Narragansett Bay Commission

OF-217 Consolidation Conduit

Phase III CSO Program: Contract IIIA-5

December 2020

Bidding Requirements, Bond Requirements, Contract Agreement, Conditions of the Contract, & Technical Specifications

DRAFT – 60% Design

BETA
701 George Washington Hwy
Lincoln, Rhode Island 02865
401.333.2382
www.BETA-Inc.com

OF-217 Consolidation Conduit

Narragansett Bay Commission

Phase III CSO Program: Contract IIIA-5

BIDDING REQUIREMENTS, BOND REQUIREMENTS, CONTRACT AGREEMENT, CONDITIONS OF THE CONTRACT, & TECHNICAL SPECIFICATIONS

Prepared by: BETA GROUP, INC.
Prepared for: Stantec

December 2020

NARRAGANSETT BAY COMMISSION
CSO PHASE IIIA-5
OF-217 CONSOLIDATION CONDUIT
CONTRACT NO. 308.05C

TABLE OF CONTENTS

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NARRAGANSETT BAY COMMISSION

CSO PHASE IIIA-5
OF-217 CONSOLIDATION CONDUIT
CONTRACT 308.05C

NOTICE TO BIDDERS

Separate sealed Bids for the CSO Phase IIIA-5, OF-217 Consolidation Conduit, Contract 308.05C, addressed to the Narragansett Bay Commission will be received at the Narragansett Bay Commission, NBC Corporate Office Building, 1 Service Road, Providence, RI 02905, until 2:00 PM prevailing time on Tuesday September 10th, 2021 at which time and place the bids will be publicly opened and read aloud. Award will be on the basis of the lowest responsive, responsible and eligible bidder. **The bidder must submit a copy of their bids for public inspection upon the opening of the bids.**

The work generally consists of construction of a consolidation conduit, new outfall pipe, and associated structures and appurtenances at the site in Pawtucket, RI. Work includes preparation of the site, construction of a consolidation conduit with segments installed by both conventional trench and microtunnel installation techniques, construction of a diversion structure to divert flow from the outfall to the consolidation conduit, construction of a relocation structure to divert flow from the existing outfall to a newly constructed outfall, construction of a new outfall pipe, protection and relocation of existing utilities, and paving.

Each Bidder shall agree to fully complete the Project, including all punch list items, within 540 consecutive calendar days from the date stipulated in the Notice-to-Proceed to commence "Work". Each Bidder further agrees to pay delay damages as specified in the Agreement.

The Contract Documents may be examined at the following locations:

Narragansett Bay Commission
Corporate Office Building
1 Service Road
Providence, RI 02905

The Contract Documents may be obtained for no charge at:

https://www.submittalexchange.com/planroom/bid.aspx?project=CSOPhaseIIIA&log=Planroom

Each BID shall be accompanied by a bid deposit in the amount of 5 percent of the Total Bid Price. This bid security shall be in the form and subject to the conditions provided in the Information for Bidders.

Successful bidder must furnish 100 percent Performance Bond and 100 percent Payment Bond.

Attention of Bidders is particularly referred to the State requirements as to conditions of employment to be observed and wage rates to be paid under the Contract as on file in the Rhode Island Department of Labor, Office of the Director. All terms, conditions, and provisions of Chapters 12 and 13 of Title 37, General Laws of Rhode Island, 1956 as amended, shall apply to all bidders, and the provisions of said Chapters 12 and 13 of Title 37, General Laws of Rhode Island, 1956, as amended, are incorporated herein by reference thereto.

The Bidder's attention is called to the Equal Opportunity Clause and the Standard Federal Equal Employment Opportunity Construction Contract Specifications set forth herein. This project is subject to Chapter 37-14.1 of the Rhode Island General Laws and regulations promulgated there under, which require that ten percent (10%) of the dollar value of work performed on the project be performed by minority and/or women's business enterprises. The successful Bidder will be required to provide the maximum practicable opportunity to small and minority business enterprises to participate in this Contract.

Bidders on this work will be required to comply with the President's Executive Order No. 11246 and amendments or supplements to the Executive Order and EPA Form 5720-4.

1. The Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation in each trade
	3.0%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction. The Contractor's compliance with the Executive Order and regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a) and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation 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 the 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 the 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.

3. The 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 of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is Pawtucket, Rhode Island in Providence County.

No Bidder may withdraw his bid within 90-calendar days after the actual date of the openings thereof.

The Owner reserves the right to waive any informality and/or to reject any or all bids.

A pre-bid conference will be held at 10:00 AM on Tuesday August 27th, 2019 at Macomber Field located at the intersection of High Street and Blackstone Street, Central Falls, Rhode Island. The meeting place is accessible. Individuals requesting interpreter services for the hearing impaired must notify the Narragansett Bay Commission office at (401) 461-8848/TDD (401) 461-6549, at least 72 hours in advance of the meeting date.

August 12th, 2021

Laurie Horridge
Executive Director

SECTION IB

INFORMATION FOR BIDDERS

IB.1 RECEIPT AND OPENING OF BIDS

The Narragansett Bay Commission, herein called the Owner, will receive sealed Bids for CSO PHASE IIIA-5, OF-217 CONSOLIDATION CONDUIT, NBC Contract No. 308.05C. Such bids, submitted in sealed envelopes plainly marked with the date and time of opening and addressed to the Narragansett Bay Commission, and endorsed for CSO PHASE IIIA-5, OF-217 CONSOLIDATION CONDUIT, NBC Contract No. 308.05C, will be received at the Narragansett Bay Commission, NBC Corporate Office Building, 1 Service Road, Providence, RI 02905, until the date and time noted in the NOTICE TO BIDDERS, at which time and place the bids will be publicly opened and read aloud. If forwarded by mail, Bid and sealed envelope marked as described above shall be enclosed in another envelope with the notation "BID ENCLOSED" on the face and addressed as indicated above.

All bids shall comply with the provisions of RIGL §37-2-18 which provides as follows:

§ 37-2-18. Competitive sealed bidding

(a) Contracts exceeding the amount provided by § 37-2-22 shall be awarded by competitive sealed bidding unless it is determined in writing that this method is not practicable or that the best value for the state may be obtained by using an electronic reverse auction as set forth in § 37-2-18.1. Factors to be considered in determining whether competitive sealed bidding is practicable shall include whether:

(1) Specifications can be prepared that permit award on the basis of either the lowest bid price or the lowest evaluated bid price; and

(2) The available sources, the time and place of performance, and other relevant circumstances as are appropriate for the use of competitive sealed bidding.

(b) The invitation for bids shall state whether the award shall be made on the basis of the lowest bid price or the lowest evaluated or responsive bid price. If the latter basis is used, the objective measurable criteria to be utilized shall be set forth in the invitation for bids, if available. All documents submitted in response to the bid proposal are public pursuant to chapter 38-2 upon opening of the bids. The invitation for bids shall state that each bidder must submit a copy of their bid proposal to be available for public inspection upon the opening of the bids. The burden to identify and withhold from the public copy that is released at the bid opening any trade secrets, commercial or financial information, or other information the bidder deems not subject to public disclosure pursuant to chapter 38-2, the Access to Public Records Act, shall rest with the bidder submitting the bid proposal.

(c) Unless the invitations for bid are accessible under the provisions as provided in § 37-2-17.1, public notice of the invitation for bids shall be given a sufficient time prior to the date set forth therein for the opening of bids. Public notice may include publication in a newspaper of general circulation in the state as determined by the purchasing agent not less than seven (7) days nor more than twenty-eight (28) days before the date set for the opening of the bids. The purchasing agent may make a written determination that the twenty-eight (28) day limitation needs to be waived. The written determination shall state the reason why the twenty-eight (28) day limitation is being waived and shall state the number of days, giving a minimum and maximum, before the date set for the opening of bids when public notice is to be given.

(d) Bids shall be opened and read aloud publicly at the time and place designated in the invitation for bids. Each bid, together with the name of the bidder, shall be recorded and an abstract made available for public inspection.

(e) The chief purchasing officer shall adopt and file regulations governing the bidding of highway and bridge construction projects in the state not later than December 31, 2011.

(f) Immediately subsequent to the opening of the bids, the copies of bid documents submitted pursuant to subsection 37-2-18(b) shall be made available for inspection by the public. Any objection to any bid on the grounds that it is nonresponsive to the invitation for bids must be filed with the purchasing agent within five (5) business days of the opening of the bids. The purchasing agent shall issue a written determination as to whether the subject bid is nonresponsive addressing each assertion in the objection and shall provide a copy of the determination to the objector and all those who submitted bids at least seven (7) business days prior to the award of the contract. If a bid is nonresponsive to the requirements in the invitation to bid, the bid is invalid and the purchasing agent shall reject the bid. The purchasing agent shall have no discretion to waive any requirements in the invitation to bid which are identified as mandatory. Nothing in this section shall be construed to interfere with or invalidate the results of the due diligence conducted by the division of purchasing to determine whether bids are responsive and responsible.

(g) Subsequent to the awarding of the bid, all documents pertinent to the awarding of the bid that were not made public pursuant to subsection 37-2-18(e) shall be made available and open to public inspection, pursuant to chapter 38-2, the Access to Public Records Act, and retained in the bid file. The copy of the bid proposal provided pursuant to subsection 37-2-18(b) shall be retained until the bid is awarded.

(h) The contract shall be awarded with reasonable promptness by written notice to the responsive and responsible bidder whose bid is either the lowest bid price, lowest evaluated, or responsive bid price.

(i) Correction or withdrawal of bids may be allowed only to the extent permitted by regulations issued by the chief purchasing officer.

(j) As of January 1, 2011, this section shall apply to contracts greater than one million dollars ($1,000,000); on January 1, 2012 for all contracts greater than seven hundred fifty thousand dollars ($750,000); on January 1, 2013 for all contracts greater than five hundred thousand dollars ($500,000); and on January 1, 2014 for all contracts awarded pursuant to this section.

History of Section

(P.L. 1989, ch. 526, § 2; P.L. 1994, ch. 137, § 1; P.L. 1999, ch. 367, § 1; P.L. 2005, ch. 296, § 1; P.L. 2010, ch. 221, § 1; P.L. 2011, ch. 342, § 1; P.L. 2011, ch. 384, § 1 .)

IB.2 LOCATION AND WORK TO BE DONE

The location and general description of the work herein specified to be done (herein sometimes referred to as the "Work") is detailed in Section 01010.

IB.3 PRE-BID CONFERENCE

A pre-bid conference will be held at the project site at Macomber Field located at the intersection of High Street and Blackstone Street, Central Falls, RI at the date and time noted in the NOTICE TO BIDDERS.

The meeting place is accessible. Individuals requesting interpreter services must notify the Narragansett by Commission Office at (401) 461-8848/TTD (401) 461-6549, at least 72 hours in advance of the meeting date.

ATTENDANCE AT THE PRE-BID CONFERENCE IS NOT MANDATROY BUT IS STRONGLY ENCOURAGED.

IB.4 CONTRACT DOCUMENTS

The Drawings, INFORMATION FOR BIDDERS, SPECIFICATIONS, all Addenda and forms for BID, AGREEMENT, and BONDS may be examined and obtained at the location and for the deposit sum designated in the NOTICE TO BIDDERS.

IB.5 DEPOSIT ON DRAWINGS AND DOCUMENTS

Not applicable. Contract Documents issued per the NOTICE TO BIDDERS.

IB.6 INFORMATION NOT GUARANTEED

All information given in the Contract Documents relating to subsurface and other conditions, natural phenomena, existing pipes, and other structures is from the best sources at present available to the Owner. All such information is furnished only for the information and convenience of bidders and is not guaranteed.

It is agreed and understood that the Owner does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing pipes or other structures encountered during construction will be the same as those indicated in the Contract Documents.

It is agreed further and understood that no bidder or contractor shall use or be entitled to use any of the information made available to him or obtained in any examination made by him in any manner as a basis of or ground for any claim or demand against the Owner or the Program Manager, arising from or by reason of any variance which may exist between the information made available and the actual subsurface or other conditions, natural phenomena, existing pipes or other structures actually encountered during the construction work, except as may otherwise be expressly provided for in the Contract Documents.

IB.7 BORINGS

Available boring information is included in an Attachment of the Contract Specifications.

IB.8 WORK ON STATE, MUNICIPAL AND PRIVATE PROPERTY

Particular attention is hereby directed to the fact that portions of the work included under this Contract may be done within the limits of properties that are State-owned, municipally-owned, or privately-owned. The Contractor shall be responsible for coordinating the prosecution of the work of this Contract with the various property owners, and for providing the work in accordance with any additional requirements as specified herein.

IB.9 OTHER CONTRACTS

The attention of bidders is directed to the fact that the work to be done under this contract may be only part of a program of improvements, that contracts could be let for additional facilities, and that the successful operation of the improvements is dependent upon the completion of the work under this contract and of the work to be done by others.

It is essential that all parties interested in the project cooperate to the end that the entire project will be brought to a successful conclusion as rapidly as possible, but the Owner cannot guarantee that no interference or delay will be caused thereby. Interference and delay resulting from such cooperation shall not be the basis of claims against the Owner.

IB.10 BIDDERS TO INVESTIGATE

Bidders are required to submit their Bids upon the following express conditions which shall apply to and be deemed a part of every Bid received, viz.:

Bidders must satisfy themselves by personal examination of the site of the Work and by such other means as they may wish, as to the actual conditions there existing, the character and requirements of the Work, the difficulties attendant upon its execution, and the accuracy of all estimated quantities stated in the Bid.

IB.11 QUESTIONS REGARDING THE CONTRACT DOCUMENTS

In general, no answer will be given to prospective bidders in reply to an oral question if the question involves an interpretation of the intent or meaning of the Contract Documents, or the equality or use of products or methods other than those designated or described in the Contract Documents. Any information given to bidders other than by means of the Contract Documents, including Addenda, as described below, is given informally, for information and the convenience of the bidder only and is not guaranteed. The bidder agrees that such information shall not be used as the basis of nor shall the giving of any such information entitle the bidder to assert any claim or demand against the Owner or the Program Manager on account thereof.

To receive consideration, all questions shall be submitted in writing (by mail, e-mail, or delivery) to Mr. Greg Waugh, NBC Construction Manager, 102 Campbell Avenue, East Providence, RI 02916, (e-mail gwaugh@narrabay.com) by 12:00 P.M on Wednesday September 4th, 2021. The Program Manager will review and consolidate questions received before the deadline, prepare written answers, and respond by Addenda sent at least four days prior to the receipt of Bids to those prospective bidders known to have taken out sets of the Contract Documents. Such Addenda shall become a part of the Contract Documents. In general, the Program Manager will neither approve nor disapprove particular products prior to the opening of Bids; such products will be considered when offered by the Contractor for incorporation into the Work.

The Contractor agrees to use the products and methods designated or described in the Contract Documents as amended by the Addenda.

Each bidder shall be responsible for determining that he has received all Addenda issued.

IB.12 BLANK FORM FOR BID

All Bids must be submitted upon the prescribed form for Bid annexed hereto, state the proposed price for each item of the Work and be signed by the bidder with his business address and place of residence. Bid forms shall be completed in ink or be typed.

Discrepancies between unit prices and their respective total amounts will be resolved in favor of the unit prices. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

All bids should be prepared in conformity with, and based upon and submitted subject to, all requirements of the Contract Documents, together with all addenda thereto.

All names shall be typed or printed below the signature.

The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which shall be filled in on the Bid Form).

IB.13 CONDITIONS OF WORK

Each bidder must inform himself fully of the conditions relating to the construction and labor under which the work is now or will be performed; failure to do so will not relieve the successful bidder of his obligation to furnish all materials and all labor necessary to carry out the provisions of the Contract Documents and to complete the contemplated work for the consideration set forth in his bid. Insofar as possible, the Contractor, in the carrying out of his work, shall employ such methods or means as will not cause any interruption of or interference with: the operation of the existing treatment facilities; sewer; traffic; use of existing utilities and structures affecting the work or other similar conditions at the site, character of equipment and facilities needed preliminary to and during prosecution of the work; requirements of owners and controlling authorities having jurisdiction over the various lands, existing structures, facilities, and utilities; and all other conditions affecting the work to be done, and the labor and materials needed; and he shall make his bid in sole reliance thereon; and shall not, at any time after submission of a bid, assert that there was any misunderstanding in regard to the nature or amount of the work to be done.

IB.14 BID SECURITY

Each Bid submitted shall be accompanied by a bid deposit in the form of bid bond, or cash, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company qualified to do business in the State of Rhode Island and satisfactory to the Owner. Any checks should be payable to the Narragansett Bay Commission Fund.

The amount of the bid deposit shall be as designated in the NOTICE TO BIDDERS.

The bid deposit must be enclosed in the sealed envelope containing the BID.

Each bid deposit may be held by the Owner as security for the fulfillment of the bidder's promises that the bidder will not withdraw his BID while it is being considered and will execute the AGREEMENT and furnish the required CONTRACT BONDS and Insurance if his BID is accepted. Should the bidder fail to fulfill such agreements, his bid check shall become the property of the owner or if a bid bond was furnished, the bid bond shall become payable to the Owner, as liquidated damages; otherwise, the bid check shall be returned to the bidder as hereinafter provided, or if the security is a bid bond, the bid bond shall become null and void.

The bid deposit will be returned to all except the three lowest bidders within three working days after the opening of bids, and the remaining checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the agreement, or, if no award has been made within ninety calendar days after the date of the opening of bids, so long as he has not been notified of the acceptance of his bid.

IB.15 WITHDRAWAL OF BIDS

Except as hereinafter in this subsection or otherwise expressly provided, once his bid is submitted and received by the Owner for consideration and comparison with other bids similarly submitted, the Bidder agrees that he may not and will not withdraw it within 90 consecutive calendar days after the actual date of the opening of Bids. The bidder may withdraw his bid by doing so in writing after the 90 day period.

Upon proper written request and identification, bids may be withdrawn at any time prior to the designated time for the opening of bids.

Unless a Bid is withdrawn as provided above, the bidder agrees that it shall be deemed open for acceptance until an AGREEMENT has been executed by both parties thereto or until the Owner notifies the bidder in writing that his Bid is rejected or that the Owner does not intend to accept it or returns his Bid deposit. Notice of acceptance of a Bid shall not constitute rejection of any other Bid.

IB.16 COMPARISON OF BIDS

Bids will be compared on the basis of the experience and competence of the bidders and on the basis of the totals of the quantities listed in the proposal under the enumerated items at the unit prices or lump sums bid for these items. The contract will be awarded to the lowest responsive, responsible and eligible bidder. However, the Owner may reject any and all bids if it is in the public interest to do so.

The term, "Lowest responsive, responsible and eligible bidder," shall mean the bidder whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work; who shall certify that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work.

Bids shall be made on each separate item of work shown in the bid (proposal) with reasonable relation to the probable cost of doing the work included in such items. The Owner reserves the right to reject, wholly, any bid on which an item or items thereof are obviously unbalanced or appear to the Owner to be so unbalanced as to affect or to be liable to affect adversely any interests of the Owner. The attention of the bidder is called to the fact that unbalancing of bids may

adversely affect the Contractor if certain portions of the work are increased or decreased as provided in the Contract Documents.

A bidder shall state the proposed price for the work by which the bids will be compared. This price is to cover all the expenses incidental to the completion of the work in full conformity with the Contract Documents. In the event that there is a discrepancy between the lump-sum or unit prices written in words and numerical figures, the prices written in words shall govern. No bid will be accepted which does not contain a unit price or lump sum as indicated for each of the applicable items enumerated in the proposal form.

IB.17 RIGHT TO REJECT BIDS

The Owner reserves the right to reject any or all Bids should the Owner deem it to be in the public interest to do so.

The Owner may reject every bid which is not accompanied by the required bid deposit or which is on a form not completely filled in, which is incomplete, conditional, obscure, or which contains any addition not called for, or which does not include the State of Rhode Island MBE/WBE Compliance Statement.

A bid which includes for any item a Bid Price that is abnormally low or high may be rejected as unbalanced.

Bidder(s) will be disqualified if more than one proposal is received from an individual, firm, partnership, corporation, or association under the same or different names and such proposals will not be considered.

IB.18 CONTRACT BONDS

The Bidder whose Bid is accepted agrees to furnish the Contract Bonds in the forms which follow in SECTION CB, titled CONTRACT BONDS, each in the sum of the full amount of the Contract Price and duly executed by the said bidder as Principal and by a surety company qualified to do business under the laws of the State of Rhode Island and satisfactory to the Owner, as Surety, for the faithful performance of the Contract and payment for labor and materials. The Surety Company shall have a rating of B+ or better within the Best Key Rating Guide. The premiums for such Bonds shall be paid by the Contractor.

IB.19 EXECUTION OF AGREEMENT

The Bidder whose Bid is accepted agrees to duly execute the AGREEMENT and furnish the required CONTRACT BONDS within the time limit stated in the BID after notification that the AGREEMENT is ready for signature.

When the Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by at least four unsigned copies of the Agreement and all other applicable Contract Documents. Within five days, excluding Saturdays, Sundays, and legal holidays, after the date of receipt of such notification Contractor shall execute and return all copies of the Agreement and all other applicable Contract Documents to the Owner. Within ten days thereafter Owner will deliver one fully signed copy to Contractor.

IB.20 INSURANCE CERTIFICATES

The Contractor will not be permitted to start any construction work until he has submitted certificates covering all insurance called for under that subsection of the AGREEMENT, titled "Insurance".

IB.21 RHODE ISLAND SALES AND USE TAX

Materials and equipment purchased for permanent installation under this Contract are exempt from the Rhode Island Sales and Use Tax. The Owner shall supply the Contractor with the required tax information upon award of the Contract. Each bidder shall take this exemption into account in calculating his bid for the work.

IB.22 PREVAILING WAGE RATES

The Prevailing Wage General Wage Decision in effect at the time that the Bids are opened is included in Section 01067 of the Contract Documents. This information may also be obtained from the Rhode Island Department of Labor and Training, Division of Professional Regulation, 1511 Pontiac Avenue - Building 70, P.O. Box 20247, Cranston, RI 02920-0943. Telephone: (401) 462-8580 Fax (401) 462-8528. This information can also be accessed from the following website address http://www.access.gpo.gov/davisbacon/ri.html.

IB.23 MANUFACTURER'S EXPERIENCE

Wherever it is written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period may be considered if the equipment supplier or manufacturer is willing to provide a bond or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

IB.24 ACCESS TO WORK

Representatives of the State and any local, municipal and federal agencies having a direct interest in the Work shall have access to the Work under this Agreement wherever it is in preparation or progress and the Contractor shall provide proper facilities for such access and inspection.

IB.25 ABILITY AND EXPERIENCE OF BIDDER

No award will be made to any bidder who cannot satisfy the Owner that he has sufficient ability and experience in this class of work and sufficient capital and plant to enable him to prosecute and complete the Work successfully within the time named. The Owner may make such investigations as they deem necessary to determine the ability of the bidder to perform the work; and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder is not properly qualified to carry out the obligations of the contract and to complete the work contemplated therein within the time stated. The Owner's decision on judgment on these matters shall be final, conclusive, and binding.

IB.26 POWER OF ATTORNEY

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

IB.27 LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable Federal and State laws, municipal ordinances, and rules and regulations or authorities having jurisdiction over construction of the project, shall apply to the Contract throughout, and shall be deemed to be included in the Contract the same as though herein written out in full.

IB.28 DATUM

The figures given in the Contract Documents after the word elevation (or letters "El.") shall mean the datum.

IB.29 OWNER MAY OMIT WORK

The Owner reserves the right to omit certain items in their entirety and other items in part as set forth in the Bid.

IB.30 REDUCTION IN SCOPE OF WORK

The Owner reserves the right to decrease the scope of the work to be done under this contract and to omit any work in order to bring the cost within available funds. To this end, the Owner reserves the right to reduce the quantity of any items or omit all of any items as set forth in the BID, either prior to executing the contract or at any time during the progress of the work. The Owner further reserves the right, at any time during the progress of the work, to restore all or part of any items previously omitted or reduced. Exercise by the Owner of the above rights shall not constitute any ground or basis of claim for damages or for anticipated profits on the work omitted.

IB.31 NONDISCRIMINATION IN EMPLOYMENT

Contracts for work under this bid (proposal) will obligate the contractors and subcontractors not to discriminate in employment practice.

The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, handicap, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed and the employees are treated during employment without regard to their race, color religion, sex, age, handicap, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotions, or transfers; recruitment or recruitment advertising, layoffs, or terminations; rates of pay or other forms of compensation; selection for training including apprenticeship; and participation in recreational and educational activities. The Contractor agrees to post in conspicuous places available to employees and applicants for employment a notice setting forth the provisions of this non-discrimination clause. 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, age, handicap or national origin. The Contractor will cause the foregoing provisions to be inserted in all sub-contracts for any work

covered by this contract so that such provisions will be binding upon each sub-contractor and upon sub-contracts for standard commercial supplies or raw materials.

The Contractor shall keep such records and submit such reports concerning the racial and ethnic origin of applicants for employment and employees as the Commission may require as consistent with Federal and State law.

The Contractor agrees to comply with such rules, regulations, or guidelines as the State of Rhode Island may issue to implement these requirements. The Contractor further warrants that he will comply with, Title VI of the Civil Rights Act of 1964, 42 U.S.C. 200d to d4.

Contractors shall comply with the provisions of the General Laws of Rhode Island and attention is called to Title 37, Chapter 13, Section 1-16, relative to the payment of wages, obligations and charges by Contractors on public works projects. Non-resident Contractors are subject to Section 44-1-6 of the RI General Laws, as amended, regarding OUT-OF-STATE CONTRACTORS.

The successful bidder will be required to comply with Equal Opportunity Requirements and to abide by the prevailing wage rates for Public Works Projects for all employees on the job. It is the responsibility of Bidders to inform themselves as to the local labor conditions, overtime compensation, health and welfare contributions, labor supply and prospective changes or adjustment of wage rates. Information is available at the Department of Labor.

IB.32 SEQUENCE OF OPERATIONS

The Contractor's attention is directed to the fact that there may be required work sequences in other sections of the Contract. The Contractor shall have no claim for additional compensation or damage on account of the required sequence of operations.

IB.33 PROTECTION OF LIVES AND HEALTH

This project is subject to all of the Safety and Health Regulations (Title 29, Part 1926, CFR, and all subsequent amendments) as promulgated by the United States Department of Labor on June 24, 1974. Contractors are urged to make themselves familiar with these regulations.

IB.34 PROJECT SIGN

The Contractor shall construct one sign in accordance with the Details included in Section 01067. The sign shall be erected in a location selected by the Program Manager. The Contractor shall maintain the sign throughout the duration of the Contract.

IB.35 STEEL PRODUCTS PROCUREMENT ACT

The Contractor shall comply with the Provisions of R.I. General Laws Section 37-2.1-1 et seq. concerning the purchasing of domestic steel.

IB.36 EQUAL EMPLOYMENT OPPORTUNITY

The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the Standard Federal EEO Construction Contract Specification set forth herein.

The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation in each trade
	3.0%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation 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 the contractor shall make a good faith effort to employ minorities and women evenly on each of his 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 the 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.

The contractor shall provide written notification to the Director of the office of Federal 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 the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

As used in this notice, and in the contract resulting from this solicitation, the "covered area" is Pawtucket, Rhode Island in Providence County.

IB.37 MINORITY AND WOMEN'S BUSINESS ENTERPRISE PARTICIPATION

The Offeror's or Bidder's attention is called to the "Regulations Governing Participation by Minority Business Enterprises in State Funded and Directed Public Construction Projects, Construction Contracts and Procurement Contracts for Goods and Services".

The goals for minority and/or women's business enterprise, expressed in percentage terms of the total dollar of the Work is ten percent.

Bidders shall submit an MBE/WBE Compliance Statement with the bid. Failure to provide said statement with the bid shall render the bid nonresponsive and result in the rejection of the bid. After a contractor has been identified as the apparent low bidder, the contractor shall, within 10 days of notification, prepare an MBE/WBE Compliance Plan for that project and submit it to the Director of the Department of Administration or his designee for approval. The Plan shall identify the MBE/WBE by name, subcontract dollar amount and type for each subcontract that the contractor projects will be awarded to MBE/WBEs over the period of the project. This plan must be approved by the State of Rhode Island, Department of Administration prior to award of the contract.

IB.38 PERMITS

The Contractor shall be responsible for obtaining local building and other required permits. Costs for such permits are the responsibility of the Contractor and shall be included in the Bid Price.

END OF INFORMATION TO BIDDERS

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BID (B)

Bidder's Name _____

To the Narragansett Bay Commission, herein called the Owner, for Construction of CSO Phase IIIA-5, OF-217 Consolidation Conduit, in Pawtucket, Rhode Island.

