’s operation including all construction loads applied to the structure. The
design shall use the latest editions of the AASHTO LRFD Bridge Design Specifications with HL-93 Live Load. The applied loads from the proposed paint containment system (enclosures, work platforms, collected waste product, equipment, etc.) shall not exceed the allowable resistance of any bridge member.

C. The Contractor shall determine the wind speed above which damage to the existing structure(s) will result from wind loading on the containment system. If actual wind speeds exceed this design wind speed, the Contractor shall immediately make provisions to properly relieve the containment wind loading. The process for relieving the wind loading shall not release any of the lead paint waste. The Contractor may redesign/reconfigure the containment enclosure(s) or suspend operations until the actual wind speeds fall to levels below the design wind speed. Any release of pollutants from the containment enclosure(s), in excess of applicable state or federal limits, to the surrounding environment due to containment failure will result in the immediate suspension of work. Prior to resuming work, the Contractor shall take appropriate actions to abate the discharge and obtain the Resident's concurrence on a plan of action to prevent reoccurrence. The time and costs associated with any delays and clean-up, modifications, and rebuilding of the containment enclosure(s) resulting from wind damage or associated with any actions required to prevent any reoccurrence of release of pollutants caused by wind loads shall be borne by the Contractor. Any delays due to the suspension of work or due to containment failure, as the result of wind loads, shall be considered Inexcusable Delays. The Contractor shall monitor and document actual wind speeds on the existing structure(s), as appropriate, to ensure the safety of the existing structure(s); the cost of all wind monitoring shall be incidental to related Contract Pay Items.

D. A plan for staging, installing, moving, and removing the containment and the methods of attachment that will be used. Attachment points to main framing members only (main girders, floorbeams, truss members may be allowed with prior approval from the Resident) will be allowed. The plan shall include the methods of access that will be provided to work areas inside containment, locations of safety lines, locations of containment entryways, etc. When the containment system is installed over navigable water, the containment system must comply with U.S. Coast Guard requirements.

E. Detailed plans for lighting the inside of the containment for surface preparation, painting, and inspection. Provide work area illumination as follows:

<table>
<thead>
<tr>
<th>Description of Work</th>
<th>Minimum</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Work Area Illumination</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Surface Preparation and Coating Application</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Inspection</td>
<td>50</td>
<td>200</td>
</tr>
</tbody>
</table>

Provide a light meter that measures illumination in foot candles. Failure to provide at least the minimum illumination will be considered denial of access to the work and may result in rejection of the work by the Resident.
F. Detailed plans for maintaining the environmental conditions required during coating application and curing, including monitoring, measuring and documenting environmental conditions.

G. Detailed plans for the collection and removal of accidental spills or discharges.

H. Technical data sheets, specification sheets and any other information needed to thoroughly describe the containment plan, materials, and containment and ventilation equipment proposed for use. Only use containment materials that are flame resistant.

506.036 Environmental Protection Plan

Thirty days prior to the initiation of work on site, submit to the Resident for review and acceptance an Environmental Protection Plan that establishes programs for the monitoring activities that will be undertaken on the Project appropriate for the specified level of cleaning, and for the proposed cleaning methods. Provisions of the plan may include, but are not limited to:

A. Regulated Area Monitoring and Maintenance.

B. High Volume Ambient Air Monitoring.

C. Ground (Soil) Evaluations.

D. Remediation of Ground (Soil), Water, and Sediment.

E. Final Cleaning/Clearance Evaluations and Documentation.

F. Environmental Testing Laboratory Qualifications.

G. Worker Protection Compliance Program.

The Contractor’s Environmental Protection Plan shall be compliant with all applicable local, State, Federal and OSHA regulations. Where appropriate, the plan shall reference and utilize the applicable sampling procedures established in the most recent version of SSPC-TU 7, Conducting Ambient Air, Soil and Water Sampling of Surface Preparation and Paint Disturbance Activities.

506.05 Protective Measures

During surface preparation and field painting of the existing structural steel, provide adequate safety measures for the protection of the public and surrounding area against damage due to paint drippings, paint spatter, over-spray, falling objects, etc. The Contractor is fully responsible for property damage or personal injury which may result from operations incidental to surface preparation of the structural steel and the field application of the coating system. The coating system shall be protected at all times during application and curing to prevent contamination caused by construction or traffic activities. No coating material shall be stored on the bridge structure, or under the bridge structure.

506.06 Inspector’s Authority

The Resident will have the authority to reject material or workmanship that does not meet the Contract requirements.

506.07 Rejections
Rejected material and workmanship shall be corrected or replaced by the Contractor in accordance with Subsection 106.8.2 of the Standard Specifications.

506.08 through 506.19 Vacant

PROTECTIVE COATING SYSTEMS

506.20 Description

Work shall consist of application of a two-coat coating system in accordance with this Specification.

506.21 Materials

Coatings systems shall be one of the following approved systems:

CARBOLINE COMPANY
- Primer – Carboguard 954 HB (Rust Bond HB), 100% solids epoxy
- Topcoat – Carbocoat 30 (Subsil 30 HS), 30% silicone alkyd

RUST-OLEUM CORPORATION
- Primer – MATHYS Noxyde Plus WB SC acrylic elastomeric
- Topcoat – MATHYS Noxyde Plus WB SC acrylic elastomeric

WASSER HIGH-TECH COATINGS
- Primer – MC-MioAluminum MIO SC moisture cure urethane
- Topcoat – MC-Ferrox A MIO SC moisture cure urethane

The Contractor shall provide the batch description, lot number, date of manufacture, shelf life and the manufacturer’s published storage requirements for each coating to the Resident. In addition, the Contractor shall provide the manufacturer’s published instructions for application of each coat of the coating system including equipment, surface preparation, anchor profile, mixing, thinning, application, cure time for the entire range of allowable environmental conditions, DFT and recoat time.

506.22 Limits of Work

All surfaces exposed during construction or in the assembled product shall be coated with primer and topcoat.

506.24 Application

All protective coatings shall be applied using a method approved by the Resident and in strict accordance with the manufacturer’s recommendations. Protective coatings shall not be applied when the steel temperature, or the ambient temperature in the immediate vicinity of the piece(s) in question, is above 90°F or below 40°F. Thinning and mixing of coatings shall be in conformance with the manufacturer’s published instructions. Thinner shall be measured using a graduated cup or other container that clearly indicates the amount of thinner being added. Mixing
shall be done using the method, equipment and for the amount of time recommended by the coating manufacturer.

Primer and topcoat shall be applied in accordance with the manufacturer’s published recommendations. Environmental conditions in the immediate vicinity of the surfaces to be coated shall be within the range of the manufacturer’s published requirements both during the coating operation and during the curing period. Primer shall not be force cured.

Recoat time shall be in accordance with the manufacturer’s published requirements for the environmental conditions at the time of application and cure. If the coating is contaminated with dust, debris, over spray or other deleterious material, the surface shall be cleaned in accordance with SSPC-SP 1 immediately prior to recoating. Other methods of cleaning may be used if approved by the Resident.

The Resident shall be given ample notice in order to inspect the product prior to coating, recoating or removal of paint from the area. “Ample notice” shall be defined at the Pre-Job meeting depending on shop or site conditions.

Substrates that are primed or surfaces that are recoated without notification of the Resident will be rejected and no further coating shall be done on the piece. Rejected coating shall be removed and re-applied. The cost of repairs shall be borne by the Contractor.

506.25 Vacant

506.26 Repairs

Damaged or unacceptable coatings shall be repaired. Damaged areas shall be prepared in accordance with the manufacturer’s published instructions or as directed by the Resident. Damaged or unacceptable coatings shall be repaired using the same coating removed and prepared for repair. Environmental conditions, cure times and DFTs shall be in accordance with manufacturer’s published directions for the coating being applied. Repairs to topcoat shall result in a uniform gloss and color match. The Resident shall have final authority concerning acceptable appearance.