The Undersigned, as bidder, herein referred to as singular and masculine, declares as follows:

(1) The only parties interested in this BID as Principals are named herein;

(2) this BID is made without collusion with any other person, firm, or corporation;

(3) no officer, agent, or employee of the Owner is directly or indirectly interested in this BID;

(4) he has carefully examined the site of the proposed Work and fully informed and satisfied himself as to the conditions there existing, the character and requirements of the proposed Work, the difficulties attendant upon its execution and the accuracy of all estimated quantities stated in this BID, and he has carefully read the Specifications and examined the Drawings, and annexed proposed AGREEMENT and the Specifications and other Contract Documents therein referred to and knows and understands the terms and provisions thereof;

(5) he understands that information relative to subsurface and other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) has been furnished only for his information and convenience without any warranty or guarantee, expressed or implied, that the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered will be the same as those shown on the Drawings or in any of the other Contract Documents and he agrees that he shall not use or be entitled to use any such information made available to him through the Contract Documents or otherwise or obtained by him in his own examination of the site, as a basis of or ground for any claim against the Owner or the Program Manager arising from or by reason of any variance which may exist between the aforesaid information made available to or acquired by him and the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered during the construction work, and he has made due allowance therefore in this BID;

(6) and he understands that the quantities of work tabulated in this BID or indicated on the Drawings or in the Specifications or other Contract Documents are only approximate and are subject to increase or decrease as deemed necessary by the Program Manager; and he agrees that, if this BID is accepted he will contract with the Owner, as provided in the copy of the Contract Documents deposited in the office of the Program Manager, this BID form being part of said Contract Documents, and that he will perform all the work and furnish all the materials and equipment, and provide all labor, services, plant, machinery, apparatus, appliances, tools, supplies and all other necessities required by the Contract Documents in the manner and within the time therein prescribed and according to the requirements of the Program Manager as therein set forth.

(Note: Bidders must bid on each item. All entries in the entire BID must be made clearly and in ink or be typed; prices bid should be written in both words and figures. In the case of discrepancy the value in words shall govern.)

1.1 BID SCHEDULE

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
Combined Sewer					
1.	Construct 48-inch Consolidation Conduit, installed by micro-tunnelling, the lump sum TOTAL PRICE IN WORDS: _____ _____	LS	1	_____	_____
2.	Construct 48-inch RCP Consolidation Conduit, installed by open cut trenching, per linear foot TOTAL PRICE IN WORDS: _____ _____	LF	XX	_____	_____
3.	Construct 42-inch RCP Outfall Pipe, installed by open cut trenching, per linear foot TOTAL PRICE IN WORDS: _____ _____	LF	XX	_____	_____
4.	Construct Lining System for Consolidation Conduit / Outfall, the lump sum TOTAL PRICE IN WORDS: _____ _____	LS	1	_____	_____
5.	Construct 8-foot diameter precast concrete manhole, per each TOTAL PRICE IN WORDS: _____ _____	EA	XX	_____	_____

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
6.	Construct additional depth of 8-foot diameter precast concrete manhole over 12-feet deep, per vertical foot TOTAL PRICE IN WORDS:	VF	XX	_____	_____
	_____ _____				
7.	Construct OF-217 Diversion Structure, complete, the lump sum TOTAL PRICE IN WORDS:	LS	1	_____	_____
	_____ _____				
8.	Construct OF-217 Relocation Structure, complete, the lump sum TOTAL PRICE IN WORDS:	LS	1	_____	_____
	_____ _____				
	Storm Drain				
9.	Construct 12-inch RCP Drain Pipe, per linear foot TOTAL PRICE IN WORDS:	LF	XX	_____	_____
	_____ _____				
10.	Construct 4-foot diameter precast concrete storm drain manhole, per each TOTAL PRICE IN WORDS:	EA	XX	_____	_____
	_____ _____				

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
11.	Construct 4-foot diameter precast concrete storm drain catch basin, per each	EA	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

Earthwork

12.	Rock excavation and disposal, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
13.	Earth excavation below normal depth, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
14.	Impermeable earth fill, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
15.	Earth excavation and backfill for test pits, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
16.	Additional gravel borrow, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
17.	Additional crushed stone, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
18.	Additional sand, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
19.	Additional concrete, all classes, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
20.	Controlled low strength material, per cubic yard	CY*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
Soil Disposal					
21.	Disposal of excess soil – Category #1 soil, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
22.	Disposal of excess soil – Category #2, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
23.	Disposal of excess soil – Category #3, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
24.	Disposal of excess soil – Category #4, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
25.	Disposal of Tidewater property soil, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
Site Restoration					
26.	Construct concrete sidewalks, driveway aprons, and wheelchair ramps, per square yard	SY	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
27.	Remove and reset granite curb, per linear foot	LF	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
28.	Install new granite curb, per linear foot	LF	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
29.	Loam and seed, per square yard	SY	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
30.	Restoration of geomembrane cap, per square yard	SY	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
Paving					
31.	Gravel base course, per square yard	SY	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
32.	Temporary trench-width bituminous pavement, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
33.	Permanent trench-width bituminous pavement, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
34.	Micromilling existing pavement, per square yard	SY	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
35.	Bituminous surface course pavement, per ton	TON	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
36.	Miscellaneous asphalt, per ton	TON*	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
37.	Traffic striping, per linear foot	LF	XX	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
Miscellaneous					
38.	Erosion and sedimentation control, the lump sum	LS	1	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
39.	Dewatering treatment system, the lump sum	LS	1	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
40.	Maintenance and Protection of Traffic, the lump sum	LS	1	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

BID ITEM	DESCRIPTION	UNIT	QTY	UNIT BID PRICE	TOTAL COST
41.	Mobilization and Demobilization, the lump sum	LS	1	_____	_____
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
	Allowances				
42.	Miscellaneous utility relocation, allowance	ALLOW	1	$XX	$XX
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
43.	Testing of materials and methods, allowance	ALLOW	1	$XX	$XX
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
44.	Unforeseen Underground Obstructions, allowance	ALLOW	1	$XX	$XX
	TOTAL PRICE IN WORDS:				
	_____				
	_____				
45.	Removal and Disposal of Special Waste, allowance	ALLOW	1	$XX	$XX
	TOTAL PRICE IN WORDS:				
	_____				
	_____				

The Total Amount of this bid, based upon the quantities of materials and labor estimated by the Bidder, (total of Bid Items No. 1 through 45, inclusive), as computed by the Bidder is:

_____ Dollars

and _____ Cents $ _____
(in words) (in figures)

1.2 ADDITIONAL BID PROVISIONS

The undersigned agrees that for extra work, if any, performed in accordance with the provisions of the annexed form of AGREEMENT, he will accept compensation as stipulated therein in full payment for such extra work.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

As provided in the INFORMATION FOR BIDDERS, the bidder hereby agrees that he will not withdraw this BID within 90 calendar days after the actual date of the opening of Bids. If the Owner shall accept this Bid and a Notice of Award accompanied by at least four unsigned copies of the Agreement and all other applicable Contract Documents are delivered to the undersigned within ninety calendar days of the Receipt of Bids, the undersigned will within five days, excluding Saturdays, Sundays, and holidays, after the date of receipt of such notification, execute and return all copies of the Agreement and all other applicable Contract Documents to the Owner. The premiums for all Bonds required shall be paid by the Contractor and shall be included in the Contract Price. The undersigned further agrees that the Bid Security accompanying this Bid shall become the property of the Owner if the Bidder fails to execute the Agreement as stated above.

The undersigned hereby agrees that the Contract Time shall commence upon the date stipulated in a written Notice to Proceed, and that all work required under the Contract shall be completed before the time limit stipulated in Table A of the Agreement.

Delay damages as detailed in Table A of the Agreement shall be imposed upon Bidder for each calendar day of delay in completing all obligations and work required within the time specified.

The bidder shall complete and submit with his bid the pages 1 through 21 inclusive. Failure to submit all bid pages, completed, shall render the bid nonresponsive and result in rejection of the bid.

Bidder acknowledges receipt of the following addendum:
Addendum No. _____ through Addendum No. _____

The bidder, by submittal of this BID, agrees with the Owner that the amount of the bid security deposited with this BID fairly and reasonably represents the amount of damages the Owner will suffer due to the failure of the bidder to fulfill his agreements as above provided.

(SEAL)

_____

(Name of Bidder)

By _____

(Signature and title of authorized representative)

_____

(Printed name of authorized representative)

_____

(Business address)

_____

(City and State)

Date_____

The bidder is a corporation incorporated, a partnership or an individual in the State or Commonwealth of _____.

(Note: If the bidder is a corporation, affix corporate seal and give below the names of its president, treasurer, and general manager if any; if a partnership, give full names and residential addresses of all partners; and if an individual, give residential address if different from business addresses.)

The required names and addresses of all persons interested in the foregoing Bid, as Principals, are as follows:

_____

_____

_____

STATEMENT OF BIDDERS QUALIFICATIONS

The following shall accompany the bid and is required as evidence of the bidder's qualifications to perform the work, as bid upon, in accordance with the contract drawings and specifications. This statement must be notarized. All questions must be answered. Additional data may be submitted on separate attached sheets.

1. Name of Bidder _____

2. Permanent Main Office Address _____
_____

3. Official Mailing Address This Contract _____
_____

4. When Organized _____

5. Where Incorporated, If a Corporation _____

6. Years Contracting under Present Name _____

7. List contracts on hand, and those completed similar in nature to this project.

		Work Performed As Contractor			
Owner	Program Manager	Subcontractor	Description of Work	Contract Amount	Date Cmp.

8. List any work the firm has failed to complete, state where and why.

_____

9. If you have ever defaulted on any contract, state where and why.

_____

_____
Name of Bidder

_____
Signature and title of authorized representative

_____
Printed name of authorized representative

_____
Business address

_____
City and State

_____
Date

NOTARIZED

Signed before me on this _____ day of _____, 20_____

Notary Public (seal)

_____

My commission expires _____

CERTIFICATE OF AUTHORIZATION
FOR
BIDDING REPRESENTATIVE

(Note: Bidder must complete for certification of authorized representative signing Bid.)

At a duly authorized meeting of the Board of Directors of the

_____, held on _____ ,
(Name of Corporation) (Date)

at which all the Directors were present or waived notice, it was voted that

_____ _____
(Name of Authorized Representative) (Title)

seal of the company shall be valid and binding upon this company.

A true copy

ATTEST _____
Clerk

Place of business _____

_____

I hereby certify that I am the clerk of the _____
(Name of the Corp.)

_____ , that _____
(Name of Authorized Representative)

the duly elected _____ of said
(Title)

company, and that the above vote has not been amended or rescinded and remains in full force and effect as of the date of this contract.

Corporate Seal

.

_____
Clerk

MBE/WBE COMPLIANCE STATEMENT

_____hereby acknowledges (its/my)
(Name of Bidder)

obligation to award a minimum of ten percent (10%) of the dollar value of the entire amount of the bid to minority and/or women's business enterprise and to comply with R.I.G.L. 17-14-1 et seq. and the regulations promulgated thereunder.

By _____
(Signature and title of authorized representative)

_____
(Printed name of authorized representative)

United States Environmental Protection Agency

Disadvantaged Business Enterprise (DBE) Program

DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] 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.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work
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.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

United States Environmental Protection Agency

Disadvantaged Business Enterprise (DBE) 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 33.302 (c).

Prime Contractor Signature	**Print Name**
Title	**Date**

Subcontractor Signature	**Print**
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

EPA FORM 6100-3 (DBE Subcontractor Performance Form)

OMB Control No: 2090-0030

Approved: 8/13/2013

United States Environmental Protection Agency

Disadvantaged Business Enterprise (DBE) 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.

Prime Contractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	__ YES	O
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	**Company Address/ Phone/ Email**	**Est. Dollar Amt**	**Currently DBE Certified**

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.

EPA FORM 6100-4 (DBE Subcontractor Utilization Form)

United States Environmental Protection Agency

Disadvantaged Business Enterprise (DBE) 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 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 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

CERTIFICATION REGARDING DEBARMENT & SUSPENSION AND OTHER RESPONSIBILITY MATTERS

In accordance with the Executive Order 12549, the prospective primary participant certifies to the best of his / her knowledge and belief, that its principals:

a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any federal department or agency;

b. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offence in connection with obtaining, attempting to obtain, or performing a public (federal, state, or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement,
theft, forgery, bribery, falsification or destruction or records, making false statements, or receiving stolen property;

c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state, or local) with commission of any of the offenses enumerated in paragraph (1) (b) of this certification.

d. Have not within a three-year period preceding this application / proposal had one or more public transactions (federal, state, or local) terminated for cause of default.

e. Acknowledge that all sub-contractors selected for this project must be in compliance with paragraphs (1) (a – d) of this certification.

_____ _____
Name and Title of Authorized Agent Date

_____
Signature of Authorized Agent

_____ I am unable to certify to the above statements. My explanation is attached.

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SECTION BB

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned

_____, as Principal, and
(insert name of bidder)

_____, as Surety, are hereby
(insert name of surety)

held and firmly bound unto the Narragansett Bay Commission, NBC Corporate Office Building, 1 Service Road, Providence, RI 02905, as Owner, in the sum of 5% of the bid as liquidated damages for payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of this obligation is such that whereas the Principal has submitted to the Narragansett Bay Commission a certain Bid attached hereto and hereby made a part hereof, to enter into a contract in writing, hereinafter referred to as the "Agreement" and/or "Contract" for CSO Phase IIIA-5, OF-217 Consolidation Conduit, NBC Contract No. 308.05C.

NOW THERFORE,

(a) If said BID shall be rejected or withdrawn as provided in the INFORMATION FOR BIDDERS attached hereto or, in the alternative,

(b) If said BID shall be accepted and the Principal shall duly execute and deliver the form of AGREEMENT attached hereto and shall furnish and specified bonds for the faithful performance of the AGREEMENT and/or Contract and for the payment for labor and materials furnished for the performance of the AGREEMENT and/or Contract, then this obligation shall be void, otherwise it shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder in no event shall exceed the amount of this obligation.

The Surety, for value received, hereby agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extensions of the time within which such BID may be accepted, and said Surety does hereby waive notice of any such extensions.

IN WITNESS WHEREOF, the parties hereto have duly executed this bond on the _____ day of _____, 20__.

(SEAL) _____ L.S.
(Name of Principal)

By_____

(SEAL) _____
(Name of Surety)

By_____

Sealed and delivered
in the presence of

_____

_____

SECTION CB

CONTRACT BONDS

PERFORMANCE BOND

(Note: This Bond is issued simultaneously with the attached Labor and Materials Bond in favor of the Narragansett Bay Commission ("Owner").)

KNOW ALL MEN BY THESE PRESENTS:

That we,

_____,

_____,
(an individual, a partnership, a corporation)

duly organized under the Laws of the State of _____,

and having a usual place of business at _____,

as Principal, and _____,

a corporation duly organized under the Laws of the State of

and duly authorized to do business in the State of Rhode Island, and having a usual place of business at _____, as Surety, are holden and stand firmly bound and obligated unto Owner, Narragansett Bay Commission, as Obligee, in the sum of _____ Dollars ($ _____) lawful money of the United States of America, to and for the true payment whereof we bind ourselves and, each of us, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal, by means of a written AGREEMENT (which together with the Contract Documents in said AGREEMENT referred to are collectively sometimes referred to as the "Contract") dated _____, has entered into a contract with the said Obligee for CSO Phase IIIA-5, OF-217 Consolidation Conduit, NBC Contract No. 308.05C, in Pawtucket, Rhode Island, a copy of which AGREEMENT is attached hereto and by reference made a part hereof.

NOW THEREFORE, THE CONDITION of this obligation is such that if the Principal shall well and truly keep and fully and faithfully perform all of the terms and conditions of said AGREEMENT and of the "Contract Documents" referred to in said AGREEMENT (which collectively are hereinafter and in said AGREEMENT sometimes referred to as the "Contract") and all modifications thereof on the Principal's part to be performed, this obligation shall be void; otherwise it shall remain in full force and effect.

Whenever the said Principal shall be, and declared by the Owner to be, in default under the said Contract, the Owner having performed the Owner's obligations thereunder, the Surety, for value received, shall promptly, at the option of the Owner:

(a) Complete the said AGREEMENT and/or Contract in accordance with its terms and conditions with replacement contractor(s) or supplier(s) consented to in writing by the Owner,

or

(b) Obtain a bid or bids for submission to and the approval of the Owner for completing the said AGREEMENT and/or Contract and any modifications thereof in accordance with the terms and conditions thereof, and upon determination by the Owner and the Surety of the lowest responsible and acceptable bidder, arrange for a contract between such bidder and the Owner, and make available to the Owner as the Work progresses (even though there should be a default or a succession of defaults under this paragraph) sufficient funds to pay the cost of completion less a sum that shall be equal to the difference between the Contract price as fixed and provided in said AGREEMENT and/or Contract or any modifications thereof to be paid thereunder to the Principal and the amount previously paid by the Owner to and/or for the account of and/or chargeable against the Principal, but not exceeding (including other costs and damages for which the Surety may be liable hereunder) the amount set forth in the first paragraph hereof.

The Surety, for value received, agrees further that no changes in, omissions from, or alterations, modifications or additions to the terms and provisions of said AGREEMENT and/or Contract or the Work to be performed thereunder, and that no extensions of time given or changes made in the manner or time of making payments thereunder, shall in any way affect the Surety's obligations on this Bond, and the Surety hereby waives notice of any such changes, omissions, alterations, modifications, additions or extensions.

No right of action shall accrue on this Bond to or for the use of any persons other than the Owner named herein or the heirs, executors, administrators, successors and assigns of the Owner.

IN WITNESS WHEREOF, we have hereunto set our hands and seal to _____ counterparts of this Bond, this _____ day of _____, in the year Two Thousand and _____.

_____(Seal)

By: _____
(Signature and title)

_____
(Signature and title)

_____
(Signature and title)

_____(Seal)
Surety

By: _____(Seal)
(Signature and title)

By: _____
Attorney-In-Fact

(Note:

If the Principal (Contractor) is a partnership, the Bond should be signed by each of the partners.

If the Principal (Contractor) is a corporation, the Bond should be signed in its correct corporate name by its duly authorized officer or officers.

If this Bond is signed on behalf of the Surety by an attorney-in-fact, there should be attached to it a duly certified copy of his power of attorney showing his authority to sign such Bonds.

There should be executed an appropriate number of counterparts of the Bond corresponding to the number of counterparts of the AGREEMENT.)

Date of Bond shall not be prior to date of Contract.

IMPORTANT:

Surety Companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

The attention of the Surety Companies and Principal executing this Performance Bond is directed to the fact that said Bond shall remain in full effect throughout the life of any guaranty or warranty periods stipulated in the Contract Documents and/or Agreement.

***

LABOR AND MATERIALS BOND

(Note: This Bond is issued simultaneously with the attached Performance Bond in favor of the Narragansett Bay Commission ("Owner").)

KNOW ALL MEN BY THESE PRESENTS:

That we,

_____,

_____,

(an individual, a partnership, a corporation)

duly organized under the Laws of the State of _____,

and having a usual place of business at

_____,

as Principal, and _____, a corporation duly organized under the Laws of the State of _____and duly authorized to do business in the State of Rhode Island, and having a usual place of business at _____, as Surety, are holden and stand firmly bound and obligated unto the Owner, Narragansett Bay Commission, as obligee, in the sum of _____ Dollars ($_____) lawful money of the United States of America, to and for the true payment whereof we bind ourselves and, each of us, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal, by means of a written AGREEMENT (where together with the Contract Documents in said AGREEMENT referred to are collectively sometimes referred to as the "Contract") dated _____, has entered into a contract with the said Obligee for CSO Phase IIIA-5, OF-217 Consolidation Conduit, NBC Contract No. 308.05C, in Pawtucket, Rhode Island, a copy of which AGREEMENT is attached hereto and by reference made a part hereof.

NOW, THEREFORE, THE CONDITION of this obligation is such that if the Principal shall promptly make payments to all Claimants as hereinafter defined, for all labor performed or furnished and for all materials and equipment furnished for or used in or in connection with the Work called for by said AGREEMENT and/or Contract and any modifications thereof, including lumber used but not incorporated in said Work, and for the rental or hire of vehicles, tools and other appliances and equipment furnished for or used in connection with said Work, this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

(a) A Claimant is defined as one having a direct contract with the Principal or with subcontractor of the Principal for labor, materials and/or equipment used or reasonably required for use in the performance of the said Work, labor and materials being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the said AGREEMENT and/or Contract and any modifications thereof.

(b) The above named Principal and Surety hereby jointly and severally agree with the Owner that every Claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such Claimant's work or labor was done or performed,

or materials or equipment were furnished by such Claimant, may sue on this bond after for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due Claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

(c) No suit or action shall be commenced hereunder by any Claimant:

(i) Unless Claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: The Principal, the Owner, or the Surety above named, within ninety (90) days after such Claimant did or performed the last of the work or labor, or furnished the last of the materials or equipment for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials or equipment were furnished, or for whom the work or labor was done or performed. Such notice shall be served by any means which provides written third party verification of delivery to the Principal, Owner, or Surety at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the said Work is located, save that such service need not be made by a public officer;

(ii) After the expiration of one (1) year following the date on which the Principal ceased Work on said AGREEMENT and/or Contract and any modifications thereof, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law;

(iii) Other than in any court of competent jurisdiction in the location in which the said Work on said AGREEMENT and/or Contract and any modifications thereof is located, and not elsewhere.

When a Claimant has satisfied the conditions of paragraph (c) above, the Surety shall promptly and at the Surety's expense take the following actions:

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

(b) Pay or arrange for payment of any undisputed amounts.

The Surety's failure to send a written answer within 60 days after receipt of the claim shall not be deemed to constitute a waiver of defenses the Surety or Principal may have or acquire as to a claim. However, if the Surety fails to timely send said written answer to the Claimant, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.

The Surety, for value received, agrees further that no changes in, commissions from, or alterations, modifications or additions to the terms and provisions of said AGREEMENT and/or Contract or the Work to be performed thereunder, and that no extensions of time given or changes made in the manner or time of making payments thereunder, shall in any way affect the Surety's obligations on this Bond, and the Surety hereby waives notice of any such changes, omissions, alterations, modifications, additions or extensions.

IN WITNESS WHEREOF, we have hereunto set our hands and seals to

_____ counterparts of this Bond, this _____ day of _____, in the year Two Thousand and _____.

_____ (Seal)
Principal

By: _____
(Signature and title)

_____
(Signature and title)

_____
(Signature and title)

_____ (Seal)
Surety

By: _____ (Seal)
(Signature and title)

By: _____
Attorney-In-Fact

(Note:

If the Principal (Contractor) is a partnership, the Bond should be signed by each of the partners.

If the Principal (Contractor) is a corporation, the Bond should be signed in its correct corporate name by its duly authorized officer or officers.

If this Bond is signed on behalf of the Surety by an attorney-in-fact, there should be attached to it a duly certified copy of his power of attorney showing his authority to sign such Bonds.

There should be executed an approximate number of counterparts of the Bond corresponding to the number of counterparts of the AGREEMENT.)

Date of Bond shall not be prior to date of Contract.

IMPORTANT:

Surety Companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

The attention of the Surety Companies and Principal executing this Labor and Materials Bond is directed to the fact that said Bond shall remain in full effect throughout the life of any guaranty or warranty periods stipulated in the Contract Documents and/or Agreement.

Certificate of Acknowledgment of Contractor if a Corporation

FOR CONTRACT BONDS

State of _____)

) ss:

County of _____)

On this _____ day of _____,

20_____, before me personally

came _____ to me known, who being by me duly sworn, did depose and say as follow:

That he resides at _____

and is the _____

of _____,

the corporation described in and which executed the foregoing instrument; that he knows the corporate seal of said corporation; that the seal affixed to the foregoing instrument is such corporate seal and it was so affixed by order of the Board of Directors of said corporation; and that by the like order he signed thereto his name and official designation.

_____

Notary Public (Seal)

My commission expires _____

END OF DOCUMENT

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CONTRACT AGREEMENT (CA)

Project Title: CSO Phase IIIA – 5: OF-217 Consolidation Conduit (hereinafter, the "Project").

Project Location: City of Pawtucket, RI

Contract: 308.05C

THIS Agreement, is made as of this _____ day of _____ 2021.

(hereinafter, the "Agreement") by and between the Narragansett Bay Commission, with an address of NBC Corporate Office Building, 1 Service Road, Providence, RI 02905, acting by and through its Commission, duly authorized therefor, which acts herein solely for said Commission and without personal liability to itself, hereinafter referred to as the "Owner," and _____, a corporation organized and existing under the laws of the State of _____, with an address of _____ (hereinafter referred to as the "Contractor").

WITNESSETH, that the Owner and the Contractor, each in consideration of the undertakings, promises, and agreements on the part of the other herein contained, have undertaken, promised, and agreed and do hereby undertake, promise, and agree, the Owner for itself, its successors and assigns, and the Contractor for itself and its heirs, executors, administrators, successors and assigns, as follows:

1. The Contractor will furnish all labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, and all other things necessary to do all work required for the completion of the Project as specified and described herein.

2. As specified and described herein, the Contractor will commence the work required by the Contract Documents on a date specified in a written "Notice to Proceed."

3. The Contractor will fully complete the Project before the expiration of the time limit stipulated in Table A of this Agreement unless the period for completion is extended otherwise by and in accordance with the Contract Documents. The Contractor further agrees to pay delay damages for each calendar day of delay in completing all obligations and work required within the time specified. The value of the delay damages is indicated in Table A included herewith as part of the Agreement.

3. The Contractor agrees to perform all of the work specified in the Contract Documents and necessary to complete the Contract, and comply with the terms therein for the total Contract Price of $_____.

4. The Owner will pay to the Contractor in the manner and at such times as set forth in this Agreement such amount as required by the Contract Documents.

5. Nothing herein shall be construed as creating any personal liability on part of any officer or agent of any public body which may be a party hereto, nor shall it be construed as giving any rights or benefits hereunder to anyone other than the Owner and Contractor.

6. This Agreement represents the entire understanding of the Owner and Contractor to those matters contained herein. No prior oral or written understanding shall be of any force or effect with respect to those matters covered hereunder. This Agreement may not be modified or altered except in writing signed by both parties.

7. This Agreement shall be administered and interpreted under the laws of the State of Rhode Island. Jurisdiction over all disputes arising from this Agreement shall be in that state.

8. If any part of this Agreement is found by a court of competent jurisdiction to be in conflict with applicable laws, such part shall be inoperative, null, and void insofar of this Agreement shall be in full force and effect.

8. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

9. This Agreement includes Table A included herewith as part of Section CA.

IN WITNESS THEREOF, the parties to this Agreement have hereunto set their hands and seals as of the day and year first above written. Four copies of this form shall be signed and sealed, with original signatures and seals, by the parties to this Agreement.

OWNER:

NARRAGANSETT BAY COMMISSION

by:_____
Vincent J. Mesolella Jr., Chairman

by:_____
Laurie Horridge, Executive Director

CONTRACTOR:

by:_____

_____
(Name and Title)

Certificate of Acknowledgment
of Contractor if a Corporation

For Agreement

I have the authority to execute this document on behalf of _____, the corporation described herein; I know the corporate seal of said corporation; the seal affixed to the foregoing instrument is such corporate seal and it was so affixed by order of the Board of Directors of said corporation; and that by the authority of said corporation, I signed thereto my name and official designation on behalf of the corporation.

_____
Corporate Officer

State of _____)

County of _____)

On this _____ day of _____, 20_____,

before me personally came _____,
the _____ of _____to me known, and known by me to be the party executing the foregoing instrument on behalf of said corporation and he/she acknowledged said instrument by him/her executed to be his/her free act and deed, individually and in his/her said capacity and the free act and deed of said corporation

_____
Notary Public (Seal)

My commission expires_____

INDEX

ARTICLE 1 – CONVENTIONS AND DEFINITIONS

§1.1 CONVENTIONS

a. Whenever in the Contract Documents, or upon the Drawings, the words "as directed," "as ordered," "as requested," "as required," "as permitted," "as instructed," "as designated," "as considered necessary," or words of like import are used, it shall be understood that the direction, order, request, requirement, or permission of the Program Manager is intended, unless clearly indicated otherwise. Similarly, the words "approved," "acceptable," "suitable," "satisfactory," and words of like import shall mean satisfactory to the Program Manager, unless clearly indicated otherwise.

b. The words "herein," "hereinafter," "hereunder," and words of like import shall be deemed to refer to the Contract Documents.

§1.2 DEFINITIONS

Wherever the words hereinafter defined or pronouns used in their stead occur in the Contract Documents, they shall have the meaning indicated which shall be applicable to both the singular and plural thereof:

a. Addenda - Written or graphic instruments issued prior to the opening of Bids which modify or interpret the Contract Documents, Drawings, and Specifications by additions, deletions, clarifications or corrections.

b. Agreement - The written contract between Owner and Contractor covering the Work to be performed; other Contract Documents which are attached to the Agreement and made a part thereof as provided therein.

c. Application For Payment - The form accepted by Program Manager which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

d. Bid - The offer or proposal of the Bidder submitted in the prescribed form setting forth the prices for the Work to be performed together with all required supporting documents.

e. Bidder - Any person, firm or corporation submitting a Bid for the Work.

f. Change Order - A written order to the Contractor signed by the Program Manager and the Owner authorizing an addition, deletion, or revision in the Work within the general scope of the Contract Documents or authorizing an adjustment in the Contract Price or Contract Time and issued on or after the date of the Agreement.

g. Completion Date: The date that equates to the date of commencement as specified in the Notice to Proceed plus the Contract Time days, plus approved expansions to the Contract Time.

h. Construction Superintendent - The person designated by the Contractor to be in charge of the Work and to carry out the provisions of the Contract Documents.

i. Contract Bonds - Bid, Performance, and Labor and Materials Payment Bonds and other instruments of security furnished by the Contractor and its surety in accordance with the Contract Documents.

j. Contract Documents - The Notice to Bidders; the Information for Bidders; the Bid; the Agreement; the Contract Bonds; the Specifications; the Drawings; Appendices; Addenda; Shop Drawings; written amendments to the Agreement; Field Orders; Change Orders; and Program Manager's written interpretations and clarifications of the Contract Documents executed on or after the date of the Agreement. The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. Where there is a conflict, the more stringent requirements as determined by the Program Manager shall govern, as provided in Article 4, Administration of the Contract.

k. Contract Price - The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

l. Contract Time - The number of calendar days stated in the Contract Documents for the completion of the Work, including completion of all the punch list items.

m. Contractor - The person, firm or corporation with whom the Owner has executed the Agreement.

n. Cost and Pricing Data - All data used by the Contractor in negotiating and pricing work covered by changes, or involved in a proposal or claim, including, but not limited to, bid estimates, estimating guides, proposal or claim estimates pricing adjustments in Contract Price or Contract Time, back-up computations and assumptions.

o. Datum - Any level surface to which Elevations are referred.

p. Defective -An adjective which, when modifying the word Work, refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference, standard, test or approval referred to in the Contract Documents.

q. Drawings - The drawings which are part of the Contract Documents and which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Program Manager.

r Earth - The word "earth", wherever used as the name of an excavated material or material to be excavated, shall mean all kinds of material other than rock as defined below.

s. Elevation - The figures given on the Drawings or in the other Contract Documents after the word "elevation" or abbreviation of it shall mean the distance in feet above the datum adopted by the Program Manager.

t. Program Manager - The person(s) or firm(s) duly appointed by the Owner to represent the Owner during the entirety of the Agreement, to observe the Work on behalf of the Owner, and to undertake certain actions and duties for the Owner as delineated in the Contract Documents. The Owner may designate itself the Program Manager.

u. Program Manager's Consultant - A person, firm or corporation having a contract with Program Manager to furnish services as Program Manager's independent professional associate or consultant with respect to the Project.

v. Extra Work - Work in connection with the Project, but not included in the Contract Documents, which is ordered in writing by the Program Manager and the Owner.

w. Field Order - A written order effecting change in the Work not involving an adjustment in the Contract Price or the Contract Time, issued by the Program Manager to the Contractor during construction.

x. Final Completion - That date as certified by the Program Manager, through written notice to the Owner, when the construction for the Project is completed in accordance with all provisions of the Contract Documents, including completion of all the punch list items.

y. Laws or Regulations - Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having any jurisdiction over any area of the Work.

z. Lump Sum Work - Work to be paid on the basis of a fixed price amount.

aa. Milestone - A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of the Work.

bb. Mobilization - Subject to the written approval of the Program Manager, the Contractor activities required to establish temporary facilities, equipment and personnel at the site thereby enabling the Work to commence.

cc. Notice of Award - The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

dd. Notice to Proceed - Written communication issued by the Owner to the Contractor authorizing it to proceed with the Work and establishing the date of commencement of the Work and the date for final completion.

ee. Owner - The Narragansett Bay Commission, also known as the Commission.

ff. Partial Utilization - Use by the Owner of a portion of the Work for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion of the Work.

gg. Product(s) - New material, machinery, components, equipment, fixtures and systems forming the Work; excluding machinery and equipment used for the preparation, fabrication, conveying and/or erection of the Work. Product(s) may also include existing materials or components required for reuse.

hh. Project - The total construction to be accomplished by the Work as provided in the Contract Documents, sometimes also referred to by the Owner's designated "Contract No. " as set forth on page 1 of the Agreement.

ii. Project Schedule - The Project Schedule shall represent the Contractor's best judgment and intended plan for the completion of the Work within the Contract Time and in compliance with the Contract Documents.

jj. Resident Representative - The authorized representative of the Program Manager who is assigned to the Project.

kk. Rock -The word "rock," wherever used as the name of an excavated material or material to be excavated, shall mean only boulders and pieces of concrete or masonry exceeding 1 cu. yd. in volume, or solid ledge rock which, in the sole opinion of the Program Manager, requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool. "Rock" shall expressly not mean: (i) soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel; (ii) loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere; and (iii) rock exterior to the maximum limits of measurement allowed, which may fall into the excavation.

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

mm. Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, Manufacturer, Supplier, or distributor which illustrate how specific portions of the Work shall be fabricated or installed.

nn. Specifications - A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

oo. Sub Agreements - A contract or purchase order awarding a part of the Work under the Contract Documents to a Subcontractor, Supplier or other person or organization.

pp. Subcontractor - An individual, firm, or corporation, approved by the Owner and Program Manager having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work on the Project.

qq. Substantial Completion - That date as certified by the Program Manager, through written notice to the Owner, when the construction for the Project or a specified part thereof is sufficiently completed in accordance with the Contract Documents so that the Work or specified part can be utilized for the purposes for which it is intended.

rr. Supplier - Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

ss. Underground Utilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other similar facilities or attachments, and any encasement containing such facilities which have been installed underground to furnish any of the following: water, electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewerage and drainage removal, traffic, or control systems.

tt. Unit Price Work - Work to be paid on the basis of a unit price for a specific item of Work.

uu. Work - The entire completed construction required to be furnished under the Contract Documents. Work includes and is the result of performing and furnishing any and all services, obligations, duties, responsibilities, labor, materials, equipment, temporary facilities, and incidentals necessary to complete the construction assigned to, or undertaken by the Contractor, pursuant to the Contract Documents.

vv. Written Notice - Any notice to any party of the Agreement relative to any part of this Agreement in writing and delivered as set forth in Section 13.2 of this Agreement.

ARTICLE 2 – OWNER

§2.1 ACCESS TO WORK

The Owner, the Program Manager, representatives of the state and any local municipal and federal agencies and their officers, agents, servants and employees may at any and all times and for any and all purposes, enter upon the Work and the site thereof and the premises used by the Contractor including off-site storage facilities and manufacturing facilities, and the Contractor shall at all times provide safe and proper facilities therefor.

§2.2 AUDIT ACCESS TO RECORDS

The Owner, the Governor of the State of Rhode Island or his/her designee, the Secretary of Administration and Finance of the State of Rhode Island or his/her designee, and the State Auditor or his/her designee shall have the right at reasonable times and upon reasonable notice to examine the books, records and other compilations of data of the Contractor and all Subcontractors which pertain to the performance of the provisions and requirements of this Contract.

If the Contractor has submitted Cost and Pricing data in connection with the pricing of any Change Order or claim related to this Contract, the Owner, the Program Manager, any of their duly authorized representatives, and those organizations itemized in the paragraph above, shall have the right to examine and audit all books, ledgers, records, and documents pertinent to all Cost and Pricing data available and relied upon by the Contractor (including that used by the Contractor in the determination of its Bid for the Work), in order to evaluate the accuracy, completeness, and currency of the Cost or Pricing data. This right to audit shall not apply to prices based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by Laws or Regulations.

The Contractor shall make available at all reasonable times the materials described in the paragraph above, for examination, audit, or reproduction, until six (6) years after final payment under this Contract.

If this Contract is completely or partially terminated, the records relating to the Work terminated shall be made available for three (3) years after any resulting final termination settlement.

Records pertaining to the settlement of claims arising under or relating to the performance of this Contract shall be made available for three (3) years after disposition of such appeals, litigation, or claims.

§2.3 RIGHT TO WITHHOLD MONIES

Notwithstanding anything to the contrary in this Agreement or the existence of any performance or labor or material payment bond, the Owner is hereby empowered to withhold from the Contractor an amount, equal in the opinion of the Owner to the amounts necessary to complete the entire Work, (or any part thereof), necessary to compensate Owner for any unexcused delay on the part of the Contractor, or necessary to pay and fully discharge any claims or liens arising out of the Work performed under this Agreement that may arise and be unpaid, for which, if established, the Owner may become liable. If any such obligations, claims or liens exceed the amount of the unpaid amounts under the Agreement, or arise after the full Agreement Price has been paid or otherwise satisfied in accordance with and subject to the terms and conditions hereof, the Contractor, immediately upon demand, shall pay to the Owner, as the case may be, all monies that the Owner may have paid or become obligated to pay for any and all costs, expenses, losses, damage, liabilities, suits, judgments, engineering/consultant fees, attorneys' fees, court costs, and awards incurred to discharge such obligations, liens or claims with respect to the Project.

ARTICLE 3 – CONTRACTOR

§3.1 OBLIGATIONS AND LIABILITY OF CONTRACTOR

The Contractor shall do all the work and perform and furnish all the labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies and all other things (except as otherwise expressly provided herein) necessary and as herein specified for the proper performance and completion of the Work in the manner and within the time hereinafter specified, in strict accordance with the Contract Documents, in conformity with the directions and to the satisfaction of the Program Manager, and at the prices herein agreed upon therefor.

If, during the performance of the Work, the Contractor discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code or of any instruction of any Supplier, the Contractor shall promptly report it to the Program Manager in writing.

All parts of the Work and all fixtures, equipment, apparatus and other items indicated on the Drawings and not mentioned in the Specifications, or vice versa, and all work and material usual and necessary to make the Work complete in all its parts, including all incidental work necessary to make it complete and satisfactory and ready for use and operation, whether or not they are indicated on the Drawings or mentioned in the Specifications, shall be furnished and executed the same as if they were called for both by the Drawings and by the Specifications.

The Contractor shall conduct the Work so as to interfere as little as possible with private business and public travel. Wherever and whenever necessary or required, it shall maintain fences, furnish watchmen, maintain lights, and take such other precaution as may be necessary to protect life and property.

The Contractor shall have complete responsibility for the Work and the protection thereof, and for preventing injuries to any persons and damage to the Work and property and utilities on or about the Work, until final completion and final acceptance thereof. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures for construction. The Contractor shall be solely responsible for initiating, maintaining and

supervising all safety precautions and programs in connection with the Work. It shall in no way be relieved of its responsibility by any right of the Program Manager to give permission or directions relating to any part of the Work, by any such permission or directions given, or by failure of the Program Manager to give such permission or directions. The Contractor shall bear all costs, expenses, losses and damages on account of the quantity or character of the Work or the nature of the land (including but not limited to subsurface conditions) in or under or on which the Work is done being different from that indicated or shown in the Contract Documents or from what was estimated or expected, or on account of the weather, elements, or other causes.

The Contractor shall conduct its operations so as not to damage existing structures or work installed either by it or by other contractors. In case of any such damage resulting from its operations, it shall repair and make good as new the damaged portions at its own expense with the consent of the damaged party. In the event that consent is not given, the Contractor shall continue to be liable for the damages caused.

The Contractor shall be fully responsible to Owner and Program Manager for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between Owner or Program Manager and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of Owner or Program Manager to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

At its sole discretion, the Parties agree that the Owner may issue joint checks to the Contractor and the Contractor’s Subcontractors and Suppliers. In no way should this create an express or implied obligation or expection on the Owner to issue joint checks.

The Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor. Contractor shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the Program Manager through the Contractor.

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

All Work performed for the Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of the Owner and Program Manager. Failure of the Contractor to specifically so bind the Subcontractor or Supplier shall constitute a material breach of this Agreement. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Article 11, Insurance and Bonds, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against the Owner, Program Manager and all other additional losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work. If

the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, the Contractor will obtain the same.

The Contractor shall promptly pay all federal, state and local taxes which may be assessed against it in connection with the Work or its operations under the Contract Documents, including, but not limited to, taxes attributable to the purchase of material and equipment, to the performance of services, and the employment of persons in the prosecution of the Work.

§3.2 COMPLIANCE WITH LAWS

The Contractor shall keep itself fully informed of all existing and future federal, state, and local laws, ordinances, rules, and regulations affecting those engaged or employed on the Work, the materials and equipment used in the Work or the conduct of the Work, and of all orders, decrees and other requirements of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the Drawings, Specifications or other Contract Documents in relation to any such law, ordinance, rule, regulation, order, decree or other requirement, the Contractor shall promptly report the same to the Program Manager in writing. The Contractor shall at all times observe and comply with, and cause all its agents, servants, employees and subcontractors to observe and comply with all such existing and future laws, ordinances, rules, regulations, orders, decrees and other requirements, and it shall protect, indemnify and save harmless the Owner, its officers, agents, servants and employees, from and against any and all claims, demands, suits, proceedings, liabilities, judgments, penalties, losses, damages, costs and expenses, including attorneys' fees, arising from or based upon any violation or claimed violation of any such law, ordinance, rule, regulation, order, decree or other requirement committed by the Contractor or any of his agents, servants, employees or subcontractors.

§3.3 SUPERVISION OF WORK

The Contractor shall be solely responsible for supervision of the Work, shall give the Work the constant attention necessary to ensure the expeditious and orderly progress thereof, and shall cooperate with the Program Manager and the Owner.

At all times, the Contractor shall have as its agent on the Project a full-time, on-site competent Superintendent capable of reading and thoroughly understanding the Contract Documents, with full authority to execute the directions of the Program Manager without delay and to supply promptly such labor, services, materials, equipment, plant, apparatus, appliances, tools, supplies and other items as may be required.

§3.4 EMPLOY COMPETENT PERSONS

The Contractor shall employ only competent persons on the Work and shall not engage in activities which may cause strikes, work stoppages or any disturbances by persons employed by the Contractor, any subcontractor, the Owner, the Program Manager or any other contractor. Whenever the Program Manager notifies the Contractor in writing that in the Program Manager’s opinion any person on the Work is incompetent, unfaithful, disorderly, or otherwise unsatisfactory, or not employed in accordance with the provisions of the Contract Documents, such person shall be discharged from the Work and shall not again be employed on it, except with the written consent of the Program Manager.

The Contractor shall verify that all members of the project team, its employees and subcontractors are legally eligible to be employed in the United States. The Contractor is required to utilize such verification sources as necessary to adequately ensure compliance with federal and state law in this regard.

The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, handicap, or national origin. The Contractor shall take affirmative action to ensure that applicants and employees are treated during employment without regard to their race, color, religion, sex, age, handicap, or national origin. Such actions shall include, but not be limited to the following: employment, upgrading, demotions, or transfers; recruitment or recruitment advertising, layoffs or terminations; rates of pay or other forms of compensation; selection of training including apprenticeship; and participation in recreational and educational activities. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notice to be provided setting forth the provisions of this nondiscrimination clause. The Contractor will in all solicitations or advertisement 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, age, handicap or national origin. The Contractor will cause the foregoing provisions to be inserted in all subcontracts for any work covered by this contract so that such provisions will be binding upon each subcontractor and upon subcontracts of standard commercial supplies or raw materials.

The Contractor shall keep such records and submit such reports concerning the racial and ethnic origin of applicants for employment and employees as the Owner may require as consistent with Federal and State law.

The Contractor agrees to comply with such rules, regulations, or guidelines as the State of Rhode Island may issue to implement these requirements. The Contractor further warrants that it will comply with Title VI of the Civil Rights Act of l964, 42 U.S.C. 200d to d4.

§3.5 EMPLOY SUFFICIENT LABOR AND EQUIPMENT

The Contractor shall at all times employ sufficient labor, plant, equipment or other means to complete the Work within the time specified herein.

If, in the sole judgment of the Program Manager, the Contractor is not employing sufficient labor, plant, equipment or other means to complete the Work within the time specified in the Project Schedule, the Program Manager may, after giving three (3) days written notice to Contractor, require the Contractor to employ such additional labor, plant, equipment and other means as the Program Manager deems necessary to enable the Work to progress properly.

§3.6 NOT TO SUBLET OR ASSIGN

The Contractor shall constantly give its personal attention to the faithful prosecution of the Work, shall keep the same under its personal control, shall not assign the Contract or sublet the Work or any part thereof without the previous written consent of the Owner, and shall not assign any of the moneys payable under the Contract, or its claim thereto, unless by and with the like written consent of the Owner and the Surety on the Contract Bonds. Any assignment or subletting in violation hereof shall be void and unenforceable.

§3.7 WARRANTY

The Contractor warrants that the Work and services to be performed under the Contract Documents, and all workmanship, materials and equipment performed, furnished, used or installed in the construction of the same, shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Drawings, Specifications, and other Contract Documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract Documents shall be fulfilled. The warrantee period shall be one year from the date of substantial completion.

§3.8 ASSIGNMENT OF WARRANTIES

The Contractor shall assign to Owner all manufacturer's and Supplier's warranties on Products. Such warranties shall be in addition to and not in substitution of the Contractor's obligations under Article 3, §3.7, Warranty.

§3.9 PROTECTION AGAINST WATER AND STORM

The Contractor shall take all precautions necessary to prevent damage to the Work by storms or by water entering the site of the Work directly or through the ground. In case of damage by storm or water, the Contractor shall, at its own cost and expense, make such repairs or replacements or rebuild such parts of the Work as the Program Manager may require in order that the finished Work may be completed as required by the Contract Documents. Without limiting the generality of the foregoing, the Contractor shall comply with the requirements of Specification Section 01501.

§3.10 PERMITS

The Contractor shall, at its own expense, take out and maintain from all federal, state, county and local authorities all permits required for its equipment, work force or particular operations (such as blasting) in the performance of the Work.

§3.11 RETURN OF DRAWINGS

All Drawings furnished by the Owner or the Program Manager to the Contractor may be used only in connection with the performance of the Work and shall be returned by the Contractor upon completion of the Work.

§3.12 CLEANING UP

During the progress of the Work, the Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, the Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. The Contractor shall leave the site clean and ready for occupancy by the Owner at Substantial Completion of the Work. The Contractor shall restore to original condition all property not designated for alteration by the Contract Documents. Without limiting the generality of the foregoing, the Contractor shall comply with the requirements of Section 01000.

§3.13 INTOXICATING LIQUORS AND CONTROLLED SUBSTANCES

The Contractor shall not sell and shall neither permit the introduction or use of intoxicating liquors or controlled substances upon or about the Work. See additional requirements under Specification Section 01540.

§3.14 PAYROLLS OF CONTRACTORS AND SUBCONTRACTORS

The Contractor and each of its Subcontractors shall prepare their payrolls on forms required by the Rhode Island Department of Labor. Pursuant to Rhode Island General Laws, Section 37-13-13, every Contractor and Subcontractor shall furnish a legible, certified copy of its payroll records of its employees employed upon the project to the director of labor and training on a monthly basis for the preceding month's work. A copy of each certified payroll, along with the transmittal letter to the director of labor and training, shall be furnished to the Owner. Each such payroll shall contain the statement required by the Federal Regulations issued pursuant to the "Anti-Kickback Statute," (48 Stat. 948; 18 U.S.C. 874; 40 U.S.C. 276).

The Contractor shall not carry on its payrolls any person not employed by it. The Contractor shall not carry on its payrolls employees of a subcontractor, but such employees must be carried only on the payrolls of the employing subcontractor.

The Contractor and each Subcontractor shall preserve its weekly payroll records for a period of three (3) years from the date of completion of the contract. The payroll records shall set out accurately and completely the name, occupational classification, and hourly wage rate of each employee, hours worked by him/her during the payroll period and full weekly wages earned by him/her, and deductions made from such weekly wages and the actual weekly wages paid to him/her. Such payroll records shall be made available at all times for inspection by the Owner or its authorized representatives, the Program Manager, agents of the United States Department of Labor, and such other persons as are required by state or federal law.

The Contractor agrees to defend, indemnify and hold harmless the Owner, its officers, directors, commissioners, associates, employees, agents, representatives, successors and assigns from and against all claims, losses, expenses (including attorneys' fees and court costs), damages, demands, judgments, causes of action or suits of any kind, arising from the failure of the Contractor or any of its subcontractors to comply with RIGL Section 37-13-13, or the rules, regulations, orders and decisions derived therefrom.

§3.15 GENERAL INDEMNIFICATION

Contractor shall defend, indemnify and hold harmless Owner and its respective parents, subsidiaries, affiliates, successors, assignees, agents, representatives, employees, officers, directors and members (collectively, the "Indemnified Parties") from and against all claims, damages, losses and expenses brought or asserted by third parties, (including but not limited to attorneys' fees and expenses), arising out of or resulting from any negligent or intentionally wrongful act or omission of Contractor or any Subcontractor or Vendor of any tier in the performance of the Work, any breach of a representation or warranty under this Agreement or any other breach of this Agreement including, without limitation, the failure to complete the Project in accordance with the requirements hereof. Contractor shall diligently defend any claim or suit brought against Owner or any assignee of Owner and shall pay all costs and expenses (including reasonable attorneys' fees and expenses) in connection with such claim or suit,

provided that Owner or such assignee gives Contractor written notice of such claim or suit and provides such reasonable assistance in connection therewith as Contractor may request.

In any and all claims, damages, losses or expenses by any employee of the Contractor, Subcontractor, Vendors, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Section shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor, any Subcontractor, Vendor or any other party under workers' compensation acts, disability benefit acts or other employee benefit acts.

Owner shall be entitled to collect, besides all legal damages attributable to Contractor's breach of any provision of this Article; (i) all attorneys' fees and costs incurred in bringing an action to enforce the provisions of this indemnity or any other indemnity contained in the Contract Documents; (ii) all attorneys' fees and costs incurred in defending the claim for which Contractor has failed to defend Owner; (iii) all expert, engineering, and consultant costs incurred in defending the claim for which Contractor has failed to defend Owner; and (iv) all other related expenses, costs, etc. incurred by Owner or the Indemnified Parties.

Only to the extent prohibited by any law prohibiting a party from being indemnified against their own negligence, the obligations of the Contractor under any indemnification provision in this Agreement shall not extend to the liability of Owner or any Indemnified Parties arising out of that party's own negligence.

§3.16 PATENTS

The Contractor shall indemnify and save harmless the Owner and all persons acting for or on behalf of the Owner from all claims and liability of any nature or kind, and all damages, costs and expenses, including attorney's fees, arising from or occasioned by an infringement or alleged infringement of any patents or patent rights on any invention, process, material, equipment, article, or apparatus, or any part thereof, furnished and installed by the Contractor, or arising from or occasioned by the use or manufacture thereof, including their use by the Owner.

ARTICLE 4 – ADMINISTRATION OF THE CONTRACT

§ 4.1 INTERPRETING THE CONTRACT DOCUMENTS

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. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result shall be furnished and performed whether or not specifically called for.

When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe the Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning unless said meaning is modified by the Contract Documents.

Reference in the Contract Documents to standard specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the edition of the standard specification, manual, code or laws or regulations identified in the reference. In the

event a particular edition is not identified, the reference shall mean the latest edition in effect at the time of receipt of the Bid.

However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall change the duties and responsibilities of the Owner, the Contractor or the Program Manager, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to the Program Manager, or any of the Program Manager's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the work or any duty or authority to undertake responsibility contrary to the provisions of this Agreement.

Clarifications and interpretations of the Contract Documents shall be issued by Program Manager as provided in §4.2, Authority of the Program Manager.

§ 4.2 AUTHORITY OF THE PROGRAM MANAGER

The Program Manager shall solely decide the intent and meaning of the Drawings, Specifications, and Contract Documents and the Program Manager’s decisions thereon and interpretation thereof shall be final, conclusive and binding on the Contractor, subject to the provisions of this § 4.2.

The Program Manager shall be the Owner's representative during the life of the Agreement and shall observe the Work in progress on behalf of the Owner. The Program Manager shall have authority (1) to act on behalf of the Owner to the extent expressly provided in the Contract Documents or otherwise in writing; (2) to determine the amount of the Work and its general conformance to the Contract Documents; and (3) to decide all questions which arise in relation to the Work, and the execution thereof.

The Program Manager will make on-site observations to observe the progress, quantity and quality of the executed Work and to determine if, in the Program Manager's sole judgment, the Work is proceeding in accordance with the Contract Documents. On-site observations by the Program Manager shall not give rise to any duty on the part of the Program Manager to undertake such observations for the benefit of the Contractor or any other third party.

The Program Manager will issue with reasonable promptness written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise), as the Program Manager may determine necessary, which shall be consistent with or reasonably inferable from the intent of the Contract Documents.

The Contractor shall proceed without delay to perform the work as directed, instructed, determined or decided by the Program Manager and shall comply promptly with such directions, instructions, determinations or decisions. If the Contractor has any objection thereto it may, within three (3) days of having received any such direction, instruction, determination or decision, require that any such direction, instruction, determination or decision be put in writing and within three (3) days after receipt of any such writing it may file a written protest with the Owner stating clearly and in detail its objections, the reasons therefor, and the nature and amount of additional compensation, if any, to which it claims it will be entitled under the Contract Documents. A copy of such protest shall be filed with the Program Manager at the same time it is filed with the Owner. Unless the Contractor requires that any such direction, instruction, determination or decision be put in writing within three (3) days of having received such

direction, instruction, determination or decision and unless the Contractor files such written protest with the Owner and Program Manager within such three (3) day period, it shall be deemed to have waived all grounds for protest of such direction, instruction, determination, or decision and all claims for additional compensation or damages occasioned thereby, and shall further be deemed to have accepted such direction, instruction, determination, or decision as being fair, reasonable, and finally determinative of its obligations and rights under the Contract Documents.

The Program Manager may authorize minor variations in the Work (not involving an adjustment in Contract Price or Contract Time) which are consistent with the intent of the Contract Documents and required to produce the intended result. These may be accomplished by a Field Order and shall be binding on the Contractor who shall perform the Work promptly.

The Program Manager shall have authority to evaluate and disapprove any test procedure for construction or equipment, and any pre-operational, start-up, or demonstration tests proposed to be conducted by the Contractor which the Program Manager believes to be inconsistent with the requirements of the Contract Documents, insufficient or unsuitable for the intended purpose, or impracticable. However, it shall not be the Program Manager's primary responsibility to make certain that any such test procedures are acceptable, nor shall this authority give rise to any duty on the part of the Program Manager to exercise this authority for the benefit of the Contractor.

Neither the Program Manager's authority to act under the Contract Documents nor any decision or determination made by the Program Manager in good faith to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Program Manager to the Contractor, any Subcontractor, any Supplier, or any other person or organization performing any of the Work, or to any surety for any of them.

Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved", or terms of like effect or importance are used, or the adjectives "reasonable", "suitable", "acceptable", "proper", or "satisfactory" or adjectives of like effect or importance are used to describe a requirement, direction, review or judgment of the Program Manager as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for general compliance with the Contract Documents (unless there is a specific statement indicating otherwise). When such a term or adjective is used, it shall not be effective to assign to the Program Manager any duty or authority to supervise or direct the furnishing or performance of the Work, including but not limited to review of Contractor’s Shop Drawings, or any duty or authority to undertake responsibility contrary to the provisions of this paragraph.

The Program Manager will not supervise, direct, control, have authority over, or be responsible for the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incidental to safety, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. The Program Manager will not be responsible for the Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

The Program Manager will not be responsible for the acts or omissions of the Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

The limitations on the Program Manager's authority and responsibility as set forth in this § 4.2 shall also apply to Program Manager's Consultants and Resident Representative.

§4.3 PROGRESS ESTIMATES

Except as hereinafter provided, the Program Manager shall make a monthly estimate in writing of the total amount and value of the work completed during each of the twelve (12) separate work periods set per the annual schedule promulgated by the Rhode Island Clean Water Finance Agency. The Owner shall retain a percentage of such estimated value, as set forth in Table A at the end of this section, as part security for fulfillment of the Contract by the Contractor and shall deduct from the balance all previous payments made to the Contractor, all sums chargeable against the Contractor and all sums to be retained under the provisions of the Contract Documents. The Owner shall pay monthly to the Contractor the balance not deducted and/or retained as aforesaid, except that payment may be withheld at any time if, in the judgment of the Program Manager, the Work is not proceeding in accordance with the Contract Documents. No progress estimate or payment need be made when, in the judgment of the Program Manager, the total value of the work done since the last estimate amounts to less than the amount set forth in Table A at the end of this section.