506.27 Handling and Storage

The coating shall be adequately cured before commencing work related to installation of the new sewer line that could disturb the coating. Under no circumstances shall work related to the installation of the new sewer line begin until the coating has achieved the manufacturer’s published minimum cure time. Coated steel members shall be handled in a manner to avoid damage to the coating. Members shall be lifted and moved using non-metallic slings, padded chains and beam clamps, softeners or other non-injurious methods. Material shall be stored, both at the coating facility and in the field, in a manner that prevents damage to the coating.

506.28 through 506.29 Vacant
506.90 Method of Measurement

Protective Coating shall be measured by the lump sum method, complete and accepted. The limits shall be as shown on the Plans or as described within the respective Subsections.

506.91 Basis of Payment

All work for Protective Coating will be paid for at the lump sum price for the respective item. Payment will be full compensation for all work and materials needed to complete the item; coating and cleaning materials, testing, labor, surface preparation, all containment, environmental protections, cleaning, application, curing and repairs to coating.

<table>
<thead>
<tr>
<th>Pay Items</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>506.9103</td>
<td>Zinc-Rich Coating System (Field Applied) – Top Flange and Web</td>
</tr>
<tr>
<td>509.9104</td>
<td>Zinc-Rich Coating System (Field Applied) – Bottom Flange</td>
</tr>
</tbody>
</table>
APPENDIX B
Test Boring Logs
<table>
<thead>
<tr>
<th>Exploration #</th>
<th>Street</th>
<th>Target Depth</th>
<th>Refusal Depth</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-1</td>
<td>Pinehurst Ln</td>
<td>20'</td>
<td>10.1'</td>
<td>possible weathered rock at 9.8'</td>
</tr>
<tr>
<td>P-2</td>
<td>Pinehurst Ln</td>
<td>15'</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>P-3</td>
<td>Pinehurst Ln</td>
<td>15'</td>
<td>11.1'</td>
<td></td>
</tr>
<tr>
<td>P-4</td>
<td>Pinehurst Ln</td>
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<td></td>
</tr>
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<td>Pinehurst Ln</td>
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<td>10.1'</td>
<td></td>
</tr>
<tr>
<td>P-6</td>
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<td>6.9'</td>
<td>water at 3.6'</td>
</tr>
<tr>
<td>P-7</td>
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</tr>
<tr>
<td>P-8</td>
<td>Pinehurst Ln</td>
<td>15'</td>
<td>7.3'</td>
<td></td>
</tr>
<tr>
<td>P-9</td>
<td>Pinehurst Ln</td>
<td>15'</td>
<td>N/A</td>
<td></td>
</tr>
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<td>11.9'</td>
<td></td>
</tr>
<tr>
<td>P-11</td>
<td>Pinehurst Ln</td>
<td>15'</td>
<td>11.2'</td>
<td>water at 8.6'</td>
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<td></td>
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<td>5.7'</td>
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<tr>
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<td>boulder 6.2-7.4'</td>
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<td>Exploration #</td>
<td>Street</td>
<td>Target Depth</td>
<td>Refusal Depth</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>--------------</td>
<td>---------------</td>
<td>------------------------</td>
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<td>7.4'</td>
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<tr>
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</tr>
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<td>12.9'</td>
<td>water at 5.6'</td>
</tr>
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<td></td>
</tr>
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<td>5.6'</td>
<td></td>
</tr>
<tr>
<td>P-23</td>
<td>Woodlands Dr</td>
<td>15'</td>
<td>12.6'</td>
<td>water at 4.1'</td>
</tr>
<tr>
<td>P-24</td>
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<td>15'</td>