Estimates of lump sum items shall be based on a schedule dividing each such item into its appropriate component parts together with a quantity and a unit price for each part so that the sum of the products of prices and quantities will equal the Contract price for the item. This schedule shall be submitted by the Contractor for and must have the approval of the Program Manager before the first estimate becomes due.

The Program Manager will determine the actual quantities and classifications of Unit Price Work performed by the Contractor.

Materials and equipment will not be included in progress estimates until the following requirements have been fulfilled.

1. The Contractor must present an invoice to the Program Manager for each item of equipment he is requesting payment. The invoice must be broken down to show the costs for the actual equipment, and reasonable costs for Operations and Maintenance manuals, spare parts, start-up certification, training, testing, final acceptance testing, and any other services required by Contract Documents.

2. Sufficient monies have been allocated in the payment requisition line items to cover all of the costs listed in "1" above, plus the costs of physically installing the equipment.

3. The equipment has been submitted and approved for use in this Project.

4. The equipment is acceptably stored and protected. Off site storage must be in a facility suitable to the Program Manager, and proof of insurance coverage specifically for the item being stored must be provided.

5. The manufacturer's short and/or long term storage requirements have been received by the Program Manager, prior to payment.

6. The Contractor has established a program to implement the manufacturer's required storage procedures. Said program to consist of at the very least a written schedule of daily, weekly,

monthly, etc., routine maintenance requirements for each piece of equipment. A copy of this schedule, signed by the Contractor, stating that the required maintenance has been performed is to be presented to the Program Manager prior to each requisition submittal.

7. Signed, notarized Title Transfers in a format to be furnished by the Program Manager must be furnished for each item of equipment.

When Items 1 through 7 above have been complied with to the satisfaction of the Program Manager, payment will be authorized for the full invoice values of the item of equipment, less normal retainage and less all costs for Operations and Maintenance manuals, spare parts, start-up certification, training, testing, final acceptance testing, and installation.

The Contractor must submit documentation to certify that the material or equipment has been paid for by the Contractor within 15 days of the Contractor receiving payment by the Owner. If this documentation is not provided, the value of the equipment or material will be deducted from the next pay requisition.

The Contractor shall include a monthly cash flow projection with each progress estimate. These projections shall indicate the actual value paid to date and the Contractor's estimate of the value due each month from that point in time through the Completion Date.

§4.4 CLAIMS AGAINST CONTRACTOR

If at any time there is any evidence of any claims for which the Contractor is or may become liable or responsible hereunder, the Contractor shall promptly settle or otherwise dispose of the same, and until such claims are settled or disposed of, the Owner may withhold payment to Contractor in accordance with Sections 2.3, 12.2, and 12.3.

§4.5 DISCHARGING LIENS

If at any time any notices of lien are filed for labor performed or materials or equipment manufactured, furnished, or delivered to or for the Work, the Contractor shall, at its own cost and expense, promptly discharge, remove or otherwise dispose of the same, and until such discharge, removal or disposition, the Owner may withhold payment to Contractor in accordance with Sections 2.3, 12.2, and 12.3.

§4.6 CLAIMS FOR DAMAGES AGAINST OWNER

If the Contractor makes claim for any damages alleged to have been sustained by breach of contract or otherwise, it shall, within three (3) days after occurrence of the alleged breach or within three (3) days after any part of the alleged damages have begun to be sustained, whichever date is the earlier, file with the Program Manager and Owner a written, itemized statement in triplicate of the details of the alleged breach and the details and amount of the alleged damages. Unless such statement is made and filed as so required, the Contractor's claim for damages shall be deemed waived, invalid and unenforceable, and he shall not be entitled to any compensation for any such alleged damages.

The Contractor shall not be entitled to claim any additional compensation for damages by reason of any direction, instruction, determination or decision of the Program Manager, nor shall any such claims be considered, unless the Contractor shall have complied in all respects with Section

4.2 of this Agreement titled "Authority of the Program Manager", including, but not limited to, the filing of a written protest in the manner and within the time therein provided.

Subject to the provisions of Section 4., Dispute Resolution below, the Contractor, and any Subcontractor, Supplier and any other person or organization performing any part of Work, agree that each of them will waive jurisdiction and venue and shall submit to the jurisdiction of the courts of the State of Rhode Island regardless of residence or domicile, with respect to any actions or suits at law or in equity arising under or related to the bidding, award or performance of the Work.

Subject to the provisions of Section 4., Dispute Resolution below, the Contractor, Subcontractor, Supplier or any other person or organization shall not commence any action, other than those in the State of Rhode Island in the county where the Owner's headquarters are located, against the Owner and the Program Manager, or any of their consultants, and/or any of their respective directors, officers, employees, representatives or agents, with regard to any matter whatsoever arising out of or relating to the validity, construction, interpretation or reinforcement of the Contract.

§4.7 DISPUTE RESOLUTION

A. Claims, counter-claims, disputes and other matters in question between the Owner and the Contractor arising out of, or relating to, this Agreement or the breach of it shall be settled by mediation under the Construction Industry Mediation Procedures of the American Arbitration Association. If a party fails to respond to a written request for mediation within 30 days after service or fails to participate in any scheduled mediation conference, that party shall be deemed to have waived its right to mediate the issues in dispute. In that event, the dispute will be resolved in accordance with this Section.

B. Submission to Arbitration**:** If the mediation does not result in settlement of the dispute within 30 days after the initial mediation conference or if a party has waived its right to mediate any issues in dispute, then any unresolved controversy or claim arising out of or relating to this Agreement or breach thereof shall be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules and judgment on the award rendered by the arbitrator(s) may be entered in any court having jurisdiction thereof.

C. Number and Qualifications of Arbitrators: In the event the claim exceeds $1,000,000, exclusive of interest and attorneys' fees, the dispute shall be heard and determined by three arbitrators consisting of persons qualified in engineering, construction management or construction law and one of the three arbitrators shall be a lawyer specializing in construction law.

D. Consolidation and Joinder: The Owner, the Program Manager, the Contractor, and all subcontractors, specialty contractors, material suppliers, engineers, designers, architects, construction lenders, bonding companies and other parties providing labor, material or services for the Project that is the subject of this Agreement are bound, each to each other, by this arbitration clause, provided that they have signed this Agreement or an Agreement that incorporates this Agreement by reference or signed any other agreement to be bound by this arbitration clause. Each such party agrees that it may be joined as an additional party to an arbitration involving other parties under any such agreement. If more than one arbitration is begun under any such agreement and any party contends that two or more

arbitrations are substantially related and that the issues should be heard in one proceeding, the arbitrator(s) selected in the first filed of such proceedings in which the Owner is a party shall determine whether, in the interests of justice and efficiency, the proceedings should be consolidated before that (those) arbitrator(s).

E. Discovery in Arbitration: At the request of a party, the arbitrator(s) shall have the discretion to order examination by deposition of witnesses to the extent the arbitrator(s) deems such additional discovery necessary to the orderly conduct of the hearings. Depositions shall be limited to a maximum of three per party, limited to three hours each and shall be held within 30 days of the making of a request. Additional depositions may be scheduled only with the permission of the arbitrator(s), and for good cause shown. All objections are reserved for the arbitration hearing except for objections based on privilege and proprietary or confidential information.

F. Governing Law and Locale of Arbitration: This Agreement and any arbitration hereunder shall be governed by the laws of the State of Rhode Island and the place of arbitration shall be Providence, Rhode Island.

ARTICLE 5 – SUBCONTRACTORS

§5.1 AWARD OF SUBCONTRACTS FOR PORTIONS OF THE WORK

Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and the Program Manager, the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner or Program Manager may reasonably object in writing to any such proposed entity or person. In such objection, the Owner or Program Manager shall provide the reason(s) for the objection. It is agreed that the Owner, in determining whether to object, may consider past negative experience with the entity or person, lack of qualifications and experience to perform the work, or a belief of financial inability to perform the work. The Contractor may respond in writing within seven (7) days should it wish to continue with the proposed entity or person. Thereafter, upon a finding of good cause for its objection, the Owner may prohibit the employ of such proposed entity or person.

§5.2 SUBCONTRACTUAL RELATIONS

By appropriate agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner.

ARTICLE 6 – CONSTRUCTION BY THE OWNER OR BY SEPARATE CONTRACTORS

§6.1 SEPARATE CONTRACTS

The attention of the Contractor is directed to the fact that the Work to be done under this Agreement is only part of the program of improvements, that contracts have been let for additional facilities, and that the successful operation of the improvements is dependent upon the completion of the Agreement under the contract and of the work to be done by others.

The Owner reserves the right to let other contracts in connection with the construction of the contemplated work of this project or contiguous projects of the Owner. The Contractor, therefore, will afford any such other Contractors reasonable opportunity for the introductions and storage of their materials and execution of their work, will properly connect and coordinate its work with theirs, and will not commit or permit any act which will interfere with the performance of their work.

The Contractor shall afford the Owner and other Contractors proper and safe access to the site and a reasonable opportunity for the introduction and storage and materials and equipment and the execution of their work, and shall properly correct and coordinate the Work with theirs. The Contractor shall not endanger any work of others by cutting, excavating or otherwise altering that work and will only cut or alter their work with the written consent of the Program Manager and those whose work will be affected.

If any part of the Contractor's Work depends upon proper execution or results of the work of the Owner or any other contractor or owner, the Contractor shall inspect and promptly report to the Program Manager in writing any delays, defects or deficiencies in that work that render it unavailable or unsuitable for proper execution and results. The Contractor's commencement of work will constitute an acceptance of other work as fit and proper for integration with the Work except for latent or nonapparent defects and deficiencies in the other work. Whenever the Work to be performed by the Contractor is dependent upon the work of others, the Contractor shall coordinate its Work with the dependent work; provide necessary dependent data and requirements; supply and/or install items to be built into dependent work; make provisions for dependent work; check and verify dependent dimensions of previously placed work; notify the Program Manager of previously placed dependent work or dependent dimensions which are unsatisfactory or prevent satisfactory installation of its Work, and not proceed with its Work until the unsatisfactory dependent conditions have been corrected. Installation of Work by the Contractor or by a Subcontractor in any given area shall constitute acceptance by the Contractor or the Subcontractor of all previously placed dependent work.

Should the Contractor cause damage to the work or property of any other contractor or owner performing work at or contiguous to the site, or should any claim arising out of the Contractor's performance of the Work at or contiguous to the site be made by any other contractor or owner against the Contractor, the Owner, or the Program Manager, the Contractor shall promptly attempt to resolve such claim with such separate contractor or owner by agreement, or otherwise resolve the dispute at law or in equity. The Contractor shall, to the fullest extent permitted by Laws and regulations, indemnify and hold harmless the Owner, the Program Manager, and their consultants, agents and employees from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys, and other professionals and court or arbitration costs) arising out of or resulting from damage to the work of others caused by the Contractor's performance of the Work.

Should another contractor or owner cause damage to the Work or property of the Contractor, or should the performance of work by another contractor or owner give rise to any other claim by the Contractor, the Contractor shall promptly attempt to resolve such claim with that contractor or owner by agreement, or otherwise resolve the dispute at law or in equity.

The Contractor shall not institute any action, legal or equitable, against the Owner or the Program Manager, their consultants agents or employees, or permit any action against them to be maintained and continued in its name or for its benefit in any court or before any arbiter

which seeks to impose liability or recover damages from the Owner or the Program Manager, or their consultants, agents or employees, on account of such damages or claims caused by another contractor or owner.

In the event that the Owner incurs costs contrary to the provisions of §6.1, Separate Contracts, the Contractor shall reimburse the Owner for those costs, and if the Contractor fails to pay the Owner within thirty (30) days after receipt of an invoice from the Owner, the Owner will be entitled to an appropriate decrease in Contract Price, or to withhold a set-off against any amount recommended for payment.

The Contractor shall be responsible for settling or resolving at equity or at law directly with all other contractors all claims arising out of delay, disruption, interference, hindrance or schedule extension caused by the Contractor or inflicted upon the Contractor by the actions of another contractor, regardless of whether or not an extension or shortening in Contract Time is ordered by the Owner. The Contractor agrees and understands that neither the Owner, the Program Manager, nor any of their consultants, employees or agents, will be involved in any way in such actions, and hereby waives any and all claims against the Owner, the Program Manager and any of their consultants, employees or agents for any such claims.

If the Contractor is delayed at any time in performing or furnishing the Work by any act or neglect of another contractor or owner performing work under a separate contract with the Owner, the Contractor shall absorb all related delay, extension or acceleration costs, however caused; except that if the Owner and the Contractor believe such delay to require an adjustment in Contract Time, the Owner may authorize the necessary extension in Contract Time. However, an extension in Contract Time(s), if any so granted, shall be the Contractor's sole and exclusive remedy with respect to the Owner and the Program Manager, or any of their consultants, agents or employees for any delay, disruption, interference, extension or hindrance and associated costs, however caused, resulting from delays caused by others performing work under separate contracts with the Owner, and the right to additional compensation for such claims is expressly waived.

The Contractor shall give prompt written notice to the Program Manager and any other affected contractor(s) whenever the Contractor anticipates a conflict in Contract Time(s) related to or simultaneous with associated contact time(s) in the work of others. Within ten (10) days thereafter, the Contractor shall be required to deliver to the Program Manager proposed actions to either prevent an adverse effect on the progress schedule of the other contractors arising from delays to the Work, or overcome an adverse effect on the Progress Schedule for the Work arising from delays from another contract, all at no additional cost to the Owner or the Program Manager.

When Work is performed out of sequence and ahead of interfacing work, the Contractor shall be responsible for taking reasonable steps to minimize damage or loss to the Work which may be caused by others during the performance of their work, including but not limited to furnishing prompt written notice to the Program Manager and to the other contractors that Work has been performed out of sequence and ahead of interfacing work.

When work by others is performed out of sequence and ahead of interfacing Work, the said work shall be considered as if it had been shown on the Contract Documents. The Contractor shall be responsible for protecting that work and shall replace, repair or otherwise settle with others any and all damage caused as a result of the performance of work out of sequence unless the Contractor had not actual knowledge thereof or could not reasonably have known thereof.

ARTICLE 7 – CHANGES IN THE WORK

§7.1 CHANGES

The Owner, through the Program Manager or a consultant, if applicable, may make changes in the Work and in the Specifications and Drawings therefor by making alterations therein, additions thereto or omissions therefrom. All Work resulting from such changes shall be performed and furnished under and pursuant to the terms and conditions of the Contract Documents. If such changes result in an increase or decrease in the Work to be done hereunder, or increase or decrease the quantities thereof, adjustment in compensation shall be made as provided hereinafter under the subsection titled "Extra Work".

Except in an emergency endangering life, safety, health or welfare of the public or property, no change shall be made without a prior written order from the Program Manager authorizing the change, and no claim for additional compensation shall be valid unless the change is so ordered in writing.

The Contractor agrees that it shall neither have nor assert any claim for or be entitled to, any additional compensation for damages or for loss of anticipated profits on work that is eliminated.

If notice 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) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

§7.2 EXTRA WORK

The Contractor shall perform any Extra Work when and as ordered in writing by the Program Manager, and shall be compensated therefor at the Cost of the Extra Work plus a Contractor's Fee as set forth in this Section.

No Extra Work shall be paid for unless specifically ordered as such in writing by the Program Manager.

At the request of the Program Manager, the Contractor shall furnish itemized statements of the Cost of the Extra Work ordered as above and give the Program Manager access to all records, accounts, bills and vouchers and correspondence relating thereto. The itemized statements shall be provided by the Contractor within seven (7) days from the date the request is sent by the Program Manager.

The methods to be used to determine an adjustment in Contract Price necessitated by changes ordered or negotiated pursuant to this Agreement, or Extra Work covered by a submittal or a claim are limited to the following:

a. Where the Extra Work is covered or is of the same character as work covered by lump sum prices in the Contract Documents: On the basis of those lump sum prices.
b. Where the Extra Work is covered or is of the same character as Unit Price Work: By application of those unit prices to the quantities of the items involved.
c. Where the Extra Work is not covered by either of the methods specified in subparagraph a or b above: By mutual acceptance of a lump sum price negotiated on the basis of the Contractor's itemized estimate of the anticipated cost of the Extra Work, determined as

specified in this Article, and a Contractor's Fee determined as one hundred percent (100%) of the fee allowed under this Article.

d. Where the Extra Work is not covered by either of the methods specified in subparagraph a or b above, and the Program Manager directs the Contractor to proceed with the Extra Work with payments to be made on the basis of actual costs: On the basis of the actual Cost of the Extra Work, determined as specified in this Article, and a Contractor's Fee determined as seventy five percent (75%) of the fee allowed under this Article.
e. Where the Extra Work is not covered by any of the preceding methods, and when payment is to be determined pursuant to Section 4.7, Dispute Resolution, the actual cost method in subparagraph d above shall be the method for determining the cost of the Extra Work.

In computing either anticipated, or actual costs, the term "Cost of the Extra Work" means the sum of all reasonable incremental costs which would be, or actually were, necessarily incurred by the Contractor in the proper performance of the Extra Work. Those costs shall be in amounts no higher than those prevailing in the locality of the Project, and shall include only the appropriate items for labor, material/equipment, subagreement, equipment, and supplemental costs specified below.

Payroll costs shall be included for craft assigned to the site and engaged in furnishing and incorporating materials or equipment in the Extra Work. Payroll costs shall include wage plus the necessary labor burdens, which may include social security, unemployment, workers' compensation, health and retirement benefits, vacation and holiday pay, and other payments pursuant to union agreements. When determining payroll costs under subparagraphs d and e above, daily time sheets, certified at the end of each day by the Program Manager and signed by the Program Manager and the Contractor, shall be the record upon which actual payroll costs shall be based. When determining payroll costs under subparagraphs d and e above, daily time sheets shall be valid only if they expressly identify the labor hours are for the Extra Work and if made when the Extra Work was performed.

Payments by the Contractor to Suppliers for all material and equipment in the Extra Work shall be included. All trade discounts, rebates and refunds and all returns from sale of surplus items shall accrue to the Owner, and the Contractor shall make provisions so that they may be obtained. When required by the Program Manager, the Contractor shall obtain competitive bids from Suppliers and shall deliver such bids to the Program Manager. When determining actual material and equipment costs, actual invoices segregating items associated with the Extra Work shall be the record upon which actual costs shall be based.

Payments by the Contractor to Subcontractors for Extra Work performed by Subcontractors shall be included. If required by the Program Manager, the Contractor shall obtain competitive detailed bids from three (3) Subcontractors and shall deliver them to the Program Manager who will then determine which bid will be selected. When determining Subcontractor costs at any tier, the Subcontractor's Cost shall be determined in the same manner as the Contractor's Cost of the Extra Work. All Subagreements shall be subject to the provisions of this Section insofar as applicable.

Equipment costs required solely in connection with the Extra Work reflecting rented or leased or owned equipment costs for individual construction equipment or machinery whose replacement value is in excess of $1,000.00 shall be included. Transportation, loading and unloading, installation, dismantling and removal costs shall be included only if such equipment is or was transported to the site solely to perform the Extra Work. Payroll costs for craft labor operating

the equipment shall be as described above. Equipment costs shall be computed using the same accounting and estimating rules regardless of whether related to added or deleted items of work.

When determining equipment costs, daily records listing the equipment units, operators, and actual usage, and certified at the end of each day by the Program Manager and signed by the Program Manager and the Contractor, shall be the record upon which actual equipment use shall be based. When determining equipment costs under subparagraphs d and e above, such daily records shall be valid only if they list the equipment units, their operators, and actual usage, and were developed when the Extra Work was performed.

Rented or owned equipment at the site and not in actual use as a direct result of the change, shall be paid at the rates for rented equipment as specified below. In no event shall the idle time claimed in a day exceed the established working schedule. Payments for idle equipment shall come due only as long as the equipment was idled solely by the actions of the Owner or Program Manager, and that the idle period exceeds that normally experienced for such equipment.

For equipment rented or leased by the Contractor, the fair rental shall be based upon the most recent edition of "Rental Rate Bluebook for Construction Equipment" (the Bluebook), published by Nielson/Dataquest, or a similar publication approved by the Program Manager. Rental for machinery and equipment shall be based upon an appropriate fraction of the approved monthly rate schedule. If the Extra Work requires the use of machinery or equipment not already on the site of the Work, the cost of transportation, not exceeding a distance of 100 miles, of such machinery or equipment to and from the Work shall be added to the fair monthly rental; provided, however, that this shall not apply to machinery or equipment already required to be furnished under the terms of the Contract Documents. In addition to the rental or leasing rate, operating costs shall not exceed the estimated hourly rate in the aforementioned guide. There shall be no operating costs allocated for idle time.

Hourly rates shall be developed by dividing the monthly Blue Book rates by 176 hours a month (the "weekly", "hourly", and "daily" rates listed in the Blue Book shall not be used). Rates in all cases shall be adjusted by application of the Rate Adjustment Tables (machine age adjustment) plus adjustments to eliminate Equipment Overhead plus Regional Adjustments.

The equipment rate for usage in excess of eight hours a day shall be fifty percent (50%) of the base hourly rate as established in the initial hourly calculation above.

The rates used for billing purposes will be those most economical to the Owner based on the circumstances of actual usage and all applicable credits and discounts.

For equipment rented or leased from lessor firms associated with or owned by the Contractor, the Contractor shall be entitled to reimbursement as though the equipment was owned equipment, as specified below.

For equipment owned by the Contractor, the Contractor shall be entitled to costs based on its normal accounting practices used in developing general bids, but in no event shall those costs plus the estimated operating costs exceed the hourly rates as established above. The Contractor shall provide documentation to substantiate the equipment rates used when developing the bid if requested by the Owner or Program Manager.

Supplemental costs may include the proportion of necessary transportation, travel and subsistence expenses of Contractor's employees incurred in discharge of duties concerned with the Extra Work, and the cost of materials, supplies and equipment installed in the Extra Work.

The Contractor shall be reimbursed for the direct cost (no additional fee) of any increased Contract Bond premium due to an increase in the adjusted Contract Price, provided, however, that the percentage premium rate applied to the increased Contract Price shall not exceed the percentage premium rate paid for the original Contract Bonds issued to the Owner. Contractor's right to recover this cost is subject to the Owner's right to audit.

The Contractor shall provide a credit to the Owner for any decreased Contract Bond premium due to a decrease in the adjusted Contract Price.

The Cost of the Extra Work shall not include any of the following costs, all of which are considered supplemental costs not allowed, administrative costs, or contingencies and covered by the Contractor's Fee:

a. Costs already included in the Contract Price for the Work (including all previously authorized adjustments).
b. Payroll costs and other compensation of personnel employed by the Contractor whether at the site or in the Contractor's principal or a branch office for management, administration or in support of the performance, management or administration of the Work, including, but not limited to, the Contractor's officers, executives, principals, general managers, project managers, construction managers, superintendents, estimators and schedulers, detailer, claims consultants, attorneys, auditors, accountants, purchasing and contracting agents, expediters, engineers, architects, timekeepers, and clerks.
c. Expenses of the Contractor's principal and branch offices including, but not limited to, Contractor's office and temporary facilities at the site.
d. Any part of the Contractor's capital expenses, including interest on the Contractor's capital employed for the Extra Work and charges for delinquent payments.
e. Costs due to the fault or negligence of the 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, deposits to be lost, costs to correct defective work, disposal of materials or equipment wrongly supplied and making good any damage to property.
f. Costs of a rental of small tools; costs of a rental of buildings.
g. Costs associated with the preparation of Change Orders (whether or not ultimately authorized), cost estimates, or the preparation or filing of claims.
h. Expenses of the Contractor associated with anticipated lost profits or lost revenues, lost income or earnings, lost interest on earnings or unpaid retainage.
i. Costs derived from the computation of a "home office overhead" rate by application of the Eichleay, Allegheny, Burden Fluctuation, or other similar methods.
j. Costs of special consultants or attorneys, whether or not in the direct employ of the Contractor, employed for services specifically related to the resolution of a claim, dispute, or other matter relating to the acceptability of the Work.
k. Acceleration costs incurred as an alternative to an extension in Contract Time on account of delays not meeting the requirements for extensions in Contract Time.
l. Escalation costs for any part of the Work which is not delayed beyond the applicable Late Dates in the Construction Schedule required by Section 01311 of the Specifications.
m. Delay costs.
n. Early completion costs.

o. Costs associated with the indirect or cumulative impact, disruption, losses of productivity, acceleration, time delays, or overtime performed by the Contractor. Changes and Extra Work are anticipated on this Project and it is entirely anticipated that there will be many Changes during the performance of the Work. Contractor, and its Subcontractors and Suppliers, agree to include any and all costs in their Extra Work pricing proposals.
p. Other administrative expense or contingent costs of any kind, and the costs of any item not specifically and expressly included in this Section.

The Contractor's Fee, (profit), in connection with the Extra Work shall not exceed the following percentages of the various portions of the Cost of the Extra Work:

a. For the Contractor's labor costs, the Contractor's Fee shall not exceed fifteen percent (15%).
b. For the Contractor's material/equipment or construction equipment costs, the Contractor's Fee shall not exceed ten percent (10%).
c. For Extra Work performed by (a) a Subcontractor having a direct Subcontract with the Contractor, the Contractor's Fee shall not exceed five percent (5%) of the cost of the Extra Work excluding lower tier fees, and the Subcontractor's Fee shall not exceed ten percent (10%); (b) a lower tier Subcontractor, the Contractor's Fee and the corresponding first tier Subcontractor's Fee shall not exceed five percent (5%) each, and the lower tier Subcontractor's Fee shall not exceed ten percent (10%).

No Contractor's fee shall be payable on the basis of Subcontractor's Fees.

The credit to be allowed by the Contractor to the Owner for any individual Change in the Work (combining additions and deletions) which results in a net decrease in cost (Cost of the Extra Work is negative) shall be the amount of the actual net decrease. The Contractor is not required to provide a credit for the fee associated with the decrease.

When more than one individual change, each resulting in a net increase or decrease in the Cost of the Extra Work, is covered in one specific Change Order or submittal or claim, the adjustment in the Contractor's Fee shall be the sum of the individual Fees

§7.3 REDUCTION IN SCOPE OF WORK

The Owner, through the Program Manager or a consultant, if applicable, reserves the right to decrease the scope of the Work to be done under this Agreement and to omit any Work should the Owner deem it to be in the public interest to do so. To this end, the Owner reserves the right to reduce the quantity of any item or omit any item as set forth in the Bid, either prior to executing the contract or at any time during the performance of the Work. The Owner further reserves the right, at any time during the performance of the Work, to restore all or part of any item previously omitted or reduced. An equitable reduction in the Contract Price shall be determined in accordance with the provisions of Section 7.2, Extra Work. Exercise by the Owner of the above rights shall not constitute any ground or basis of claim for damages or for anticipated profits on the work omitted.

§7.4 CHANGES NOT TO AFFECT BONDS

Any changes made in the Work or the Drawings or Specifications therefor (whether such changes increase or decrease the Contract Price or Contract Time or any changes in the manner of time of payments made by the Owner to the Contractor, or any other modifications of the Contract Documents, shall in no way annul, release, diminish or affect the liability of the Surety

on the Bonds given by the Contractor, it being the intent hereof that, notwithstanding such Changes, the liability of the Surety on said bonds continue and remain in full force and effect.

§7.5 MODIFICATION

Except as otherwise expressly provided herein, the Contract may not be amended or otherwise modified except in writing signed by the parties hereto. In the event the Contractor does not sign the respective documents outlined in the Agreement, the Owner shall issue a unilateral modification.

ARTICLE 8 – TIME

§8.1 COMPUTATION OF TIME

Any period of time in days will be computed in calendar days and shall exclude the first and include the last day of such period. If the last day of any such period falls on a day other than a business day, that day shall be omitted from the computation.

§8.2 ALLOWABLE DELAY BY OWNER

The Owner may delay the beginning of the Work or any part thereof if the necessary lands or rights-of-way for such Work shall not have been obtained. The Contractor shall have no claim for additional compensation or damages on account of such delay, but shall be entitled only to an extension of time as hereinafter provided.

§8.3 TIME FOR COMPLETION

The rate of progress shall be such that the Work shall be performed and completed in accordance with the Contract Documents before the expiration of the time limit stipulated in Table A of this Agreement, except as otherwise expressly provided herein.

The time of commencement, any interim milestones and final completion of the Work in accordance with the Contract Documents are essential conditions of this Agreement.

It is agreed that the rate of progress herein required has been purposely set low enough to allow for the ordinary and foreseeable delays incident to construction work of this character. No extension of time will be given for ordinary or foreseeable delays, inclement weather, or accidents, and the occurrence of such will not relieve the Contractor from the necessity of maintaining this rate of progress and completing the Work within the Contract Time.

If delays are caused by acts of God, acts of government, unavoidable strikes, extra work, or other causes or contingencies clearly beyond the control or responsibility of the Contractor, the Contractor may be entitled to additional time to perform and complete the Work, provided that the Contractor shall, within ten (10) days from the beginning of such delay notify the Owner in writing, with a copy to the Program Manager, of the cause and particulars of the delay. Upon receipt of such notification, the Owner shall review and evaluate the cause and extent of the delay. If, under the terms of the Agreement, the delay is properly excusable, the Owner will, in writing, appropriately extend the Contract Time for completion of the Work. (This paragraph will be interpreted to include delays in receipt of equipment provided that the Contractor placed its order and submitted shop drawings for such equipment promptly after execution of the Contract, that it has shown due diligence in following the progress of the order, and that the time

required for delivery is in accordance with conditions generally prevailing in the industry.) The Contractor agrees that it shall not have or assert any claim for nor shall it be entitled to any additional compensation or damages on account of such delays.

The time is of the essence for this Agreement and the Work to be performed and completed in accordance with the Contract Documents. Where, in accordance with the Contract Documents additional Contract Time is allowed for completion of any Work, the new time fixed by such extension shall be of the essence of this Agreement.

§8.4 EXTENSION OF TIME

When Extra Work, as per §7.2, is ordered near the completion of the Work or at any time during the performance of the Work which unavoidably increases the time for the completion of the Work, an extension of time shall be granted as hereinbefore provided. An extension of time for Extra Work which is not on the critical path of the Project Schedule will not be considered.

The criteria to be used to determine an adjustment in Contract Time necessitated by changes ordered or negotiated pursuant to this Agreement, or work covered by a submittal or a claim, are limited to the following:

An adjustment in Contract Time will be based solely upon net increases in the time required for the performance or completion of parts of the Work that negatively impact the Critical Path of the Project Schedule. However, even if time required for the performance or completion of controlling parts of the Work is extended, an extension in Contract Time will not be granted until all of the available Total Float in the Project Schedule is consumed and performance or completion of the controlling Work necessarily extends beyond the Contract Time.

An extension in Contract Time will not be granted unless the Contractor can demonstrate through an analysis of the Project Schedule that the increases in the time to perform or complete the Work, or specified part of the Work, beyond the corresponding Contract Time(s) arise from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and its Subcontractors, suppliers or other persons or organizations, and that such causes in fact lead to performance or completion of the Work, or specified part in question, beyond the corresponding Contract Time, despite the Contractor's reasonable and diligent actions to guard against those effects. Examples of such causes include acts of God, acts of government, unavoidable strikes, certain extra work, or other causes or contingencies clearly beyond the control or responsibility of the Contractor.

It is the intent of the Contract Documents that an extension in Contract Time, if any granted, shall be the Contractor's sole and exclusive remedy in law or in equity for any delay, disruption, interference, or hindrance and associated costs, however caused.

§8.5 DELAY DAMAGES

As set forth in Section 8.3, Time For Completion, time is of the essence with respect to the date for final completion specified in Table A of this Agreement and all other time periods and dates specified in the Contract Documents. The Contractor understands that delays in completion of the Work will cause the Owner to suffer damages and incur costs, and will expose the Owner to other substantial liabilities. Such damages, costs, and liabilities include, but may not be limited

additional engineering/consultant fees, administrative expenses, legal expenses, penalties or fines. The amount currently estimated after the Owner's approximation of these costs is identified in Table A. Contractor and Owner agree that the anticipated damages to the Owner arising from delay are difficult to forecast and to quantify and therefore voluntarily stipulate that the fixed amount per day listed in Table A is a good faith approximation of the anticipated damages. Contractor does not consider this amount of liquidated delay damages a penalty and expressly and voluntarily agrees to the assessment of the liquidated damages.

The Contractor understands that, without limitation of the provisions of Section 3.1, Obligations and Liability of Contractor, or any other provisions of the Contract Document, if the Contractor shall neglect, fail or refuse to achieve final completion of the work within the time specified in Table A, or shall fail to achieve any other interim or milestone date specified in the Contract Documents, as such-times or dates may be extended pursuant to the provisions of the Contract Documents, the Owner will hold the Contractor strictly liable for all such damages, costs, expenses or liabilities sustained or incurred by the Owner arising directly or indirectly out of such delays.

Such damages may be retained from time to time by the Owner from progress payments or any other amounts owing to the Contractor, or otherwise collected. None of the following shall constitute a waiver or release of the Contractor's or its Surety's obligations or liabilities for such damages or any portion thereof: (a) acceptance of any portion of the Work or the use or occupancy thereof; (b) completion of a portion of the Work or the use or occupancy thereof by the Owner or separate Contractor; or (c) the Owner's requiring or allowing the Contractor or its Surety to complete the Work. The Owner's right to recover such damages is in addition to and shall not limit any other rights and remedies provided under the Contract Documents or by operation of law.

However, the Contractor shall not be charged with delay damages or any excess costs when the delay in completion of the Work is for reasons included in Section 8.4, Extension of Time. Provided, further, that Contractor shall furnish Owner the required notification of such delays in accordance with Section 4.6, Claims for Damages Against Owner.

ARTICLE 9 – PAYMENTS AND COMPLETION

§9.1 PRICES FOR WORK

The Owner shall pay and the Contractor shall receive the prices stipulated in the Bid made a part hereof as full compensation for everything performed and furnished and for all risks and obligations undertaken by the Contractor under and as required by the Contract Documents.

§9.2 FORMAL ACCEPTANCE

This Agreement constitutes an entire contract for one whole and complete Work or result. Fixing of the date of completion and acceptance of the Work or a specified part thereof shall only be effective when accomplished by a writing specifically so stating and signed by the Owner.

§9.3 SUBSTANTIAL COMPLETION

Unless otherwise provided in the Contract Documents, Substantial Completion shall mean that substantially all of the Work has been completed and opened to public use except for minor

incomplete or unsatisfactory work items that do not materially impair the usefulness of the Work required by the Contract Documents. Substantial Completion shall be conclusively determined by the Program Manager after inspection of the Work and in accordance with all requirements of the Contract Documents.

When the Contractor determines that he has met all requirements for Substantial Completion as detailed in the Contract Documents, it shall notify the Owner and the Program Manager in writing that the entire Work is substantially complete (except for items specifically listed by the Contractor as incomplete) and request that the Program Manager issue a Certificate of Substantial Completion. Within a reasonable time thereafter, the Owner, the Contractor and the Program Manager shall make an inspection of the Work to determine the status of completion. If, after consultation with the Owner, the Program Manager does not consider the Work substantially complete, the Program Manager will notify the Contractor in writing stating the reasons therefor. If, after consultation with the Owner, the Program Manager determines and the Owner agrees that the Work is substantially complete, the Program Manager will prepare and deliver to the Contractor, in a form approved by the Owner, a Certificate of Substantial Completion which shall fix the date of Substantial Completion. Included or referenced within the Certificate of Substantial Completion shall be a list of items to be completed or corrected before final payment.

The Owner shall have the right to exclude the Contractor from the Work, or specified part, after the date of Substantial Completion, but the Owner shall allow the Contractor reasonable access to complete or correct items on the list included within or referenced by the Certificate of Substantial Completion.

§9.4 PARTIAL UTILIZATION

The Owner may, at any time in a written order to the Contractor (1) declare that he intends to use a specified part of the Work which in the Owner's opinion is sufficiently complete, in accordance with the Contract Documents, to permit its use; (2) enclose a tentative list of items remaining to be completed or corrected, and (3) fix the date of Substantial Completion of that specified part of the Work.

No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of Section 11.1, Insurance, in respect to property insurance.

Within forty-five (45) days after acceptance under this subsection, the Program Manager shall make an estimate in writing of the amount and value of the part of the Work so accepted. The Owner shall pay said amount to the Contractor after deducting therefrom all previous payments, all charges against the Contractor as provided for hereunder, and all amounts to be retained under the provisions of the Contract, said payment to be made at the time of the next monthly progress estimate.

Partial utilization by the Owner under this subsection shall not relieve the Contractor of any obligations under the Contract Documents except to the extent agreed upon in writing between the Owner and the Contractor.

The Owner shall have the right to exclude the Contractor from any part of the Work which has been accepted, but the Owner shall allow the Contractor reasonable access thereto to complete or correct items on the tentative list.

§9.5 FINAL ESTIMATE AND PAYMENT

As soon as practicable (but not more than sixty-five (65) days) after final completion of the Work, the Program Manager shall make a final estimate in writing of the quantity of Work done under the Contract and the amount earned by the Contractor.

The Owner shall pay to the Contractor the entire amount found by the Program Manager to be earned and due hereunder after deducting therefrom all previous payments and all charges against the Contractor as provided for hereunder. Except as in this subsection otherwise provided, such payment shall be made not later than forty five (45) days after but in no event before, the expiration of the time within which claims for labor performed or materials or equipment furnished must be filed under the applicable Lien Law.

All quantities shown on progress estimates and all prior payments shall be subject to correction in the final estimate and payment.

§9.6 LIABILITY OF OWNER

No person, firm or corporation, other than the Contractor, who signed this Contract as such, shall have any interest herein or right hereunder. No claim shall be made or be valid either against the Owner or any agent of the Owner and neither the Owner nor any agent of the Owner shall be liable for or be held to pay any money, except as herein provided. The acceptance by the Contractor of the payment as fixed in the final estimate shall operate as and shall be a full and complete release of the Owner and of every agent of the Owner of and from any and all claims, demands, damages and liabilities of, by or to the Contractor for anything done or furnished for or arising out of or relating to or by reason of the Work or for or on account of any act or neglect of the Owner or of any agent of the Owner or of any other person, arising out of, relating to or by reason of the Work, except the claim against the Owner for the unpaid balance, if any there be, of the amounts retained as herein provided.

§9.7 RIGHT TO MATERIALS

Nothing in the Contract shall be construed as vesting in the Contractor any right of property in the materials, equipment, apparatus and other items furnished after they have been installed or incorporated in or attached or affixed to the Work or the site and no later than the time of payment, but all such materials, equipment, apparatus and other items shall, upon being so installed, incorporated, attached or affixed, become the property of the Owner. Nothing in this subsection shall relieve the Contractor of its duty to protect and maintain all such materials, equipment, apparatus and other items.

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

§10.1 SAFETY PRECAUTIONS

The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work.

§10.2 HAZARDOUS MATERIALS

If a hazardous material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), is encountered on the site by the Contractor, the Contractor shall, upon

recognizing the condition, immediately stop its Work in the affected area and report the condition to the Owner and Program Manager in writing.

ARTICLE 11 – INSURANCE AND BONDS

§11.1 INSURANCE

Before starting and until final completion and acceptance of the Work, including Warranties, the Contractor shall procure and maintain insurance of the types specified in paragraphs (A) to (F), inclusive, below. All insurance shall be obtained from companies satisfactory to the Owner.

Insurance shall be in such forms as will protect the Contractor from all claims and liability for damages for bodily and personal injury, including accidental death, and for property damage, which may arise from operations under the Work, whether such operations be by itself, its subcontractors, or by anyone directly or indirectly employed or engaged by the Contractor.
The following types of insurance shall be provided. The insurance carriers shall be rated by A.M. Best's with no less than an "A" rating and a financial size of "8" or higher. The limits of the various policies shall be as detailed in the Certificates of Insurance attached hereto:

A. Statutory Worker's Compensation and Employer's Liability Insurance including Longshore and Harbor Workers Coverage and Maritime coverage if appropriate.

B. Commercial General Liability Insurance.

1. Commercial General Liability (CGL) Insurance.

2. If the CGL coverage contains a General Aggregate Limit, such General Aggregate shall apply separately to each project.

3. CGL coverage shall be written on ISO Occurrence form CG 00 01(10 93) or a substitute form providing equivalent coverage and shall cover liability arising from premises, operations, independent contractors, products-completed operations, and personal and advertising injury.

4. The Owner and any other entity required by the Owner (including the Program Manager) shall be included as additional insured on the CGL, using ISO Additional Insured Endorsement CG 20 10 (11 85) or CG 2010 (10 93) AND CG 20 37 (10 01) or CG2033 (10 01) AND CG2037 (10 01) or an endorsement providing equivalent coverage to the additional insured. This insurance for the additional insured shall be as broad as the coverage provided for the named insured contractor or subcontractor. It shall apply as primary and non-contributing insurance before any other insurance or self-insurance, including any deductible, maintained by, or provided to, the additional insured. (See waiver of surrogate requirements shown below).

5. Contractor and Subcontractors shall maintain CGL coverage for themselves and the Owner for the duration of the Project and maintain Completed Operations coverage for themselves and the Owner for at least 3 years after final payment of the Work.

6. The Contractor's CGL policy shall include the "Per Project Aggregate" coverage endorsement.

C. Commercial Automobile Liability Insurance.

1. Business Auto Liability.

2. Business Auto coverage must include coverage for liability arising out of all owned, leased, hired and non-owned automobiles.

3. The Owner and any other entity required by the Owner shall be included as an additional insured on the commercial auto policy on a primary, non-contributing basis.

D. Builders' Risk and Installation Floater Coverage issued on an "All Risk" form including the completed value basis in the amount of the total insurable value of all structures, materials, and equipment to be built and installed. The policy shall indicate the Owner, the Contractor, all Subcontractors, and the Program Manager as the named insured with loss payable to the Owner as Trustee. Any co-insurance clause shall be null and void and the agreed amount endorsement shall apply.

The Builders Risk coverage should include the perils of Flood and Earthquake with a minimum sub-limit of $10,000,000 for each peril. Flood coverage needs to be provided in Zone X only.

Comprehensive Boiler and Machinery coverage must also be included within the Builders Risk policy or the purchase of a separate policy. This coverage must include equipment and machinery testing exposure.

If the Owner is to occupy and/or utilize the building or structure while under renovation or construction, then the Builders risk Policy must include a “permission to Occupy” endorsement or agreement to the coverage.

E. Commercial Umbrella Insurance must include as underlying coverage Worker's Compensation and Employer's Liability, Commercial General Liability, Commercial Auto Liability, and include the Owner as an additional insured on the CGL and Auto Liability on a primary, non-contributing basis. Additional insured status must be provided to Owner and any other entity required by the Owner. This additional insured status shall be primary and non-contributing to any other policies maintained by the Owner and any other additional insured.

F. Pollution Liability including asbestos and lead abatement coverage. The coverage shall include Extended Completed Operations coverage for two years.

If the Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with Section 9.4, Partial Utilization; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent to endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

Should there by an insured loss on any of the above lines of coverage, it shall be the Contractor’s responsibility for the payment of any deductable that may apply.

Waiver of Subrogation: The Contractor and its Subcontractors shall waive all rights against the Owner, its officers, directors and employees for recovery of damages to the extent these damages are covered by Workers Compensation and Employers Liability, Commercial General Liability, Commercial Automobile Liability, Commercial Umbrella Liability, Pollution Liability or insurance maintained per requirements stated above.

All insurance shall be obtained before the Work is started and shall be maintained until the date of final completion of the Work and performance of warranty obligation except for Builders' Risk insurance which shall be maintained until final completion, or until the Owner occupies or otherwise takes possession of the structure, whichever occurs first.

All policies shall be so written that the Owner and the Program Manager will be notified in writing of cancellation or restrictive amendment at least thirty (30) days prior to the effective date of such cancellation or amendment.

Copies of the foregoing insurance policies shall be provided to the Owner within thirty (30) days of the execution of the Agreement.

Certificates of Insurance from the Contractor's insurance carriers stating the coverage provided, the limits of liability, and expiration dates shall be filed in triplicate with the Owner and the Program Manager before operations are begun. Such certificates shall be on the form furnished by the Program Manager, a copy of which is attached hereto.

Renewal certificates must be furnished by the Contractor prior to the expiration date of any of the initial insurance.

No insurance required or furnished hereunder, nor the failure of the Owner or the Program Manager to object to same, shall in any way relieve the Contractor of or diminish any of its responsibilities, obligations and liabilities under the Contract Documents.

§ 11.2 ADDITIONAL OR SUBSTITUTE BONDS

If at any time the Owner, for justifiable cause, is or shall become dissatisfied with any Surety or Sureties the Contractor shall, within five (5) calendar days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other Surety or Sureties, as may be acceptable to the Owner. The premiums on such bonds shall be paid by the Contractor with no additional expense to the Owner. No further payments shall be deemed nor will be made until the new Surety or Sureties shall have furnished such as acceptable bond to the Owner.

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK

§12.1 EXAMINATION OF WORK

The Program Manager shall be furnished by the Contractor with every reasonable facility for examining and inspecting the Work and for ascertaining that the Work is being performed in accordance with the requirements and intent of the Contract, even to the extent of requiring the uncovering or taking down portions of finished work by the Contractor.

Should the Program Manager in its sole judgment consider the Work thus uncovered or taken down satisfactory, the cost of uncovering or taking down and the replacement thereof shall be

considered as Extra Work unless the original Work was done in violation of the Contract Documents in point of time or in the absence of the Program Manager or the Program Manager's inspector and without the Program Manager's written authorization, in which case said cost shall be borne by the Contractor. Should the work uncovered or taken down prove unsatisfactory in the Program Manager's sole judgment, said cost shall likewise be borne by the Contractor.

Examination or inspection of the Work shall not relieve the Contractor of any of its obligations to perform and complete the Work as required by the Contract Documents.

§12.2 DEFECTIVE WORK

Until acceptance and in accordance with its Warranty obligations, the Contractor shall promptly, without charge, repair, correct or replace work, equipment, materials, apparatus or parts thereof which are defective, damaged or unsuitable or which in any way fail to comply with or be in strict accordance with the provisions and requirements of the Contract Documents or applicable Warranty and shall pay to the Owner all resulting costs, expenses, losses or damages suffered by the Owner (including, but not limited to, all costs of repair or replacement of work by others).

If any material, equipment, apparatus or other items brought upon the site for use or incorporation in the Work, or selected for the same, is rejected by the Program Manager as unsuitable or not in conformity with the Specifications or any of the other Contract Documents, the Contractor shall forthwith remove such materials, equipment, apparatus and other items from the site of the Work and shall at its own cost and expense make good and replace the same and any material furnished by the Owner which shall be damaged or rendered defective by the handling or improper installation by the Contractor, its agents, servants, employees or subcontractors.

If the Contractor fails within a reasonable time after written notice from the Program Manager to correct Defective Work or to remove and replace rejected Work as required by the Program Manager in accordance with this Section, or if the Contractor fails to perform the Work in accordance with the Contract Documents, or if the Contractor fails to comply with any other provision of the Contract Documents, the Owner, may, after three (3) days' written notice to the Contractor, correct and remedy any such deficiency. (This notification period may be reduced when the deficiencies affect the health, safety or welfare of the public or critical facility operations.) In exercising the rights and remedies under this paragraph the Owner shall proceed expeditiously. In connection with such corrective and remedial action, the Owner may exclude the Contractor from all or part of the site, take possession of all or part of the Work, and suspend the Contractor's services related thereto, take possession of the Contractor's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid the Contractor but which are stored elsewhere. The Contractor shall allow the Owner, the Owner's representatives, agent and employees, the Owner's other contractors and the Program Manager access to the site to enable the Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by the Owner in exercising such rights and remedies will be charged against the Contractor. 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 the damaged by correction, removal or replacement of the Contractor's Defective Work. The Contractor shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by the Owner or the Owner's rights and remedies hereunder.

If, instead of requiring correction or removal and replacement of Defective Work, the Owner prefers to accept it, the Owner may do so. The Contractor shall pay all claims, costs, losses and damages attributable to the Owner's evaluation of and determination to accept such Defective Work. A Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work and the Owner shall be entitled to an appropriate decrease in the Contract Price.

§12.3 RETAIN MONEY FOR REPAIRS

If at any time any part of the Work requires repair, correction or replacement, the Owner may notify the Contractor in writing to make the required repairs, correction, or replacements. If the Contractor neglects to commence making such repairs, correction, or replacements to the satisfaction of the Owner within (3) days from the date of receipt of such notice, or having commenced fails to perform such Work with diligence, the Owner may employ other persons to make the same, and all direct and indirect costs of making said repairs, correction or replacements, including compensation for additional professional services, shall be paid by the Contractor.

ARTICLE 13 – MISCELLANEOUS PROVISIONS

§13.1 NIGHT AND SUNDAY WORK

No work shall be done at night or on Sunday except (1) usual protective work, such as pumping and the tending of temporary lighting/power and temporary heating, (2) work done in case of emergency threatening injury to persons or property, or (3) if all of the conditions set forth in the next paragraph below are met.

No work other than that included in (1) and (2) above shall be done at night or on Sunday except when (a) in the sole judgment of the Program Manager, the work will be of advantage to the Owner and can be performed satisfactorily, (b) the work will be done by a crew organized for regular and continuous work, (c) the Program Manager has given written permission for such work, or (d) the work is specified in Section 01311 or Section 01810 to be completed in accordance with specific time restraints.

§13.2 NOTICE AND SERVICE

Any notice given per this Agreement shall be in writing

The principal contacts for written notices for the Owner and Contractor shall be the following at the commencement of the Work:

Owner's Contact for Notice: _____

Address: _____

Email: : _____

Contractor's Contact for Notice: _____

Address: : _____

Email: : _____

The Owner and Contractor may only change the contact person for notice in writing.

For all notices other than those given pursuant to Article 14, Termination and Suspension, or communications to the Contractor's sureties, notice and delivery of the written communication shall be deemed accomplished by one or more of the following methods:

(a) Email communication. Notice shall be deemed effective one (1) business day after sending of the email communication to the proper email address designated above (or later designated substitute) unless receipt is confirmed by the recipient or otherwise responded to by the recipient in which case notice is accomplished the same day the email was sent and actually received.

(b) Personal delivery. Written notices may be delivered in-hand to the contact person designated above. Notice shall be deemed effective on the date of actual receipt.

(c) Mail. Written notices may be delivered by U.S. Mail, Federal Express, UPS, or some other professional delivery service provided that the written communication is properly addressed to the contact person (or later designated substitute) for the Owner or Contractor.

For notices given pursuant to Article 14, Termination and Suspension or any written notice or other communication to the Contractor's sureties, such notices shall be mailed by certified mail, return receipt requested, to the home office of the Contractor, the home office of the Surety (or address listed for notice by the Surety on the issued Bonds, if any), or to the agent who executed the Bonds on behalf of the Surety.

§13.3 HEADINGS

The headings or titles of any section, subsection, paragraph, provision, or part of the Contract Documents shall not be deemed to limit or restrict the content, meaning or effect of such section, subsection, paragraph, provision or part.

§13.4 NO CONFLICT WITH LAWS OR REGULATIONS

The duties, obligations, criteria or procedure imposed by this Agreement and the rights and remedies made available are in addition to, and are not 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, except that in the event that a specific part of detailed requirement of a provision, criterion or procedure in this Agreement and a specific part or detailed requirement of a provision, criteria or procedure imposed or available by Laws or Regulations are in conflict, the specific part or detailed requirement of such provision, criterion or procedure imposed or available by Laws or Regulations in conflict shall govern. All other specific parts or detailed requirements in the provisions, criteria or procedures of this Agreement not in conflict with applicable laws or regulations shall remain in full force and effect and be read with the controlling specific part or detailed requirement.

The provisions of this Section 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.

If the Agreement or Contract Documents contain any unlawful provisions, such unlawful provisions shall be of no effect. Upon the application of either party, the unlawful provisions shall be considered stricken from the Agreement or the Contract Documents without affecting the remainder of the Agreement or Contract Documents.

It is intended that all provisions of law required to be inserted in the Agreement or Contract Documents shall be and are inserted herein. If through mistake, neglect, oversight or otherwise, any such provisions is not herein inserted or inserted in improper form, upon the application of either party, the Agreement or Contract Documents shall be changed by the Owner, at no increase in Contract Price or extension in Contract Time, so as to strictly comply with the law and without prejudice to the rights of either party hereunder.

§13.5 NO WAIVER

Observation by the Program Manager or by any of the Program Manager's representatives, any measurement or report by the Program Manager, any order by the Owner for the payment of money, any payment for or acceptance of any Work or any extension in Contract Time or any Partial Utilization by the Owner shall not operate as a waiver of any provision of the Contract Documents, or any power preserved to the Owner, or of any right to any damages provided. Any waiver of any breach of this Contract shall not be held to be a waiver of any other or subsequent breach.

Neither the inspection by the Owner or the Program Manager, nor any order, measurement, approval, determination, decision or certificate by the Program Manager, nor any order by the Owner for the payment of money, nor any payment for or use, occupancy, possession or acceptance of the whole or any part of the Work by the Owner, nor any extension of Contract Time, nor any other act or omission of the Owner or of the Program Manager shall constitute or be deemed to be an acceptance of any Defective Work, materials, or equipment nor operate as a waiver of any requirement or provision of the Contract Documents, nor of any remedy, power or right of or herein reserved to the Owner, nor of any right to damages for breach of contract. Any and all rights and/or remedies provided for in the Contract are intended and shall be construed to be cumulative; and, in addition to each and every other right and remedy provided for herein or by law, the Owner shall be entitled as of right to a writ of injunction against any breach or threatened breach of the Agreement by the Contractor, by its Subcontractors or by any other person or persons.

The Owner reserves the right to correct any error that may be discovered in any estimate that may have been paid, and to adjust same to meet the requirements of the Contract Documents. The Owner further reserves the right, should proof of Defective Work on the part of the Contractor be discovered after final payment, to claim, and recover from the Contractor or its surety, or both, such sums as may be sufficient to correct the error, or make good the defects in the Work.

Any waiver issued by the Owner of any provision of the Contract Documents shall only be effective if issued in writing by the Owner and shall be specific, shall apply only to the particular matter concerned and not to other similar or dissimilar matters.

ARTICLE 14 – TERMINATION AND SUSPENSION

§14.1 SUSPENSION OF WORK

The Owner may at any time and without cause suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to the Contractor that shall fix the date on which Work shall be resumed. The Contractor shall resume the Work on the date so fixed. The Contractor shall be entitled to an extension of the Contract Time in accordance with the provisions of Section 8.4, Extension of Time.

The Contractor may be entitled to an equitable adjustment in accordance with the provisions of Section 7.2, Extra Work. No equitable adjustments shall be made for any suspension to the extent that performance would have been so suspended pursuant to this Agreement or for which an equitable adjustment is provided for or excluded under any other provision of the Contract Documents.

§14.2 TERMINATION FOR CAUSE

The Owner, acting on belief or knowledge, shall have full power and authority to give written notice to the Contractor and the Surety of the Owner's intention to terminate the services of the Contractor seven (7) days after the giving of notice, or sooner, if, in the opinion of the Owner it is in the best interests of the Owner to do so, because:

a. The Contractor fails to complete the Work, or a separable part of the Work, within the corresponding Contract Time, including any authorized adjustments;
b. The Contractor refuses or fails to perform the Work, or a separable part of the Work, with the diligence that will cause its completion within the corresponding Contract Time, including any authorized adjustments;
c. The Contractor refuses or fails to supply sufficient skilled workers, materials, or equipment in adherence with the Project Schedule revised from time to time;
d. The Contractor refuses or fails to provide labor, including that of subcontractors, that can work in harmony with all other elements of labor employed or to be employed by Contractor or other contractors of Owner;
e. The Contractor refuses or fails to comply with the Project Schedule requirements;
f. The Contractor disregards the authority of the Program Manager;
g. The Contractor is unable to pay its debts generally as they become due;
h. The Contractor in response to a demand by the Owner as a result of the Contractor becoming insolvent, seeking relief in bankruptcy, or making a general assignment for the benefit of creditors, fails to provide adequate assurances, the adequacy of which the Owner shall be the sole judge, of the Contractor's future performance in accordance with the requirements of the Contract Documents;
i. A trustee, receiver, custodian or agent of the Contractor is appointed under applicable law or under Contract, whose appointment or authority to take charge of property of such Contractor is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of the Contractor's creditors; or
j. The Contractor otherwise violates any provisions of the Contract Documents, fails to perform the Work in accordance with the Contract Documents, or disregards Laws or Regulations of any public entity having jurisdiction over any aspect of the Work.

If upon receipt of a notice of intent to terminate for cause, the Contractor does not cure the default or make adequate assurances that it will immediately take action to cure the default

within three (3) days of that notice, the Owner shall have full power and authority, to terminate in whole or in part the Work of the Contractor, exclude the Contractor from the site and, take possession of the Work and of all the Contractor's tools, appliances, plant, construction equipment and machinery at the site and use the same to the full extent they could be used by the Contractor (without liability to the Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid the Contractor but which are stored elsewhere and prosecute the Work to completion by Contract or as the Owner may deem expedient. Upon receipt of a notice of termination, the Contractor shall immediately proceed in accordance with any specific provisions or instruction, to protect and maintain the Work, and make reasonable efforts to mitigate any costs.