<td>N/A</td>
<td>water at 0.6'</td>
</tr>
<tr>
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<td>Woodlands Dr</td>
<td>20'</td>
<td>9.4'</td>
<td>water at 0.7'</td>
</tr>
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<td>15'</td>
<td>6.2'</td>
<td></td>
</tr>
<tr>
<td>P-27</td>
<td>Woodlands Dr</td>
<td>15'</td>
<td>5.9'</td>
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</tr>
<tr>
<td>P-28</td>
<td>Woodlands Dr</td>
<td>20'</td>
<td>9.3'</td>
<td>cobbles and boulders 4.2-9.3'</td>
</tr>
<tr>
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<td>Woodlands Dr</td>
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<td>7.9'</td>
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</tr>
<tr>
<td>P-30</td>
<td>Woodlands Dr</td>
<td>20'</td>
<td>4.6'</td>
<td></td>
</tr>
<tr>
<td>P-31</td>
<td>Woodlands Dr</td>
<td>15'</td>
<td>7.1'</td>
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</tr>
<tr>
<td>P-32</td>
<td>Woodlands Dr</td>
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<td>9.2'</td>
<td>4.3-5.8' boulder</td>
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<td>Woods Rd</td>
<td>20'</td>
<td>3.6'</td>
<td>weathered rock at 1.6'</td>
</tr>
<tr>
<td>P-34</td>
<td>Woods Rd</td>
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<td>9.1'</td>
<td>water at 6.2'</td>
</tr>
<tr>
<td>Exploration #</td>
<td>Street</td>
<td>Target Depth</td>
<td>Refusal Depth</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>--------------</td>
<td>---------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>P-35</td>
<td>Woods Rd</td>
<td>15'</td>
<td>6.8'</td>
<td>water at 3.2'</td>
</tr>
<tr>
<td>P-36</td>
<td>Woods Rd</td>
<td>20'</td>
<td>2.4'</td>
<td>bedrock outcrop 6' from probe</td>
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<tr>
<td>P-38</td>
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<td>10.7'</td>
<td>water at 9.9'</td>
</tr>
<tr>
<td>P-39</td>
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<td>6.3'</td>
<td>water at 3.4'</td>
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<td>7.5'</td>
<td>water at 4.0'</td>
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<tr>
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<td>9.3'</td>
<td>water at 3.7'</td>
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<tr>
<td>P-42</td>
<td>Woods Rd</td>
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</tr>
<tr>
<td>P-100</td>
<td>X Country</td>
<td>20'</td>
<td>18.1'</td>
<td>water at 16.2'</td>
</tr>
<tr>
<td>P-101</td>
<td>Middle Rd</td>
<td>20'</td>
<td>10.2'</td>
<td>water at 4.4'</td>
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<tr>
<td>P-102</td>
<td>Middle Rd</td>
<td>15'</td>
<td>7.9'</td>
<td>water at 6.7'</td>
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<tr>
<td>P-103</td>
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<td>15'</td>
<td>8.8'</td>
<td>possible weathered rock at 7.4'</td>
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<tr>
<td>P-104</td>
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<td>4.2'</td>
<td>possible weathered rock at 3.6'</td>
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<tr>
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<td>15'</td>
<td>5.1'</td>
<td>possible weathered rock at 4.3'</td>
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<tr>
<td>P-106</td>
<td>Middle Rd</td>
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<td>N/A</td>
<td>water at 5.9'</td>
</tr>
<tr>
<td>P-107</td>
<td>Middle Rd</td>
<td>20'</td>
<td>13.8'</td>
<td>possible weathered rock at 10.9'</td>
</tr>
</tbody>
</table>
APPENDIX C
Maine DEP NRPA Permit-By-Rule
U.S. ACOE Self-Verification Notification
License Agreement

THIS AGREEMENT is made this __th day of __, 2020 between the Maine Turnpike Authority ("MTA"), having an office at 2360 Congress Street, Portland, Maine, and the Town of Falmouth ("Town") with an office at 271 Falmouth Road, Falmouth, ME 04105.

The MTA, as holder of the fee or easement interests over which the Town of Falmouth desires access, hereby grants to the Town of Falmouth, a License to install and maintain an insulated gravity sewer main hanging on the westerly steel beam of the Middle Road (Route 9) bridge and within the approaches of said bridge and manholes installed as part of said sewer pipe within the right of way of the MTA (the "Project").

The portions of the MTA property used by Town of Falmouth under this License are referred to herein as "the Premises."

This License is conditioned on the following requirements with respect to the Project:

1. Work on the Premises: Any construction, maintenance, replacement, renewal, repair or other work by the Town of Falmouth or its agents on the Premises shall be undertaken only after the MTA has approved the same and approved any applicable plans and specifications. All work conducted by the Town of Falmouth or its agents on the Premises is subject to the approval of the MTA as to the timing, nature, manner of conduct and duration of the activity. The MTA shall have the right, though not the obligation, to supervise any activity on the Premises with appropriate personnel. The Town of Falmouth agrees to reimburse the MTA for all expenses that the MTA incurs in relation to the Town’s installation and construction of the sewer infrastructure, including but not limited to staff and consultant time in reviewing plans or specifications and supervision in the field of the Town of Falmouth’s work. Prior to entry onto the Premises for purposes of constructing, maintaining, replacing or repairing the Project, the Town or its agents will provide prior notice and obtain prior written approval from the MTA, unless the nature of a repair or other required work is an emergency and safety is a concern, in which case the Town of Falmouth shall immediately implement a repair procedure and notify the MTA as soon as practicable thereafter. Any disturbance to the Premises created by the work of the Town of Falmouth or its agents will be promptly corrected by the Town of Falmouth in a manner approved by the MTA and the Town of Falmouth will restore the Premises to the condition it was in prior to Town of Falmouth’s entry and work.

2. Contractor Insurance and Bonding: The Town of Falmouth will require any contractor or other agent doing work on its behalf on the Premises to maintain general liability and automobile insurance with such limits as the MTA may approve and which shall name the MTA as an additional insured in all matters relating to operations on the Premises. The MTA may require any person or entity performing work on the Premises to provide a performance bond or similar instrument for the full amount of the work from a surety company or financial institution acceptable to the MTA prior to commencement of any work.

3. Licensee Insurance: For so long as the Town of Falmouth operates and maintains the Project on the Premises, it shall maintain public liability and automobile insurance with such limits as the MTA may
approve, which shall not be less than $2,000,000 per occurrence, and which shall name the MTA as an additional insured in all matters relating to operations on the Premises.

The Town of Falmouth shall provide proof of insurance, including certificates of insurance and copies of relevant additional insured endorsements and copies of all insurance policies or surety bonds required by sections 2 and 3 of this License upon request.

4. **Maine Tort Claims Act:** Any insurance policy required by this License may contain the following or similar provision: "Without limiting in any way Insurer's obligation to defend the Additional Insured against any claim or insure any promise of indemnification, this policy shall not be deemed a waiver of any immunity or limitation on damages to which either the insured or the additional insured is entitled to under the Maine Tort Claims Act or any other statutory or common law, as now existing or hereafter amended."

5. **Indemnification:** The Town of Falmouth shall, regardless of Town of Falmouth’s negligence or lack thereof, indemnify and hold harmless the MTA from and against any and all claims, losses, damages and expenses (including attorney's fees and defense costs) that may arise from the Town of Falmouth's operations on the Premises. Nothing contained herein is intended to waive or modify the defenses, immunities, limitations of liability, and other protections available to the Town of Falmouth or the MTA under any provisions of State or Federal law, including, but not limited to, Maine Tort Claims Act, 14 M.R.S.A., section 8101 et seq. (the "Act").