In the event that the Owner so terminates the Contractor's services for cause, the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct, indirect and consequential costs of completing the Work (including but not limited to delay damages, fees and charges of engineers, consultants, architects, attorneys and other professionals and court costs) that excess will be paid to the Contractor. If those costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. Costs incurred by the Owner will be incorporated in a Change Order.

Where the Contractor's services have been so terminated by the Owner, the termination will not affect any rights or remedies of the Owner against the Contractor then existing or which may accrue after termination. Any retention or payment of monies due the Contractor by the Owner will not release the Contractor from liability.

All provisions of the Contract Documents that by their nature survive the Completion Date under the Agreement shall remain in full force and effect after a termination for cause.

The Owner may, at its sole discretion, permit the Contractor to continue to perform Work when the Contractor is in default, however caused, including but not limited to default under subparagraph b above. Such a decision by the Owner shall in no way operate as a waiver on the part of the Owner of any of its rights under the Contract Documents.

Where the Contractor's services have been so terminated by the Owner, and the Surety completes the Work in place of the defaulted Contractor, the Surety's contract with another contractor makes that Contractor a Subcontractor under the Agreement, in which case:

> The provisions of §7.2, Extra Work, shall remain in full force and effect, and the methods and criteria to be used to compute the Surety's and that contractor's Cost of the Work involved in any subsequent changes shall be limited to those provided in §7.2, Extra Work. All Work performed by any such contractor pursuant to a Subcontract between that contractor and the Surety shall be governed by the requirements of the Contract Documents pertaining to Subcontracts.

§14.3 TERMINATION FOR CONVENIENCE

Upon seven (7) days written notice to the Contractor and the Surety, the Owner may, without cause and without prejudice to any other right or remedy, elect to terminate the Agreement in whole or in part. Upon receipt of such notice, the Contractor shall immediately proceed in accordance with any specific provisions or instructions, protect and maintain the Work, and make reasonable and diligent efforts to mitigate costs associates with the termination.

In any such termination for the convenience by the Owner, the Contractor shall be paid for Work completed in accordance with the Contract Documents prior to receipt of the notice of termination, and for reasonable termination settlement costs relating to commitments which had become firm prior to the termination; provided, however, that the payment to the Contractor will exclude any and all anticipated supplemental costs, administrative expenses and profit on uncompleted Work.

If, after notice of termination of the services of the Contractor for any of the causes listed in subparagraphs a through g, "Termination for Cause", it is determined that the Contractor was not in default, the termination shall be deemed to have been for the convenience by the Owner. In such event, the Contractor may recover from the Owner payment in accordance with this Section.

TABLE A

AGREEMENT SUBSECTION	ITEM	LIMITS
§8.3	Contract Times	Contract Time, as defined in the Contract Agreement Article 1.2.l, shall be on or before 540 consecutive calendar days.
§8.5	Delay Damages	$500.00 per calendar day
§4.3	Percentage of Progress Estimates to be Retained	5% Until Substantial Completion; 0.5% plus Punch List through one year after the Completion Date
§4.3	Amount of Minimum Progress Estimates	$10,000.00

CERTIFICATE OF INSURANCE

PROJECT: _____

INSURANCE AGENCY: _____

TYPE	COVERAGE REQUIRED BY INSURANCE CONTRACT DOCUMENTS	POLICY COMPANY	POLICY NUMBER	COVERAGE	EXPIRATION DATE
Workmen's Compensation and Employee's Liability Insurance	As Required by the Laws of the State of Rhode Island	_____	_____	$_____	_____
Commercial General Liability	$1,000,000 each occurrence	_____	_____	$_____	_____
	$2,000,000 annual aggregate Products – Completed Operation aggregate	_____	_____	$_____	_____
Commercial Automobile Liability	$1,000,000 each accident	_____	_____	$_____	_____
Builder's Risk Insurance	Not Required	.			
Commercial Umbrella Liability Insurance	$2,000,000	_____	_____	$_____	_____
Pollution Liability including asbestos and lead abatement	$1,000,000 each occurrence	_____	_____	$_____	_____
	$3,000,000 aggregate	_____	_____	$_____	_____

We certify that the coverages noted above meet or exceed the coverages required under Article 11 of the Contract Agreement.

_____
Contractor's Authorized Representative
Date _____

_____
Insurance Agents. Authorized Representative
Date _____

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DIVISION 1

GENERAL REQUIREMENTS

SECTION 01000

GENERAL SPECIFICATIONS

1. Abbreviations
2. Handling and Distribution
3. Materials - Samples - Inspection
4. Access to the Work
5. Storage of Materials and Equipment
6. Inspection of Work Away From the Site
7. Occupying Private Land
8. Interference with and Protection of Streets
9. Traffic Control
10. Safety
11. Sanitary Regulations
12. Lines, Grades and Measurements
13. Dimensions of Existing Structures and Pipes
14. Work to Conform
15. Pipe Location
16. Limits of Normal Excavation
17. Computation of Quantities
18. Precautions During Adverse Weather
19. Installation of Equipment
20. Test Pits/Vacuum Excavations
21. Buried Utility Warning and Identification Tape
22. Architectural Coatings
23. Noise Limitations
24. Right to Know Law
25. Special Waste
26. Subsurface and Physical Conditions
27. Sales Tax Exemption
28. Hydraulic Uplift of Structures
29. Hours of Construction
30. Open Excavations
31. Protection and Relocation of Existing Structures and Utilities
32. Dust Control
33. Clean Up and Disposal of Excess Material
34. Construction Employment
35. Public Utilities
36. Provisions for Control of Erosion
37. Hurricane Preparedness Plan
38. Disturbance of Existing Survey Markers

PART 1 GENERAL

1.01 ABBREVIATIONS

A. Where any of the following abbreviations are used in the Contract Documents, they shall have the meaning set forth opposite each.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers, Inc.
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANS	American National Standard
ANSI	American National Standards Institute
API	American Petroleum Institute
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
AWPA	American Wood-Preservers' Association
AWWA	American Water Works Association
CEMA	Conveyor Equipment Manufacturer=s Association
CS	Commercial Standard
IBR	Institute of Boiler and Radiator Manufacturers
IPS	Iron Pipe Size
JIC	Joint Industry Conference Standards

NBS	National Bureau of Standards
NEC	National Electrical Code; latest edition
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
Fed. Spec.	Federal Specifications issued by the Federal Supply Service of the General Services Administration, Washington, D.C.
125-lb	ANS American National Standard for Cast-Iron Pipe 250-lb. ANS Flanges and Flanged Fittings, Designation B16.1-1975, for the appropriate class
AWG	American or Brown and Sharpe Wire Gage
NPT	National Pipe Thread
OS&Y	Outside screw and yoke
Stl. WG	U. S. Steel Wire, Washburn and Moen, American Steel and Wire or Roebling Gage
UL	Underwriters' Laboratories
USS Gage	United States Standard Gage
WOG	Water, Oil, Gas
WSP	Working steam pressure

1.02 HANDLING AND DISTRIBUTION

A. The Contractor shall handle, haul, and distribute all materials and all surplus materials on the different portions of the Work, as necessary or required; shall provide suitable and adequate storage room for materials and equipment during the progress of the Work, and be responsible for the protection, loss of, or damage to materials and equipment furnished by him, until the final completion and acceptance of the Work.

B. Storage and demurrage charges by transportation companies and vendors shall be borne by the Contractor.

1.03 MATERIALS - SAMPLES - INSPECTION

A. Unless otherwise expressly provided on the Drawings or in any of the other Contract Documents, only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the Contractor to be incorporated in the Work shall be subject to the inspection of the Program Manager. No material shall be processed or fabricated for the Work or delivered to the Work site without prior concurrence of the Program Manager.

B. As soon as possible after execution of the Agreement, the Contractor shall submit to the Program Manager the names and addresses of the manufacturers and suppliers of all materials and equipment he proposes to incorporate into the Work. When shop and working drawings are required as specified below, the Contractor shall submit prior to the submission of such drawings, data in sufficient detail to enable the Program Manager to determine whether the manufacturer and/or the supplier have the ability to furnish a product meeting the Specifications. As requested, the Contractor shall also submit data relating to the materials and equipment he proposes to incorporate into the Work in sufficient detail to enable the Program Manager to identify and evaluate the particular product and to determine whether it conforms to the Contract requirements. Such data shall be submitted in a manner similar to that specified for submission of shop and working drawings.

C. Facilities and labor for the storage, handling, and inspection of all materials and equipment shall be furnished by the Contractor. Defective materials and equipment shall be removed immediately from the site of the Work. See also Section 01600 – Materials and Equipment.

D. If the Program Manager so requires, either prior to or after commencement of the Work, the Contractor shall submit samples of materials for such special tests as the Program Manager deems necessary to demonstrate that they conform to the Specifications. Such samples shall be furnished, taken, stored, packed, and shipped by the Contractor as directed. Except as otherwise expressly specified, the Owner shall make arrangements for, and pay for, the tests.

E. All samples shall be packed so as to reach their destination in good condition, and shall be labeled to indicate the material represented, the name of the building or work and location for which the material is intended, and the name of the Contractor submitting the sample. To ensure consideration of samples, the Contractor shall notify the Program Manager by letter that the samples have been shipped and shall properly describe the samples in the letter. The letter of notification shall be sent separate from and should not be enclosed with the samples.

F. The Contractor shall submit data and samples, or place his orders, sufficiently early to permit consideration, inspection and testing before the materials and equipment are needed for incorporation in the Work. The consequences of his failure to do so shall be the Contractor's sole responsibility.

G. In order to demonstrate the proficiency of workmen, or to facilitate the choice among several textures, types, finishes, surfaces, etc., the Contractor shall provide such samples of workmanship of wall, floor, finish, etc., as may be required.

H. When required, the Contractor shall furnish to the Program Manager triplicate sworn copies of manufacturer's shop or mill tests (or reports from independent testing laboratories) relative to materials, equipment performance ratings, and concrete data.

I. After review of the samples, data, etc., the materials and equipment used on the Work shall in all respects conform therewith.

1.04 ACCESS TO THE WORK

A. The Contractor shall provide sufficient and proper facilities at all times for inspection of all work under this project in preparation or in progress, by the Owner, the agents and employees of the Owner, by authorized representatives of the State of Rhode Island, the Federal Government and by the Program Manager.

B. The Contractor shall furnish the Program Manager or his authorized representative and other personnel mentioned above with such facilities and assistance as are necessary to ascertain performance of the work in accordance with the plans and specifications.

1.05 STORAGE OF MATERIALS AND EQUIPMENT

A. The Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements. The materials and equipment shall be placed as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the work. The Contractor shall assume full responsibility for any damage to any such land or area, or to the Owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such Owner or occupant because of the performance of the Work, the Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. See also Section 01600 – Materials and Equipment.

B. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

1.06 INSPECTION OF WORK AWAY FROM THE SITE

A. If work to be done away from the construction site is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing, or before shipment, the Contractor shall give notice to the Program Manager of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Program Manager in ample time so that the necessary arrangements for the inspection can be made.

1.07 OCCUPYING PRIVATE LAND

A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with labor, tools, materials, or equipment, any land outside the rights-of-way or property of the Owner. A copy of the written consent shall be given to the Program Manager.

1.08 INTERFERENCE WITH AND PROTECTION OF STREETS

A. The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefor from the proper authorities. If any street, road or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.

B. Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions made therefor.

C. The Contractor shall, at least 24 hours in advance, notify the Police and Fire Departments in writing, with a copy to the Program Manager, if the closure of a street or road is necessary. He shall cooperate with the Police Department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

1.09 TRAFFIC CONTROL

A. Whenever and wherever, in the opinion of the Program Manager, traffic is sufficiently congested or public safety is endangered, the Contractor will furnish uniformed special officers to direct traffic and to keep traffic off the roadway area affected by construction operations. If police details are required, the direct cost for the detail will be paid directly by the Narragansett Bay Commission provided that slips are collected by Contractor and submitted to Narragansett Bay Commission.

B. The employment or presence of uniformed special officers or police shall in no way relieve the Contractor of any responsibility or liability which is his under the terms of the contract.

1.10 SAFETY

A. The Contractor shall take all necessary precautions and provide all necessary safeguards to prevent personal injury and property damage. The Contractor shall provide protection for all persons, including but not limited to his employees and employees of other contractors or subcontractors; members of the public; and employees, agents, and representatives of the Owner, the Program Manager, and regulatory agencies that may be on or about the Work. The Contractor shall provide protection for all public and private property including but not limited to structures, pipes, and utilities, above and below ground.

B. The Contractor shall provide and maintain all necessary safety equipment such as fences, barriers, signs, lights, walkways, guards and fire prevention and fire-fighting equipment and shall take such other action as is required to fulfill his obligations under this subsection.

C. The Contractor shall comply with all applicable Federal, State and local laws, ordinances, rules and regulations and lawful orders of all authorities having jurisdiction for the safety of persons and protection of property.

D. The Contractor shall designate a responsible member of his organization at the site whose duty shall be responsible for all matters of safety. This responsible person shall have the authority to take immediate action to correct unsafe or hazardous conditions and to enforce safety precautions and programs.

E. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until Final Completion and Program Manager has issued a notice to Owner and Contractor that the Work is acceptable.

1.11 SANITARY REGULATIONS

A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required.

B. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.12 LINES, GRADES AND MEASUREMENTS

A. The Contractor shall employ a competent land surveyor, registered within the State of Rhode Island as a Professional Land Surveyor. The Contractor shall require said surveyor to establish all lines, elevations, reference marks, batter boards, etc., needed by the Contractor during the progress of the Work, and from time to time to verify such marks by instrument or other appropriate means.

B. The Program Manager shall be permitted at all times to check the lines, elevations, reference marks, batter boards, etc., set by the surveyor, who shall correct any errors in lines, elevations, reference marks, batter boards, etc., disclosed by such check. Such a check shall not be construed to be an approval of the surveyor's work and shall not relieve or diminish in any way the responsibility of the Contractor for the accurate and satisfactory construction and completion of the entire Work.

C. The Contractor shall make, check, and be responsible for all measurements and dimensions necessary for the proper construction of and the prevention of misfittings in the Work.

1.13 DIMENSIONS OF EXISTING STRUCTURES AND PIPES

A. Where the dimensions and locations of existing structures and pipes are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

1.14 WORK TO CONFORM

A. During its progress and on its completion, the Work shall conform truly to the lines, levels, and grades indicated on the Drawings or given by the Program Manager and shall be built in a thoroughly substantial and workmanlike manner, in strict accordance with the Drawings, Specifications, and other Contract Documents and the directions given from time to time by the Program Manager.

B. All work done without instructions having been given therefor by the Program Manager, without proper lines or levels, or performed during the absence of the Program Manager, will not be estimated or paid for except when such work is authorized by the Program Manager in writing. Work so done may be ordered uncovered or taken down, removed, and replaced at the Contractor's expense.

1.15 PIPE LOCATION

A. Exterior pipelines will be located substantially as indicated on the Drawings, but the right is reserved to the Owner, acting through the Program Manager, to make such modifications in location as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings, etc., are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

B. Small interior piping is indicated diagrammatically on the Drawings, and the exact location is to be determined in the field. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, so as not to interfere with equipment or access ways, and, in general, without diagonal runs.

1.16 LIMITS OF NORMAL EXCAVATION

A. In determining the quantities of excavation to which unit prices shall apply, the limits of normal width and depth of excavation shall be as described below, unless other limits are indicated on the Drawings or specified.

B. For pipes in trench, the normal width of the trench shall be measured between vertical planes and as shown on the project details. Payment width of trenches shall be as shown on the project details, unless otherwise indicated in Section 01025 - Measurement and Payment. The normal depth shall be measured to a distance of 0.5-foot below the bottom of the pipe in earth and 1.0-foot in rock, unless there be a cradle underneath the pipe, in which case the normal depth shall be measured to the underside of the bedding. The width of trench for the bedding shall be assumed to be that specified above for pipes in trench.

C. For concrete placed directly against undisturbed earth, the normal width and depth of the excavation for such concrete shall be measured to the neat lines of the concrete as indicated on the Drawings or as ordered.

D. For concrete placed against rock surfaces resulting from rock excavation, the normal width and depth of the excavation shall be measured to 4 inches outside the neat lines of the concrete as indicated on the Drawings or as ordered.

E. For other structures, except manholes as noted below, the normal width shall be measured between vertical planes 1-foot outside the neat lines of the several parts of the structure, except that the width at any elevation shall be measured as not less than the width at a lower elevation. The normal depth shall be measured to the underside of that part of the structure for which the excavation is made.

F. No additional width or depth of trenches excavated in earth or rock shall be allowed at standard circular manholes.

G. Wherever bell holes are required for jointing pipe, they shall be provided without additional compensation over and above that resulting from measurements as above described.

1.17 COMPUTATION OF QUANTITIES

A. For estimating quantities in which the computation of areas by geometric methods would be comparatively laborious, it is agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of such areas.

B. It is further agreed that the computation of the volume of prismoids shall be by the method of average end areas.

1.18 PRECAUTIONS DURING ADVERSE WEATHER

A. During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.

B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.

1.19 INSTALLATION OF EQUIPMENT

A. Special care shall be taken to ensure proper alignment to all equipment with particular reference to the pumps, drives, shafts and motors. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. Equipment manufacturer instructions shall be complied with fully. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been completed, the bed plates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations, and after confirmation of all alignments, the sole plates shall be firmly grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping.

B. All wedges, shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.

1.20 TEST PITS/VACUUM EXCAVATION

A. Test pits or vacuum excavations for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at locations shown on the drawings or in areas where the Contractor deems it necessary to obtain subsurface information. Test pits or vacuum excavations shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Program Manager. There shall be no direct reimbursement for test pits/vacuum excavations unless a payment item is specifically indicated elsewhere in the Contract Documents.

1.21 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping, in accordance with project details. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED PIPING BELOW or similar. Use

permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with printed side up at a depth of 12 inches below the top surface of earth or the top surface of the subgrade under pavements.

1.22 ARCHITECTURAL COATINGS

A. Maintain coordination among all Sections requiring coatings. All coatings shall match to the satisfaction of the Program Manager with regard to color and texture. Items rejected by the Program Manager shall promptly be removed from the job site.

1.23 NOISE LIMITATIONS

A. All equipment to be furnished under this Contract, unless specified otherwise in the technical specifications, shall be designed to insure that the sound pressure levels does not exceed 85 decibels over a frequency range of 37.8 to 9600 cycles per second at a distance of three feet from any portion of the equipment, under any load condition, when tested using standard equipment and methods. Noise levels shall include the noise from the motor. Mufflers or external baffles shall not be acceptable for the purpose of reducing noise. Data on noise levels shall be included with shop drawing submittals.

1.24 RIGHT TO KNOW LAW

A. The Contractor shall submit Material Safety Data Sheets for all substances or mixture of substances used on the Project by him/her or his/her subcontractors prior to commencing any work in accordance with all Federal and State requirements.

1.25 SPECIAL WASTE (SEE DIVISION 2 SPECIFICATIONS)

1.26 SUBSURFACE AND PHYSICAL CONDITIONS

A. In preparation of Drawings and Specifications, the Program Manager has relied upon existing record drawings made available by Owner and utility companies with service in the area of the project. This information is not guaranteed accurate or complete.

1.27 SALES TAX EXEMPTION

A. Project is exempt from sales tax on products permanently incorporated in the work. Sales tax exemption certificate number shall be available from the Owner.

B. Contractor shall place the tax exemption certificate number on invoices for materials incorporated in the work.

C. Upon completion of work, Contractor shall file with Owner a notarized statement that all purchases made were entitled to be exempt. Contractor shall pay legally assessed penalties for improper use of Owner's tax exemption status.

1.28 HYDRAULIC UPLIFT OF STRUCTURES

A. The Contractor shall be responsible for the protection of all new and existing structures against hydraulic uplift until such structures have been accepted final by the Owner.

1.29 HOURS OF CONSTRUCTION

A. Except as otherwise specifically allowed elsewhere in the Contract Documents, normal construction activity shall take place only between the hours of 7:00 am to 5:00 pm excluding, Saturdays, Sundays and legal holidays. The Contractor shall plan the Work so as to avoid working beyond these hours. However, if despite the Contractor's diligent efforts, the Contractor believes that overtime work is necessary in order for the Contractor to complete the Work, the Contractor may apply to the Program Manager and to the Owner for approval to perform overtime work, which approval may be withheld in their sole discretion. No additional compensation or time extension shall be due to the Contractor whether approval is granted or denied.

B. If the Contractor believes that overtime work is necessary, it shall obtain prior approval from the Program Manager and the Owner. The Contractor shall file a request for such approval in writing and shall include the specific reasons therefore and the time that the overtime work is expected to be concluded. Overtime work will normally be limited to evening hours (5:00 p.m. to 8:00 p.m.) Monday through Friday and daytime hours (7:00 a.m. to 5:00 p.m.) on Saturdays except in special circumstances approved by the Program Manager and the Owner.

1.30 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property.

B. For trench excavation, the Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of trench excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Program Manager. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Program Manager may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in certain areas and requiring that the trench shall not remain open overnight.

C. The Contractor shall take precautions to prevent injury to the public due to open excavations. All trenches, excavations, excavated material, equipment, or other obstacles which could be dangerous to the public and treatment plant personnel shall be well lighted at night.

1.31 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.

B. Assistance will be given to the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, sewers, electrical conduits and force mains). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract.

D. If, in the opinion of the Program Manager, permanent location of a utility owned by the Owner is required, the Program Manager may direct the Contractor, in writing, to perform the work. If relocation of a privately owned utility is required, the Contractor will notify the Utility and the Contractor will perform the work as directed by the Utility. The Contractor shall fully cooperate with the Owner and the Utility and shall have no claim for delay due to such relocation. The Contractor shall notify all utility companies.

1.32 DUST CONTROL

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water as necessary, so as to minimize the creation and dispersion of dust. If the Program Manager decides that it is necessary to use calcium chloride, and it is allowed by local authorities, for more effective dust control, the Contractor shall furnish and apply the material as directed.

B. Calcium chloride shall be commercial grade, furnished in 100 lb, 5-ply bags, stored under weatherproof cover and stacked alternately for ventilation. Application for dust control shall be at the rate of about 1/2 pound per square yard, unless otherwise directed by the Program Manager.

1.33 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. The Program Manager and the Owner reserve the right to direct site clean-up if deemed necessary. The Contractor shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor shall and his subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

1.34 CONSTRUCTION EMPLOYMENT

A. The Contractor shall advertise for and give preference in hiring to qualified workers from the Cities and Towns serviced by the Narragansett Bay Commission (Providence, Pawtucket, East Providence, Cranston, Central Falls, Cumberland, Lincoln, Johnston and North Providence) for any available positions associated with the work included in this Contract. The Contractor shall

undertake positive efforts to meet this requirement which shall include, but not be limited to, placing employment advertisements in newspapers serving the communities within these communities, interviewing persons from within these communities who may apply for positions, and hiring subcontractors and suppliers from within these communities.

1.35 PUBLIC UTILITIES

A. The Contractor shall comply with the following requirements for excavations in public and private property. Compliance shall include the following:

1. The Contractor shall notify public utility companies in writing at least 72 hours (excluding Saturdays, Sundays and legal holidays) but not more than 30 days before excavating in areas where underground utility plant (pipes, cables, manholes, etc.) exist.
2. The Contractor shall be responsible for providing the Utility Companies with a schedule of his activities in areas where the utilities exist.
3. The Contractor shall immediately notify utility companies of any damage to their utilities resulting from construction operations.

B. The Contractor shall contact DIGSAFE at 1-800-225-4977 at least 72 hours before digging, trenching, blasting, demolishing, boring, backfilling, grading, landscaping or other earth moving operations in any public ways, rights of way and easements.

1.36 PROVISIONS FOR CONTROL OF EROSION

A. The Contractor shall take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens and calcium chloride into the supplies and surface waters of the State. Special precautions shall be taken in the use of the construction equipment to prevent operations which promote erosion.

B. Disposal of drainage shall be in an area approved by the Owner. The Contractor shall prevent the flow or seepage of drainage back into the drainage area. Drainage shall not be disposed of until silt and other sedimentary materials have been removed. Particular care shall be taken to prevent the discharge of unsuitable drainage to a water supply or surface water body.

C. As a minimum, the following shall apply:

1. In open areas brush and stumps shall not be removed until no more than 1 week prior to the start of excavation in that area. The existing ground surface shall be disturbed as little as possible until no more than one week prior to the start of excavation.
2. Silt fence shall be provided at points where drainage from the work site leaves the site, to reduce the sediment content of the water. Sufficient silt fence shall be provided such that all flow will filter through the hay. Other methods which reduce the sediment content to an equal or greater degree may be used as approved by the Program Manager.
3. Drainage leaving the site shall flow to water courses in such a manner to prevent erosion.
4. Loaming and seeding or mulching of cross county areas shall take place as soon after excavation as practicable. This shall be considered part of the work and full payment for the work need not be made until it has been completed.

D. Measures for control of erosion must be adequate to assure that turbidity in the receiving water will not be increased more than 10 standard turbidity units (s.t.u.), or as otherwise required by the State or other controlling body, in waters used for public water supply unless limits have been

established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 s.t.u. unless otherwise permitted.

1.37 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of the Notice To Proceed, submit to the Program Manager and the Owner, for approval, a Hurricane Preparedness Plan. The Plan shall describe in detail the necessary measures which the Contractor will perform, at no additional cost to the Owner, in case of a hurricane warning. Revise Plan as required by the Program Manager and Owner.

1.38 DISTURBANCE OF ALL EXISTING SURVEY MARKERS

A. The Contractor shall replace all bounds and survey markers disturbed by his operations at his own expense. The bounds shall be relocated by a land surveyor registered in the State of Rhode Island.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF GENERAL SPECIFICATIONS

SECTION 01010

SUMMARY OF WORK AND CONTRACT MILESTONES

PART 1 GENERAL

1.01 LOCATION OF WORK

A. The work of this Contract is located in the City of Pawtucket, Rhode Island at the following locations:

1. Taft Street, Parcel No. 54//827 owned by the City of Pawtucket herein referred to as “Town Landing”, and Parcel 54//826 owned by the National Grid, herein referred to as “Tidewater property”.

1.02 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and construct the project complete and ready for operation in its entirety as shown on the Drawings and specified herein.

B. The work herein specified to be done (herein sometimes referred to as the "Work") consists generally of the construction of new large diameter conduits, manholes, and diversion structures contained in the Contract Documents.

C. The work includes construction of the following major elements as further described in the Contract Documents. All lengths, sizes, and dimensions given are approximate:

1. 48-inch RCP Pipe (Consolidation Conduit)
   - Open Cut Construction: 320 Linear feet
   - Microtunneling: 1,450 Linear Feet
2. 42-inch RCP Pipe (Relocated Outfall)
   - Open Cut Construction: 500 Linear feet
3. Precast Concrete structures
   - Five (5) 8’ diameter manholes
   - One (1) Diversion Structure
   - One (1) Relocation Structure
4. Surface restoration
5. Other miscellaneous tasks contained in the Contract Documents.

1.03 WORK BY OTHERS

A. The Contractor’s occupation of the work site or portions thereof and its operations throughout the course of the Work may be affected by the operations of others adjacent to and within the work site. National Grid occupies the Tidewater Site and operates an active electric substation and natural gas regulator facility. In addition, ongoing construction contracts within the contract limits include:

- National Grid: Sitewide Remedy Design
- Fortuitous Partners: Tidewater Landing

B. In addition to those activities detailed hereinbefore the Contractor shall also coordinate its operations in the public rights-of-way with other utilities, RIDOT and the City of Pawtucket, as provided elsewhere in the Contract Documents.

C. The Contractor's use of the premises shall be within the limits shown on the Drawings, in accordance with schedule milestones specified by the Contract Documents and as defined in the Agreement for the performance of the Work.

D. The Contractor shall maintain access and utilities to the adjacent businesses and residents at all times.

E. The Contractor shall assume full responsibility for security of all its subcontractor's materials and equipment stored on site.

F. If directed by the Owner, the Contractor shall move any stored items which interfere with operations of the Owner or other contractors, without an increase to Contract Price or Contract Time.

G. The Contractor shall obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.04 TIDEWATER PROPERTY

The Tidewater property is owned by National Grid, and the NBC has secured an easement for the installation and maintenance of the improvements. The Tidewater Property has residual contamination associated with its former use as a manufactured gas plant (MGP). Requirements related to working on the property are included within the following specifications:

01065 – Project Safety and Health Specifications
Appendix ……

1.05 CONTRACT MILESTONES

A. TIDEWATER PROPERTY

1. All work within the Tidewater property and Tidewater Street shall be completed no later than February 1, 2023.
2. Continued coordination…….

B. Town Landing Property

1. Continued Coordination ……

C. FINAL COMPLETION

1. Final Completion, as defined in the Contract Agreement Article 1.2.x, shall be achieved within 540 calendar days from the Notice to Proceed date.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SUMMARY OF WORK AND CONTRACT MILESTONES

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The following subsections describe the measurement of, and payment for, the work to be done under the items listed in the Bid Schedule.

B. Each unit or lump sum price stated in the Bid Schedule shall constitute full compensation as herein specified for each item of work completed in accordance with the drawings and specifications, including cleaning up.

C. The prices for those items that involve excavation shall include compensation for disposal of all excavated material, handling of all water in accordance with the Contract Documents, installation of all necessary excavation and support elements, and the removal and disposal of excavation support elements as required.

D. The retainage specified in the **Contract Agreement** shall apply to all payments to the Contractor, except for Allowances, as applicable.

E. The Contractor shall take no advantage of any apparent error or omission on the Contract Documents, and the Program Manager/Construction Manager shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.

F. All portions of the Work required by the Contract Documents are either in an applicable allowance, a lump sum, or a unit price item listed in the Bid Schedule. Work for which there is not a separate item will be considered incidental to the Contract Documents and no additional compensation shall be allowed.

G. Related Work Described Elsewhere:

1. Information for Bidders, Section IB.
2. Contract Agreement, Section CA.
3. Submittals, Section 01300.
4. Materials and Equipment, Section 01600.

1.02 SUBMITTALS

A. Submit to the Program Manager/Construction Manager for approval, a Schedule of Values allocating subcomponent costs within the various portions of the Work.

B. Upon the request of the Program Manager/Construction Manager, support the Schedule of Values with data that will substantiate their correctness.

C. Submit each Application for Payment on a form approved by the Program Manager/Construction Manager showing allowances, lump sum Schedule of Value items, and approved work performed for each unit price item in accordance with the Bid Schedule.

1.03 ALLOWANCES

A. Payment will be made for invoices submitted by the Contractor subject to the conditions and limitations in the Contract Documents.

B. The Contractor shall add overhead and profit to allowances in accordance with Extra Work.

C. The allowance will be adjusted to the actual amount paid for such services and supported by invoice and no retainage will be withheld from this amount.

D. The Contractor shall be responsible for the prompt payment for these allowance services to the appropriate payee providing said service and shall submit evidence to the Program Manager/Construction Manager of payments to the payee prior to its inclusion in the invoice.

1.04 LUMP SUM ITEMS

A. Payment of the lump sum items established in the Contractor's Bid under the various line items in the Bid Schedule incorporated into the Agreement shall be full compensation for all labor, materials, and equipment required to furnish, deliver, install, construct, and test the Work covered under the lump sum bid item.

B. Payment of the lump sum items established in the Contractor's Bid shall also fully compensate the Contractor for any other work that is not specified or shown, but which is necessary to complete the Lump Sum Work items.

C. Payments for Lump Sum Work will be based upon measured and approved physical progress for each activity in accordance with the breakdown of the lump sum prices agreed to in the Schedule of Values.

1.05 UNIT PRICE ITEMS

A. Payment for all work shall be in accordance with the unit price bid items in the Bid Schedule and shall be full compensation for all labor, materials, and equipment required to furnish, deliver, install, construct and test the Work covered under the unit price bid item. Work for which there is not a price schedule item will be considered incidental to the Work and no additional compensation shall be allowed.

B. Payment will be made only for the actual approved quantities of work performed in compliance with the Contract Documents. The Contractor will receive reimbursement equal to the approved quantity times applicable unit price.

C. Owner reserves the right to remove select bid items and to increase or decrease the unit quantity of bid items. The successful bidder is made aware that the unit price so stated on the Bid Schedule constitutes full compensation for that item, regardless of any increase or decrease in the unit quantity of that bid item. There is no guarantee of any minimum or maximum quantity for any bid item. Standards of the industry (e.g., renegotiation of the bid price due to a 25% increase or decrease in the unit quantity of the bid item) shall not be enforceable under this contract

D. Measurement of all quantities of items listed in the Bid shall be done by the Contractor and verified by Owner. The measurement will include proper and complete documentation of all items to the satisfaction of the Owner prior to submission for payment. The measurement submitted shall be in the same unit description listed in the Bid Schedule.

E. Measurement of bid items made for unit quantities will be subject to the maximum permissible excavation trench width and depth allowed by the contract for payment purposes, as stipulated on the Drawings and Contract Documents. Excavations that are made deeper or cut wider due to Contractor's means and methods or for the Contractor's convenience will not be subject to additional payment. As such, the actual quantity used will not necessarily reflect the payable quantity, unless otherwise authorized by Owner. Contractor shall adjust their unit prices accordingly.

1.06 ALLOWANCE ITEMS

A. Under these items, the Contractor shall be reimbursed for certain charges, authorized by Owner, for work not included in, or incidental to, other bid items but that is otherwise required in the course of completing the work of this Contract.

B. The allowance price for these items established in the Bid is an estimated figure to facilitate comparison of bids only. The actual amount to be paid under these items shall constitute full compensation for wages paid, premiums on Workman's Compensation Insurance, payment on account for Social Security and other direct assessments on payroll, as may be required, and all other costs incidental to the services rendered.

C. The allowance price for these items shall NOT include any costs associated with services rendered for routine utility markings, repair of damages incurred as a result of the Contractor's operations, relocations or dismantling and reassembling of utilities done at the Contractor's request and/or convenience or other utility relocation specifically covered under any other bid item, or any other unauthorized services rendered by utility companies. The purpose of this item is strictly for the Contractor's reimbursement for those unforeseen services authorized by Owner prior to the work being performed.

D. Any work proposed to be paid for under these items shall be approved by the Owner in advance of performing the work.

1.07 PRICES INCLUDE

A. The prices stated in the Proposal include full compensation not only for furnishing all the labor, equipment and material needed for, and for performing the work and building the structures contemplated by, the Contract, but also for assuming all risks of any kind for expenses arising by reason of the nature of the soil, groundwater, or the action of the elements; for all excavation and backfilling; for the removal of and delay or damage occasioned by trees, stumps, tracks, pipes, ducts, timber, masonry or other obstacles; for removing, protecting, repairing, or restoring, without cost to the Owner, all pipes, ducts, drains, sewers, culverts, conduits, curbs, gutters, walks, fences, tracks, or other obstacles, road pavements and other ground surfacing whether shown on plans or not; for draining, damming, pumping or otherwise handling and removing, without damage to the work or to other parties, and without needless nuisance, all water or sewage from whatever source which might affect the work or its progress, or be encountered in excavations made for the work; for furnishing, inserting and removing all sheeting, shoring, staging, cofferdams, etc.; for all signs, fencing, lighting, watching, guarding, temporary surfacing, bridging, snow removal,

etc., necessary to maintain and protect travel on streets, walks and private ways; for making all provisions necessary to maintain and protect buildings, fences, poles, trees, structures, pipes, ducts and other public or private property affected or endangered by the work; for the repair or replacement of such things if injured by neglect of such provisions for removing all surplus or rejected materials as may be directed; for replacing, repairing and maintaining the surfaces of streets, highways, public and private lands if and where disturbed by work performed under the Contract or by negligence in the performance of work under the Contract; for furnishing the requisite filling materials in case of any deficiency or lack of suitable materials; for obtaining all permits and licenses and complying with the requirements thereof, including the cost of furnishing any security needed in connection therewith; for any and all expense on account of the use of any patented device or process; for protection against inclement or cold weather; for all expenses incurred by or on account of the suspension, interruption, or discontinuance of work; for the cost of the surety bond and adequate insurance; for all taxes, fees, union dues, etc., for which the Contractor may be or become liable, arising out of his operations incidental to the Contract; for providing equipment on the site and off site; for providing a field office and its appurtenances and for all general and incidental expenses; for tools, implements and equipment required to build and put into good working order all work contemplated by the Contract; for maintaining and guaranteeing the same as provided; and for fulfilling all obligations assumed by the Contractor under the Contract and its related documents.

B. The Owner shall pay and the Contractor shall receive the prices stipulated in the Bid made a part hereof as full compensation for everything performed and for all risks and obligations undertaken by the Contractor under and as required by the Contract.

C. The prices for those Items which involve excavation shall include compensation for disposal of surplus excavated material and handling water.

D. In all Items involving excavation, the price shall be based on doing the entire excavation in earth. Where rock is excavated, the price, therefore, shall be in addition to the cost of excavating earth and no deduction will be made in the amount for earth excavation.

E. The prices for all pipe Items (i.e. sewers, service connections, drains, etc.) shall constitute full compensation for furnishing, laying, jointing and testing; earth excavation, backfill and compaction; materials for bedding pipe as specified; and cleaning up.

F. Payment for boulder excavation less than one (1) cubic yard in size, including hauling boulders offsite and furnishing and installing appropriate backfill material, is included in the various items of work on the Bid Schedule and no separate payments shall be made thereof.

G. Payment for stripping topsoil, including stockpiling, and clearing and grubbing, including disposal, is included in the prices for the various items of work on the Bid Schedule and no separate payment shall be made thereof.

H. Payment for bituminous concrete pavement excavation and disposal, including saw cutting and excavation and disposal of temporary trench patches placed by Contractor, is incidental to the items provided on the Bid Schedule and no separate payment shall be made thereof.

I. Payment for permits and bonds required by the contract is included in the prices for the various items in the Bid Schedule and no separate payment shall be made thereof.

J. Payment for all signage required for this project is included in the prices for the various items in the Bid Schedule and no separate payment shall be made thereof.

K. No separate payment will be made for work or items associated with Division 1 – General Requirements unless otherwise specified herein. This includes Professional Engineer design fees incurred by the Contractor where this is required for submittals. Contractor shall incorporate the cost for these items into the prices submitted on the Bid Schedule.

L. Owner shall pay the direct cost of police details in the event they are required, but Contractor shall be responsible for coordinating and scheduling police details assigned to the project. Cancellation charges imposed due to changes or errors in Contractor's scheduling shall be paid for solely by the Contractor.

PART 2 PRODUCTS

2.01 PARTIAL PAYMENT FOR PRODUCTS

A. Contractor may request partial payment for Products (supplies, material and/or equipment) as defined in Section 01600 - Materials and Equipment, which will be incorporated into the Work and which are delivered and stored off-site. The request may only be made when submitting Contractor's proposal for a Schedule of Values. In order for this request to be considered, the Contractor must comply with the requirements of this sub-section and the Agreement. Any payments approved pursuant to this sub-section shall not exceed sixty-five percent (65%) of the Product's invoiced value and shall be subject to retainage as set forth in the Agreement. Contractor shall obtain prior approval since NBC reserves the right to refuse approval for payment for any equipment or materials suitably stored off-site in its sole discretion, regardless of whether all conditions contained herein have been met.

B. Partial payment may be made for Products eligible for off-site delivery and storage only upon presentation by the Contractor of a Bill of Sale, an invoice or an Affidavit certifying that the material is received by NBC free and clear of all liens, encumbrances and security interests of any kind and including for off-site delivery evidence acceptable to NBC that "all risks" property insurance in an amount sufficient to protect the interests of NBC is in effect at the approved site and that NBC is a loss payee equal to or greater than its percentage of ownership.

C. Partial payment for Products delivered and stored off-site shall be contingent upon Contractor's compliance with the storage and protective maintenance requirements set forth in Section 01600 and all other requirements necessary to preserve equipment warranties for the benefit of NBC.

D. All costs associated with delivery to and storage at an off-site facility shall be assumed by the Contractor notwithstanding the Contractor's request for and obtaining of NBC approval to so deliver and store the materials.

E. Contractor shall provide written evidence to NBC of having made arrangements for unrestricted access by NBC and its authorized representatives to the materials wherever stored, including provision for NBC to take control and possession of such materials at any time and without restriction.

F. Contractor must provide NBC, upon request and prior to any partial payment, documentation that transfers absolute legal title to such material to NBC conditional only upon receipt of

final payment. Neither such transfer of this nor any partial payment shall constitute acceptance by NBC of the materials nor void the right to reject materials subsequently found to be unsatisfactory, or in any way relieve the Contractor of any obligation arising under the Contract Documents.

PART 3 EXECUTION (NOT USED)

PART 4 COMPENSATION

4.01 CONSTRUCT 48-INCH CONSOLIDATION CONDUIT, INSTALLED BY MICROTUNNELLING (BID ITEM NO. 1)

A. Measurement

1. The work of this section will be measured by the percent complete of the installation of 48-inch RCP consolidation conduit utilizing microtunneling methods, complete, in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. Payment for this item shall be in accordance with an approved Schedule of Values developed from the price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The lump sum price for these items shall constitute full compensation for preparing and submittal of shop drawings, constructing consolidation conduit, at all depths, complete, by the microtunnel method, as indicated on the Drawings and as specified, (Section 02314) including removal and disposal of all surplus excavated material, grouting, testing and all incidental work not specifically included for payment under other items.
3. The lump sum price shall also include costs for the installation of all shafts required by the microtunnel operation including clearing, leveling, management of overhead utilities, saw cutting of the existing pavement and sidewalks, removal and disposal of all existing sidewalks and pavement including any existing bituminous, concrete or reinforced concrete base, if encountered, excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), designing and constructing excavation support and dewatering systems, protection and support of existing utilities, maintaining flows of all utilities, dewatering of excavations, repairing and/or replacing existing utilities, safety precautions, furnishing, installing, operating, maintaining, replacing and removing all microtunnel equipment and appurtenances, all bedding material, including all incidental work not specifically included for payment under other items.
4. The lump sum price shall also include costs for furnishing, installing, and testing permanent structures associated with microtunnel shafts and/or pits, specifically MH 217-5, MH 217-6, and MH 217-7.
5. The work of this section shall also include special requirements for work completed on the Tidewater and Town Landing Properties including coordination with National Grid,

coordination with existing construction projects, health and safety and management of contaminated fill/soil and groundwater.

6. Partial payment of the lump sum will be made on the approved Schedule of Values for work completed in accordance with the Contract Documents.

4.02 CONSTRUCT 48-INCH RCP CONSOLIDATION CONDUIT, INSTALLED BY OPEN CUT TRENCHING (BID ITEM NO. 2)

A. Measurement

1. The work of this section will be measured by the number of linear feet of 48-inch RCP consolidation conduit actually installed utilizing trenching methods in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.
2. Structures shall be subtracted from the linear footage quantity; linear footage shall be measured along the centerline of the trench from beginning invert of the pipe to ending invert of the pipe.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per linear feet as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager.
2. The work of this section shall include preparing and submittal of shop drawings, all necessary excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), dewatering, temporary support of excavations, cutting, demolition, removal and disposal of existing tank and building foundations, furnishing and installing required bedding material, backfilling with suitable common borrow, furnishing and installing backfill material where adequate common borrow does not exist, pavement/concrete saw cutting, removal and disposal of pavement/concrete and excess soil, removal and disposal of existing pipe where replacement is proposed, and testing.
3. The work of this section shall also include special requirements for work completed on the Tidewater Property including coordination with National Grid, coordination with existing construction projects, health and safety and management of contaminated fill/soil and groundwater.

4.03 CONSTRUCT 42-INCH RCP OUTFALL PIPE, INSTALLED BY OPEN CUT TRENCHING (BID ITEM NO. 3)

A. Measurement

1. The work of this section will be measured by the number of linear feet of 42-inch RCP pipe actually installed in accordance with the Plans and/or as directed by the Program Manager.
2. Structures shall be subtracted from the linear footage quantity; linear footage shall be measured along the centerline of the trench from beginning invert of the pipe to ending invert of the pipe.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per linear feet as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager.
2. The work of this section shall include preparing and submittal of shop drawings, all necessary excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), dewatering, temporary support of excavations, furnishing and installing required bedding material, backfilling with suitable common borrow, furnishing and installing backfill material where adequate common borrow does not exist, pavement/concrete saw cutting, removal and disposal of pavement/concrete and excess soil, removal and disposal of existing pipe where replacement is proposed, and testing.
3. The work of this section shall also include all labor, equipment, and materials to construct outfall penetration through the revetment as detailed on the Drawings.
4. The work of this section shall also include special requirements for work completed on the Tidewater Property including coordination with National Grid, coordination with existing construction projects, health and safety and management of contaminated fill/soil and groundwater.

4.04 CONSTRUCT LINING SYSTEM FOR CONSOLIDATION CONDUIT / OUTFALL (BID ITEM NO. 4)

A. Measurement

1. The work of this section will be measured by the percent complete of the lining system satisfactorily installed in accordance with the Plans and/or as directed by the Program Manager.

B. Payment

1. Payment for this item shall be in accordance with an approved Schedule of Values developed from the price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager.
2. The work of this section shall include preparing and submittal of shop drawings, mobilization, inspection of system prior to liner system installation, maintenance of existing flow, infiltration control as required, surface preparation, installation of liner system, quality control measurement, preparation and laboratory testing of samples, and final inspection of system after installation.
3. The work of this section shall also include special requirements for work completed on the Tidewater Property including coordination with National Grid, coordination with existing construction projects, and health and safety.

4.05 CONSTRUCT 8-FOOT DIAMETER PRECAST CONCRETE MANHOLE (BID ITEM NO. 5)

A. Measurement

1. The work of this section will be measured by the actual number of manholes furnished and installed, between zero and 12-feet in depth, complete as indicated on the Drawings and/or as directed by the Program Manager.
2. Payment for this work shall be measured as specified at the price provided in the Bid to furnish and install each new 8-foot diameter precast concrete manhole at locations shown on the Plans.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per each manhole installed as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work shall include all necessary excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), dewatering, temporary support of excavation, furnishing and installing required bedding material, backfilling with suitable common borrow, furnishing and installing backfill material where adequate common borrow does not exist, pavement/concrete saw cutting, removal and disposal of pavement/concrete and excess soil, and traffic control. Required testing of the manholes as called for in these specifications shall also be included within this pay item.
3. The work shall also include furnishing and installing manhole frames and covers and all associated grade adjustment.
4. The work of this section shall also include special requirements for work completed on the Tidewater Property including health and safety and management of contaminated fill/soil and groundwater.
5. Structures MH 217-5, MH 217-6, and MH 217-7 shall not be measured for payment under this Item, but shall be included for payment under the Construct 48-Inch Consolidation Conduit, Installed by Microtunneling Item.

4.06 CONSTRUCT ADDITIONAL DEPTH OF 8-FOOT DIAMETER PRECAST MANHOLE OVER 12-FEET DEEP (BID ITEM NO. 6)

A. Measurement

1. The work of this section will be measured by the actual vertical feet of 8-foot diameter manholes furnished and installed, from the 12-foot depth to the top of the base slab, complete as indicated on the Drawings and/or as directed by the Program Manager.
2. Payment for this work shall be measured as specified at the price provided in the Bid to furnish and install each new 8-foot diameter precast concrete manhole, from the 12-foot depth to the top of the base slab, at locations shown on the Plans.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per each foot of manhole greater than 12 feet installed as listed in the Bid Schedule. The

price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager.

2. The unit price for this item shall constitute full compensation for furnishing and installing manhole structure in excess of 12-feet deep, complete, including, additional excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), excavation support, backfill, and all labor, materials and equipment required to complete the additional structure depth, as indicated on the Drawings and as specified.

4.07 CONSTRUCT OF-217 DIVERSION STRUCTURE (BID ITEM NO. 7)

A. Measurement

1. The work of this section will be measured by the percent complete of the OF-217 Diversion Structure satisfactorily installed in accordance with the Plans and/or as directed by the Program Manager.
2. Payment for this item shall be made as a percentage of the lump sum price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

B. Payment

1. Payment for this item shall be in accordance with an approved Schedule of Values developed from the price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager.
2. The work of this section shall include preparing and submittal of shop drawings, excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), design of excavation support and dewatering systems, installing and removing as required the support of excavation, dewatering, maintaining existing flow as required, preparing the subgrade and installing structure bedding, furnishing and installing the structure, complete, including access hatches, weir wall(s), flap gate(s), and floatables control device, connecting pipes to the new structure, backfilling the excavation, final inspection of system after installation, testing, installation of electrical service, conduit, wiring and panels and all other items necessary to complete the work not specifically included for payment under other items.
3. The work of this section shall also include special requirements for work completed on the Tidewater Property including coordination with National Grid, health and safety and management of contaminated fill/soil and groundwater.

4.08 CONSTRUCT OF-217 RELOCATION STRUCTURE (BID ITEM NO. 8)

A. Measurement

1. The work of this section will be measured by the percent complete of the OF-217 Relocation Structure satisfactorily installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.
2. Payment for this item shall be made as a percentage of the lump sum price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

B. Payment

1. Payment for this item shall be in accordance with an approved Schedule of Values developed from the price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work of this section shall include preparing and submittal of shop drawings, excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), design of excavation support and dewatering systems, installing and removing as required the support of excavation, dewatering, coordination, protection, and relocating existing utilities, maintaining existing flow as required, preparing the subgrade and installing structure bedding, furnishing and installing the structure, complete, including manhole frame(s) and cover(s) and/or access hatches, connecting pipes to the new structure, plugging existing downstream pipe, backfilling the excavation, final inspection of system after installation, testing, and all other items necessary to complete the work not specifically included for payment under other items.
3. The work of this section shall also include special requirements for work completed on the Tidewater Property including health and safety and management of contaminated fill/soil and groundwater.
4. The work of this section shall also include the required water main relocation activities depicted on the Drawings.

4.09 CONSTRUCT 12-INCH RCP DRAIN PIPE (BID ITEM NO. 9)

A. Measurement

1. The work of this section will be measured by the number of linear feet of 12 inch RCP pipe actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.
2. Structures shall be subtracted from the linear footage quantity; linear footage shall be measured along the centerline of the trench from beginning invert of the pipe to ending invert of the pipe.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per linear feet as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other

incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

2. The work of this section shall include preparing and submittal of shop drawings, all necessary excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), dewatering, temporary support of excavations, furnishing and installing required bedding material, backfilling with suitable common borrow, furnishing and installing backfill material where adequate common borrow does not exist, pavement/concrete saw cutting, removal and disposal of pavement/concrete and excess soil, removal and disposal of existing pipe where replacement is proposed, and testing.

4.10 CONSTRUCT 4-FOOT DIAMETER PRECAST CONCRETE STORM DRAIN MANHOLE (BID ITEM NO. 10)

A. Measurement

1. The work of this section will be measured by the number of manholes actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per each manhole installed as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work shall include preparing and submittal of shop drawings, all necessary excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), dewatering, temporary support of excavation, furnishing and installing the manhole structure including required bedding material, connecting pipes to the new structure, backfilling with suitable common borrow, furnishing and installing backfill material where adequate common borrow does not exist, pavement/concrete saw cutting, removal and disposal of pavement/concrete and excess soil, and testing. Required testing of the manholes as called for in these specifications shall also be included within this pay item.
3. The work shall also include furnishing and installing manhole frames and covers and all associated grade adjustment.

4.11 CONSTRUCT 4-FOOT DIAMETER PRECAST CONCRETE STORM DRAIN CATCH BASIN (BID ITEM NO. 11)

A. Measurement

1. The work of this section will be measured by the number of manholes actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per each catch basin installed as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work shall include preparing and submittal of shop drawings, all necessary excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), dewatering, temporary support of excavation, furnishing and installing catch basin structure including required bedding material, connecting pipes to the new structure, backfilling with suitable common borrow, furnishing and installing backfill material where adequate common borrow does not exist, pavement/concrete saw cutting, removal and disposal of pavement/concrete and excess soil, and testing. Required testing of the manholes as called for in these specifications shall also be included within this pay item.
3. The work shall also include furnishing and installing catch basin frames and grates and all associated grade adjustment.
4. The work shall also include furnishing and installing catch basin hoods on all outlet pipes.

4.12 ROCK EXCAVATION AND DISPOSAL (BID ITEM NO. 12)

A. Measurement

1. The Work of this section shall be measured by the cubic yard quantity of in-place rock or boulders that are larger than 1 cubic yard in size and require removal.
2. When rock is encountered, the material shall be uncovered and the Program Manager/Construction Manager notified. The Program Manager/Construction Manager shall determine quantities by volumetric computation determined from measurements performed before rock excavation begins and measurements performed after completion of rock excavation. If the Contractor fails to uncover the rock and notify the Program Manager/Construction Manager to allow ample time for cross sectioning the undisturbed material, the Contractor shall have no right-of-claim to any classification other than that allowed by the Program Manager/Construction Manager.
3. Measurements of rock excavation within a trench shall be as indicated on the trench limits shown on the project drawing details. The depth of rock removal will be limited to 12” below the bottom of the pipe or structure. No compensation will be made for rock excavated beyond the limits shown on the Drawings and in these Specifications, unless specifically authorized in writing by the Owner. The Contractor should include in this bid item any and all costs associated with over excavation of rock beyond pay limits that they deem necessary for construction purposes.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

2. This work shall include excavation, breaking (mechanical removal), hauling off site and legal disposal of rock in accordance with the requirements of Section 02210 Rock Excavation and providing screened gravel for any deficiency of trench backfill and all work incidental thereto, for which payment is not provided under other items.

4.13 EARTH EXCAVATION BELOW NORMAL DEPTH (BID ITEM NO. 13)

A. Measurement

1. The quantity of earth excavation below normal depth (limit of normal excavation) to be included for payment under this item shall be the number of cubic yards of unsuitable material excavated, measured to the depths and lengths ordered by the Engineer, to the trench width payment limits indicated on the Drawings, or limits of actual excavation, whichever is smaller, unless ordered otherwise by the Engineer, as indicated on the Drawings and as Specified.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall also include replacement of unsuitable material with sand, gravel borrow or crushed stone as specified and detailed on the Drawings, at the direction of the Engineer.
3. The unit price shall also include wrapping screen gravel in a geotextile envelope if said screened gravel is used for pipe bedding below normal depth.
4. The unit price shall constitute full compensation for proper disposal of unsuitable material.

4.14 IMPERMEABLE EARTH FILL (BID ITEM NO. 14)

A. Measurement

1. The work of this section will be measured by the number of cubic yards of impermeable earth fill actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full compensation for preparing and submittal of shop drawings, furnishing and installing the impermeable earth fill, complete as specified and/or directed by the Engineer.

4.15 EARTH EXCAVATION AND BACKFILL FOR TEST PITS (BID ITEM NO. 15)

A. Measurement

1. The work of this section will be measured by the number of cubic yards excavated and backfilled, measured to the extent of the work done as directed by the Program Manager/Construction Manager.

B. Payment

1. The unit price for this item shall constitute full compensation for saw cutting and removal and disposal of pavement, excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), design and construction of excavation support, dewatering, utility support, backfill and compaction for test pits.
2. The unit price shall also include collection and recording of data and existing conditions discovered as a result of the test pit.

4.16 ADDITIONAL GRAVEL BORROW (BID ITEM NO. 16)

A. Measurement

1. The work of this section will be measured by the number of cubic yards of additional gravel borrow actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. Gravel borrow ordered by the Engineer for backfill of trenches above normal depth shall be paid for under this item. The quantity of gravel used as backfill for trenches above normal depth shall be measured by the cubic yards to the depth and length ordered by the Engineer and to the width between payment limits for normal excavation as indicated on the Drawings. Gravel borrow outside the limits of normal excavation shall be furnished, placed, and compacted at the Contractor's expense, and no measurement will be made for such gravel.
3. Gravel borrow ordered to be used at other locations shall be measured after compaction and paid for under this item as the number of cubic yards of gravel actually placed and compacted as directed.
4. Gravel borrow used to backfill rock excavations will not be measured for payment under this item but shall be included as part of the unit price for "Rock Excavation and Disposal".
5. Gravel borrow used to backfill and/or fill around and/or beneath structures will not be measured for payment under this item but shall be included as part of the appropriate lump sum price for the structures.

4.17 ADDITIONAL CRUSHED STONE (BID ITEM NO. 17)

A. Measurement

1. The work of this section will be measured by the number of cubic yards of additional crushed stone actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. Additional crushed stone used for support of existing utilities or ordered by the Engineer to be used at other locations shall be paid for under this item. The quantity to be paid for shall be the number of cubic yards measured in place after compaction, of additional crushed stone within the limits directed by the Engineer.
3. Crushed stone used for bedding pipe, to backfill authorized excavations, for any drainage purpose, or as indicated on the Drawings for work for which appropriate payment items have been provided shall not be measured for payment under this item.
4. Crushed stone used to backfill rock excavations will not be measured for payment under this item but shall be included as part of the unit price for "Rock Excavation and Disposal".
5. Crushed stone used to backfill and/or fill around and/or beneath the structures will not be measured for payment under this item, but shall be included as part of the appropriate lump sum price for the structures.