6. **License Permissive / Revocable at Will:** The Town of Falmouth may not assign this License without the written permission of the MTA, but if so assigned shall bind the successor or assignee. This License is permissive and grants no property right in the Premises. If MTA operational needs require relocation or modification of the facilities licensed herein, the Town of Falmouth shall promptly modify or relocate its facilities at its own expense in accordance with the MTA's requirements and any work required to accomplish said relocation or modification shall be done in accordance with the terms of this License governing work on MTA land, including but not limited to the reimbursement provisions of section one. The MTA may revoke this License upon 183 days' written notice to the Town of Falmouth for any reason whatsoever that in the MTA's sole judgment warrants such a revocation, including but not limited to the violation of any covenant herein. In the event of a revocation of this License the Town of Falmouth shall remove all installations placed by it on the Premises, shall restore the Premises to a condition equivalent to its condition prior to any use under this License, and shall thereafter cease all use of the Premises.

7. **Relocation of Facilities:** The Town of Falmouth, Maine understands that it may be required under this License to suspend operations at any time or to relocate all or a portion of the Project from the Premises if such suspension or relocation is necessary or convenient for MTA operations.
IN WITNESS WHEREOF, the Maine Turnpike Authority and Town of Falmouth have caused this instrument to be signed in their corporate name both hereunto duly authorized this 19th day of May, 2020.

Licensor:
Maine Turnpike Authority

Peter Mills, Executive Director

Date: May 19, 2020

Attest:
Jonathan Arey, Secretary MTA

Licensee:
Town of Falmouth

Date: May 19, 2020
Section VI: Self-Verification Notification Form
(for all tidal and non-tidal projects in Maine subject to Corps jurisdiction)

US Army Corps of Engineers
New England District

At least two weeks before work commences, complete all fields (write “none” if applicable) below or use the fillable form found at www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/Maine-General- Permit/. The two-week lead time is not required for emergency situations. Send this form, an Official Species List, and project plans to the following email address: genae-r-me@usace.army.mil

Maine Project Office
U.S. Army Corps of Engineers
442 Civic Center Drive, Suite 350
Augusta, Maine 04330

Permittee: Town of Falmouth, ME
Address, City, State, Zip: 271 Falmouth Road, Falmouth, ME 04105
Email, Phone: Dan Marks, Superintendent: dmarks@falmouthme.org, 207-781-4462

Agent: Wright-Pierce
Address, City, State, Zip: 11 Bowdoin Mill Island, Suite 140, Topsham, ME 04086
Email, Phone: Bryanna Denis, Project Manager: bryanna.denis@wright-pierce.com, 207-798-3777

Contractor: None- the project has not yet been bid.
Address, City, State, Zip:
Email, Phone:

Project Name: West Falmouth Sewer Improvements Phase 1, Middle Road
Address, City, State, Zip:
Lat °N, Long °W: 43°43'47.62" N, 70°14'29.28" W
Waterway Name: Skittery Gusset Creek
Description of Work: Replacement in-kind of an existing culvert structure, which crosses Middle Road and is comprised of three 30" corrugated metal pipes.

Proposed Starting Date: March 2022
Proposed Finish Date: November 2022

Area of wetland impact (SF):
Permanent: 1,100 SF
Temporary: 1,600 SF
Area of waterway impact (SF):
Permanent:
Temporary:

Work will be done under the following Section V General Permits (circle all that apply):

I. Inland Waters and wetlands:
1 2 3 4 5 6 7 8 ✓ 10 11 12 13 14 15 16 17 18 19 20 21 ✓ 23
II. Navigable Waters:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 ✓ 22 23

Have MHPC and all five federally-recognized tribes in Maine been notified of the proposed work? Yes ___ Yes ___ No

Your signature below, as permittee, indicates that you accept and agree to comply with the terms, eligibility criteria, and general conditions for Self-Verification under the Maine General Permit.

Permittee Signature: [Signature] Date: 10/4/22

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