4.18 ADDITIONAL SAND (BID ITEM NO. 18)

A. Measurement

1. The work of this section will be measured by the number of cubic yards of additional sand actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. Additional sand ordered by the Engineer for backfill of trenches above normal depth shall be paid for under this item. The quantity of sand fill used as backfill for trenches above normal depth shall be measured by the cubic yard to the depth and length ordered by the Engineer and to the width between payment limits for normal excavation as indicated on the Drawings. Sand fill outside the limits of normal excavation shall be furnished, placed and compacted at the Contractor's expense, and no measurement will be made for such sand fill.
3. Sand fill ordered to be used at other locations shall be measured after compaction and paid for under this item as number of cubic yards of sand fill actually placed and compacted as directed.
4. Sand fill used to backfill rock excavations will not be measured for payment under this item but shall be included as part of the unit price for "Rock Excavation and Disposal".

4.19 ADDITIONAL CONCRETE (BID ITEM NO. 19)

A. Measurement

1. The work of this section will be measured by the number of cubic yards of additional concrete actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full compensation for furnishing and placing additional concrete regardless of class or strength, as directed by the Engineer and as specified.
3. No measurement shall be made under this item for concrete used as indicated on the Drawings for work for which appropriate payment items have been provided or for concrete used to backfill unauthorized excavations.

4.20 CONTROLLED LOW STRENGTH MATERIAL (BID ITEM NO. 20)

A. Measurement

1. The work of this section will be measured by the number of cubic yards of controlled low strength material actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per cubic yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full compensation for furnishing and placing of controlled low strength material, and procedures, materials and equipment to protect same until set-up.

4.21 DISPOSAL OF EXCESS SOIL – CATEGORY #1 (BID ITEM NO. 21)
DISPOSAL OF EXCESS SOIL – CATEGORY #2 (BID ITEM NO. 22)
DISPOSAL OF EXCESS SOIL – CATEGORY #3 (BID ITEM NO. 23)
DISPOSAL OF EXCESS SOIL – CATEGORY #4 (BID ITEM NO. 24)

A. Measurement

1. The work of this section will be measured by the number of tons of soil actually disposed in accordance with the Contract Documents and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per ton disposed, as measured by the calibrated scale at the receiving facility, certified by the receiving facility, as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other

incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

2. The work shall include all costs associated with the disposal of categorized soil, as defined in Specification Section 02075, including completing and furnishing the appropriate material shipping record forms to the satisfaction of the Program Manager/Construction Manager.
3. All costs associated with excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), and loading and hauling of material for disposal at appropriate licensed facilities shall not be included for payment under this Item, but shall be included in the respective Bid Items under which the soil was generated.
4. Soil placed within the project limits shall not be measured for payment under this Item.
5. Soil generated from the Tidewater property shall not be measured for payment under this Item, but shall be measured for payment under the Disposal of Tidewater Property Soil.

4.22 DISPOSAL OF TIDEWATER PROPERTY SOIL (BID ITEM NO. 25)

A. Measurement

1. The work of this section will be measured by the number of tons of soil generated from the Tidewater Property actually disposed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per ton disposed, as measured by the calibrated scale at the receiving facility, certified by the receiving facility, as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work shall include all costs associated with the disposal of soil generated from the Tidewater Property, including completing and furnishing the appropriate material shipping record forms to the satisfaction of the Program Manager/Construction Manager.
3. All costs associated with excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), and loading and hauling of material for disposal at appropriate licensed facilities shall not be included for payment under this Item, but shall be included in the respective Bid Items under which the soil was generated.
4. All costs associated with coordinating soil disposal activities with National Grid and/or their representative(s) shall not be included for payment under this Item, but shall be included in the respective Bid Items under which the soil was generated.
5. Soil placed within the project limits shall not be measured for payment under this Item.
6. Soil generated from the Tidewater property shall not be measured for payment under this Item, but shall be measured for payment under the Disposal of Tidewater Property Soil.

4.23 CONSTRUCT CONCRETE SIDEWALKS, DRIVEWAY APRONS, AND WHEELCHAIR RAMPS (BID ITEM NO. 26)

A. Measurement

1. The work of this section will be measured by the number of square yards of concrete actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per square yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full and complete compensation for preparing and submittal of shop drawings, all labor, materials and equipment, including expansion joint material, reinforcement, and all other incidentals required to finish the work, complete and accepted by the Engineer.
3. The unit price shall include saw cutting, removal and disposal of existing soil, sidewalks, driveway aprons and wheelchair ramps, providing gravel sub base as required, trimming and fine grading gravel sub base, formwork, placing concrete, finishing, properly curing and protecting the fresh concrete, installation of ADA required detectable warning devices and replacement of all signposts and resetting of curb boxes and castings all as required to construct the Work and not specifically included for payment under other items.

4.24 REMOVE AND RESET GRANITE CURB (BID ITEM NO. 27)

A. Measurement

1. The work of this section will be measured by the number of linear feet of granite curb actually removed and reset, measured along the centerline of the curb, in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per linear feet as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price for this item shall constitute full compensation for saw cutting, excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), bedding, concrete, formwork, removal and replacement of gravel, backfill, compaction, restoration of bushes, trees and plantings, fences and walls disturbed by the Contractor's operations, to a condition at least equal to a condition which existed prior to construction, as directed by the Engineer, at no additional cost to the Owner, and all other work incidental to remove salvage and reset existing curbing and not specifically included for payment under other items.

3. Furnishing and installing concrete curb lock is incidental to the work of this item. No separate payment shall be made for this work.
4. Curbing damaged during removal or other construction operations shall be replaced in kind at no expense to the Owner.
5. Payment for this item shall be used to correct unavoidable curb settlement as a result of the contractor's operations.

4.25 INSTALL NEW GRANITE CURB (BID ITEM NO. 28)

A. Measurement

1. The work of this section will be measured by the number of linear feet of new granite curb actually installed, measured along the centerline of the curb, in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per linear feet as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price for this item shall constitute full compensation for preparing and submittal of shop drawings, saw cutting pavements, excavation and handling of material, temporary stockpiling, stockpile management (including but not limited to perimeter erosion controls, stockpile covering, dust mitigation, etc.), waste characterization sampling and analysis, costs associated with obtaining acceptance for materials from appropriate licensed facilities (if required), loading and hauling of material for disposal at appropriate licensed facilities, replacement of excavated areas with clean fill (if required), bedding, concrete, formwork, removal and replacement of gravel backfill, compaction, restoration of bushes, trees and plantings, fences and walls disturbed by the Contractor's operations, to a condition at least equal to a condition which existed prior to construction, as directed by the Engineer, at no additional cost to the Owner, and all other work incidental to furnishing and installing new curbing and not specifically included for payment under other items.
3. Furnishing and installing concrete curb lock is incidental to the work of this item. No separate payment shall be made for this work.
4. Curbing damaged during other construction operations shall be replaced in kind at no expense to the Owner.

4.26 LOAM AND SEED (BID ITEM NO. 29)

A. Measurement

1. The work of this section will be measured by the number of square yards, surface measurement, of the area on which the placing of loam has been installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per square yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

2. The unit price shall include preparing and submittal of shop drawings, removal and disposal of existing grassed areas, trimming and fine grading the sub base, furnishing loam from sources outside of the project limits, placing loam, seed, lime, fertilizer, protecting and maintaining the area, replacement of all signposts and resetting of curb boxes and castings all as required to construct the Work and not specifically included for payment under other items.

4.27 RESTORATION OF GEOMEMBRANE CAP (BID ITEM NO. 30)

A. Measurement

1. The work of this section will be measured by the number of square yards of geomembrane cap actually restored in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per square yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full and complete compensation for coordination with National Grid, preparing and submittal of shop drawings, all labor, materials and equipment and all other incidentals required to restore the geomembrane cap, complete, as detailed on the Drawings and/or as otherwise directed by the Program Manager/Construction Manager.

4.28 GRAVEL BASE COURSE (BID ITEM NO. 31)

A. Measurement

1. The work of this section will be measured by the number of square yards of gravel base course actually furnished and installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per square yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full compensation for preparing and submittal of shop drawings, furnishing and installing the gravel base course, complete as specified and/or detailed on the Drawings.
3. Material taken from excavations deemed suitable by the Program Manager/Construction Manager, for use as dense graded crushed stone base course shall not be included for payment under this item.

4.29 TEMPORARY TRENCH-WIDTH BITUMINOUS PAVEMENT (BID ITEM NO. 32)

A. Measurement

1. The work of this section will be measured by the number of tons of bituminous pavement actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per ton as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full compensation for preparing and submittal of shop drawings, furnishing and installing bituminous pavement as herein specified and as otherwise directed by the Program Manager/Construction Manager.
3. The unit price shall also include all additional work required in roads and streets, such, saw cutting existing pavement, special compaction requirements, safety precautions including but not limited to barricades, fences and all other appurtenant work not specifically paid for under other Items.

4.30 PERMANENT TRENCH-WIDTH BITUMINOUS PAVEMENT (BID ITEM NO. 33)

A. Measurement

1. The work of this section will be measured by the number of tons of bituminous pavement actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per ton as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall constitute full compensation for preparing and submittal of shop drawings, furnishing and installing bituminous pavement as herein specified and as otherwise directed by the Program Manager/Construction Manager.
3. The unit price shall also include all additional work required in roads and streets, such, saw cutting existing pavement, special compaction requirements, safety precautions including but not limited to barricades, fences and all other appurtenant work not specifically paid for under other Items.

4.31 MICROMILLING EXISTING PAVEMENT (BID ITEM NO. 34)

A. Measurement

1. The work of this section will be measured by the number of square yards of bituminous pavement actually removed by micromilling in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per square yard as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price for this Item shall include full compensation for site preparation, removal and resetting of existing manhole covers, catch basin grates, valve boxes, etc.; micromilling existing pavement to an average depth as indicated on the Drawings and

satisfactory disposal of all materials outside the limits of the Contract, all tools machines, labor, cutting all edges at limit of work and in front of edgestone; as directed and all else incidental thereto for which separate payment is not provided under other items.

4.32 BITUMINOUS SURFACE COURSE (BID ITEM NO. 35)

A. Measurement

1. The work of this section will be measured by the number of tons of bituminous pavement actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per ton as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price for this Item shall constitute full compensation for n for preparing and submittal of shop drawings, construction of the pavement as herein specified and directed by the Engineer.
3. The unit price shall also include all additional work required for work in roads and streets, including adjusting existing manhole covers, catch basin grates, valve boxes, etc., saw cutting existing pavement, furnishing and applying required tack coats and emulsions; sweeping, special compaction requirements, keying in driveways and side streets, safety precautions including but not limited to warning signs, barricades, fences and all other appurtenant work not specifically paid for under other Items.

4.33 MISCELLANEOUS ASPHALT (BID ITEM NO. 36)

A. Measurement

1. The work of this section will be measured by the number of tons of bituminous pavement actually installed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The accepted quantity of the work in this section will be paid for at the contract unit price per ton as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The unit price shall include furnishing and installing bituminous pavement as herein specified and as otherwise directed by the Program Manager/Construction Manager.
3. The unit price shall also include all additional work required in roads and streets, such, saw cutting existing pavement, special compaction requirements, safety precautions including but not limited to barricades, fences and all other appurtenant work not specifically paid for under other Items.

4.34 TRAFFIC STRIPING (BID ITEM NO. 37)

A. Measurement

1. The work of this section will be measured by the linear foot of line striping and painting work actually completed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. Payment for this item shall be made per linear foot for the price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for preparing and submittal of shop drawings, all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work of this section shall include cross walks, double yellow lines, single white lines and any other pavement markings required.

4.35 EROSION AND SEDIMENTATION CONTROL (BID ITEM NO. 38)

A. Measurement

1. The work of this section will be measured by the percent of erosion and sedimentation controls work performed in accordance with the Plans, as directed by the Program Manager/Construction Manager, as required to comply with applicable regulations and permits, and/or as otherwise required by the Owner. This shall include installation, maintenance, removal and disposal of the controls as well as any restoration work required for areas damaged or impacted by erosion and sedimentation resulting from Contractor's operations with no additional cost to the Owner.

B. Payment

1. Payment for this item shall be made as a percentage of the Lump Sum price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for preparing and submittal of shop drawings, all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.
2. The work of this section includes measures taken by the Contractor to control the generation and spread of dust from excavations and stockpiles, including the application of calcium chloride, water, etc. No separate payment will be made for this work.
3. The work of this item includes measures taken by the Contractor to avoid tracking of soils from the site, such as constructing vehicle tracking pads at access points. No separate payment will be made for this work.

4.36 DEWATERING TREATMENT SYSTEM (BID ITEM NO. 39)

A. Measurement

1. The work of this section will be measured by the percent complete of the dewatering treatment system satisfactorily installed, operated, maintained, and decommissioned in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. Payment for this item shall be made as a percentage of the lump sum price listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

2. Prices shall also include compensation for effort associated with design and coordinating and obtaining permits from NBC, conducting sampling and laboratory analytical costs required for the permit.
3. Prices shall also constitute full compensation for preparing and submittal of shop drawings, labor and materials associated with design, installation, maintenance, operation and decommissioning and removal of the system.

4.37 MAINTENANCE AND PROTECTION OF TRAFFIC (BID ITEM NO. 40)

A. Measurement

1. The work of this section will be measured by the percent complete of traffic control devices work actually completed in accordance with the Plans and/or as directed by the Program Manager/Construction Manager.

B. Payment

1. The work in this section will be paid for at the contract lump sum price as listed in the Bid Schedule. The price so-stated constitutes full and complete compensation for preparing and submittal of shop drawings, all labor, materials, and equipment and for all other incidentals required to finish the work, complete and accepted by the Program Manager/Construction Manager.

4.38 MOBILIZATION AND DEMOBILIZATION (BID ITEM NO. 41)

A. Measurement

1. The work of this section shall be measured on a percentage basis. The payable quantity will be for preparatory work and operations, which must be performed or for costs which must be incurred prior to beginning work, final clean-up and demobilization of temporary facilities and equipment, restoration of impacted areas, permit fees, and the cost of payment and performance bonds. Mobilization shall include but is not limited to movement of personnel, equipment, supplies, and incidentals to the project site for the establishment of all Contractor's field offices, utilities, temporary fencing, installation, maintenance, and removal of tracking pads, temporary access roadways, equipment/machinery pads, and other facilities necessary for work on the project. Demobilization shall include but is not limited to moving out of personnel and equipment, cleaning entire site, and removing debris and rubbish.

B. Payment

1. Payment for this item shall be made as a percentage of the Lump Sum price listed in the Bid Schedule. The prices so-stated constitute full and complete compensation for all work included in this item. The bid price shall be no more than 5% of total bid with payment as follows:
   a. 25% will be paid upon Notice to Proceed
   b. 50% will be paid upon completion of access road
   25% will be paid for demobilization.

4.39 MISCELLANEOUS UTILITY RELOCATION (BID ITEM NO. 42)

A. Measurement

1. Under this Item, the Contractor shall be reimbursed for certain charges for required utility relocations due to unavoidable conflicts with the new constructed facilities, as authorized

by the Program Manager/Construction Manager.

B. Payment

1. The allowance price for these Items established in the BID is an estimated figure to facilitate comparison of bids only. The actual amount to be paid under this item shall constitute full compensation for services rendered.
2. The allowance price for these Items shall NOT include any costs associated with services rendered for routine utility markings, repair damages incurred as a result of the Contractor's operations, relocations or dismantling and reassembling of utilities done at the Contractor's request and/or convenience or other utility relocation specifically covered under any other bid item, or any other unauthorized services rendered by utility companies. The purpose of this item is strictly for the Contractor's reimbursement for those unforeseen services authorized by the Program Manager/Construction Manager prior to the work being performed.
3. The Contractor will be paid based on the actual PAID invoiced amount from the Utility Company in question, as approved by the Program Manager/Construction Manager in accordance with Article 7.2 of the Contract Agreement. If the total cost for such charges is greater or less than the allowance amount stated under this item of the BID, a debit or credit of the difference in cost shall be to the Owner.
4. Costs for supporting of poles required and performed by the appropriate utility shall also be included for payment under these items.

4.40 TESTING OF MATERIALS AND METHODS (BID ITEM NO. 43)

A. Measurement

1. Under this Item, the Contractor shall be reimbursed for certain material testing, as authorized by the Program Manager/Construction Manager, not otherwise included for payment under other Items.

B. Payment

1. The allowance price for these Items established in the BID is an estimated figure to facilitate comparison of bids only. The actual amount to be paid under this item shall constitute full compensation for services rendered.
2. The Contractor will be paid based on the actual PAID invoiced amount, as approved by the Program Manager/Construction Manager in accordance with Article 7.2 of the Contract Agreement. If the total cost for such charges is greater or less than the allowance amount stated under this item of the BID, a debit or credit of the difference in cost shall be to the Owner.

4.41 UNFORESEEN UNDERGROUND OBSTRUCTIONS (BID ITEM NO. 44)

A. Measurement

1. Under this Item, the Contractor shall be paid on a time and materials basis for labor, equipment, and materials required to remove unforeseen underground obstructions as authorized and/or directed by the Program Manager/Construction Manager.

B. Payment

1. The allowance price for these Items established in the BID is an estimated figure to facilitate comparison of bids only. The actual amount to be paid under this item shall constitute full compensation for services rendered.
2. The Contractor will be paid on a time and materials basis for labor, equipment, and materials provided by the Contractor and on the actual PAID invoiced amount for

services provided by subcontractors and vendors, as approved by the Program Manager/Construction Manager in accordance with Article 7.2 of the Contract Agreement. If the total cost for such charges is greater or less than the allowance amount stated under this item of the BID, a debit or credit of the difference in cost shall be to the Owner.

4.42 REMOVAL AND DISPOSAL OF SPECIAL WASTE (BID ITEM NO. 45)

A. Measurement

1. Under this Item, the Contractor shall be paid on a time and materials basis for labor, equipment, and materials required to remove and dispose of Special Waste as defined in Specification Section 02767, as authorized by the Program Manager/Construction Manager.

B. Payment

1. The allowance price for these Items established in the BID is an estimated figure to facilitate comparison of bids only. The actual amount to be paid under this item shall constitute full compensation for services rendered.
2. The Contractor will be paid on a time and materials basis for labor, equipment, and materials provided by the Contractor and on the actual PAID invoiced amount for services provided by subcontractors and vendors, as approved by the Program Manager/Construction Manager in accordance with Article 7.2 of the Contract Agreement. If the total cost for such charges is greater or less than the allowance amount stated under this item of the BID, a debit or credit of the difference in cost shall be to the Owner.

END OF SECTION

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SECTION 01035

MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Procedures for making modifications to the Contract by change orders or other means.

B. Related Sections

1. Section CA - Contract Agreement

1.02 CHANGE ORDERS

A. In general Change Orders will be issued for modification of Contract Documents which will incorporate changes in the Contract requirements, including additions or deletions in the Work; for unforeseen field conditions which will necessitate changes in the Work; changes in code provisions or other requirements of federal, state or local authority requiring changes in the Work; changes in the availability of products or for incorporating new products into the work and for changes directed by the Engineer for the benefit of the Owner.

B. Authority to execute Change Orders shall be that of the Engineer and not of the Contractor. Changes Orders will, in general, originate by a "Change Order Proposal Request" or by issuance of a "Construction Change Authorization".

C. Unless authorized by the Engineer, no work shall be performed that is involved in the change until a formal Change Order is issued.

D. To initiate a Change Order, the Engineer will forward a Change Order proposal request describing the proposed changes and if required, include additional or revised drawings and specifications soliciting a formal quotation of cost and time to complete the proposed Change Order work. Upon reaching mutual agreement on the cost and time, the Engineer will sign his approval of the Change Order and submit it to the Contractor for his full signature of acceptance.

1.03 FIELD ORDERS

A. The Engineer may, to avoid costly removal of, or alterations to, present on-going work, issue a Work Directive Change authorizing the Contractor to proceed, subject to later negotiation of the price of the change.

1.04 PRICE AGREEMENTS

A. Prices agreed upon to cover the Change Orders may be either by mutual acceptance of a lump sum or by unit prices as stated in the Contract bid proposal or actual direct cost plus a percentage for overhead, profit and other expenses consistent with Section CA – Contract Agreement.

B. Work done by a subcontractor entitles the General Contractor a percentage of the sum of the actual direct cost, not including the subcontractor's overhead and profit, consistent with Section CA – Contract Agreement.

C. Method for computing the cost of the change shall be based on the net additional increase. No overhead and profit shall be deducted from prices for changes deleting work.

D. The Change Order form document shall indicate the net adjustment (+/-) to the total Contract price as a result thereof including extension or reduction of time when applicable.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01040

COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for coordinating the various parts of Work under this Contract.

1.02 REQUIREMENTS

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.

C. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

D. Coordinate work with all utility companies necessary for completion of work under this contract.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

END OF SECTION

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SECTION 01045

CUTTING, CORING AND PATCHING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers the cutting, coring, and rough and finish patching of holes and openings in existing structures (manholes, pipes, etc.).

B. The Contractor shall see that all such cuts, cores, and openings are located accurately and are of proper size and shape and shall consult with the Program Manager and the contractors and subcontractors concerned in reference to this work.

C. In case of his failure to leave or cut all such openings or have all such sleeves provided and set in proper time, Contractor shall cut them or set them afterwards at his own expense, but in so doing he shall confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the written consent of the Program Manager.

D. The Contractor shall not cut or alter the work of any subcontractor or any other contractor, nor permit any of his subcontractors to cut or alter the work of any other contractor or subcontractor, except with the written consent of the contractor or subcontractor whose work is to be cut or altered or with the written consent of the Program Manager. All cutting and patching or repairing made necessary by the negligence, carelessness, or incompetence of the Contractor or any of his subcontractors shall be done by or at the expense of the Contractor and shall be the responsibility of the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. All cutting and coring shall be performed in such a manner as to limit the extent of patching.

B. All holes cut through concrete, existing or proposed manholes, and existing or proposed pipes shall be core drilled unless otherwise approved. No structural members shall be cut without approval of the Program Manager. No holes may be drilled in/through structural members or supports without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

C. Rough patching shall be such as to bring the cut or cored area flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

D. Prior to coring and cutting, rebar shall be located using a Rebar Locator. If possible relocate to avoid rebar.

3.02 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.

3.03 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.

END OF CUTTING, CORING AND PATCHING

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Survey work and other field engineering responsibilities of the Contractor.

1.02 REQUIREMENTS

A. The Contractor shall be responsible for layout of the work and the establishing of lines and grades.

B. Establish elevations, lines, levels, reference marks, batter boards, etc., required during the progress of the Work. Verify such marks by instrument to confirm accuracy.

C. Locate and protect survey control and reference points.

D. Make, check, and be responsible for all measurements and dimensions necessary for the proper construction of the Work.

E. The Program Manager will be permitted to check the lines, elevations, reference marks, batter boards, etc., set by the Contractor. The Contractor shall correct any errors found in lines, elevations, reference marks, batter boards, etc. Such a check shall not be construed as approval of the Contractor's work and shall not relieve or diminish the responsibility of the Contractor for the accurate construction and completion of the Work.

F. Control datum for survey as shown on Drawings.

1.03 QUALITY ASSURANCE

A. Qualifications

1. Employ a Civil Engineer or Land Surveyor registered within the State of Rhode Island, acceptable to the Program Manager.

B. Certifications

1. Submit certificate signed by the Contractor’s Engineer or Land Surveyor stating elevations and locations of the Work are in conformance with the Contract Documents.

PART 2 PRODUCTS (NOT USED)
PART 3 EXECUTION (NOT USED)

END OF FIELD ENGINEERING

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SECTION 01060

PERMITS AND REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The Contractor is responsible for obtaining all federal, state and local permits required to complete the work and to comply with all regulatory requirements. The Contractor shall fill out all forms and furnish all drawings required to obtain the permits. A copy of the approved permit shall be submitted to the Program Manager. All fees associated with these permits shall be paid by the Contractor as part of the project. Work shall not commence on any phase of the work requiring a permit until the permit is obtained.

B. The Work specified in this section includes permits and regulatory requirements. Specific requirements are also included in other specification areas.

C. Related Work Described Elsewhere:
1. Agreement, Section CA
2. General Specifications, Section 01000
3. Miscellaneous and Special Project Requirements, Section 01100
4. Construction Facilities and Temporary Services, Section 01500
5. Traffic Regulations, Section 01570

1.02 SUBMITTALS

A. Submit draft copies of all permit applications to the Program Manager a minimum of five (5) days before the permit application is submitted to the permitting agency.

B. Submit a copy of all permits obtained by the Contractor.

1.03 REGULATORY AGENCIES

A. Contractor shall comply with all laws, rules, regulations, and ordinances promulgated by any authority having jurisdiction over the Work, including, but not limited to:

1. RI Department of Environmental Management;
2. RI Coastal Resources Management Council;
3. City of Pawtucket;
4. Permit for Discharge of Construction Water into NBC Sewer System in accordance with the Rules and Regulations for the Use of Wastewater Facilities within the Narragansett Bay Water Quality Management District Commission.
   Contact: Narragansett Bay Commission

1.04 PERMITS OBTAINED BY OWNER:

A. Contractor shall comply with all permits and Orders of Conditions obtained by Owner.

1. Application for RIPDES General Permit for Stormwater Discharge associated with Construction Activity was submitted on XX.
2. CRMC Assent

1.05 PERMITS OBTAINED BY CONTRACTOR

A. Prior to performing the Work, Contractor shall be responsible for obtaining and paying for all other permits required for the work of this Contract including but not limited to permits required of his equipment, work force, and of particular operations (such as fuel storage, air emissions, disposal of excavated material). Such permits may include those listed above. Contractor shall determine and obtain all necessary permits to enable Contractor and Program Manager occupation of the construction trailers at the work site.

B. The Contractor shall be solely responsible for obtaining and paying for at no additional cost to the NBC, all permits, licenses, mitigation, certifications or approvals required for either transportation, off-loading, stockpiling, storage and final use or off-site disposal of excavated material and construction and demolition material generated during the performance of the Work.

C. At no additional cost to the NBC, the Contractor shall be responsible for collecting representative samples of materials to be disposed of off-site and providing any analyses as may be required to receive agency approvals for use or off-site disposal of material and for scheduling and coordinating inspections necessary for receipt of local or state permits, approvals or certifications.

D. The Contractor shall be responsible for providing to the NBC in a timely and acceptable manner copies of all permits, licenses, certifications or approvals or other applicable information required to demonstrate receipt of required permits.

E. Should the Contractor propose construction or means and methods which are not allowed by the permits included herein, the Contractor shall be solely responsible for obtaining any permit amendments or new permits which would allow compliance with Contractor's proposed means and methods at no additional cost to the NBC. The Contractor shall be constrained from commencing construction within the affected areas until applicable permit amendments or new permits have been received.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PERMIT COSTS AND FINES

A. Any and all costs, including NBC and Program Manager costs, or fines levied by regulatory agencies for violations of permit requirements which are a direct result of the Contractor's performance or lack thereof shall be paid by the Contractor at no additional cost to the NBC.

PART 4 ATTACHMENTS

RIPDES General Permit for Stormwater Discharge associated with Construction Activity is provided as Appendix F (Pending)

CRMC Assent

END OF PERMITS AND REGULATORY REQUIREMENTS

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SECTION 01065

PROJECT SAFETY AND HEALTH SPECIFICATIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes health and safety requirements for the Phase III Narragansett Bay Commission Combined Sewer Overflow Control Facilities Program. Requirements included in this section are in addition to Local, State, and Federal requirements. Where conflicts or discrepancies exist between requirements, the more stringent requirement shall govern.

B. Related Work Described Elsewhere:
1. Agreement, Section CA.
2. General Specifications, Section 01000
3. Tidewater site requirements, Appendix___

1.02 COMPLIANCE

A. In prosecuting the work of this Contract, the Contractor and Sub-Contractors shall provide working conditions on each operation that shall be as safe and healthful as the nature of that operation permits. The various operations connected with the Work shall be so conducted that they will not be injurious to safety or health and shall otherwise conform to the requirements of the Contract Documents. The Contractor and Sub-contractors shall comply at a minimum with all requirements of the Contract Documents and provisions, regulations and recommendations issued pursuant to the Occupational Safety and Health Act of 1970, and the Construction Safety Act of 1969, as amended, and with laws, rules and regulations of other authorities having jurisdiction, with regard to all matters relating to the safety and health of workers and the general public. Compliance with government requirements is mandated by law and considered only a minimum level of safety performance. All work shall therefore be performed in accordance with best safe work practices recognized by the construction industry and the requirements of the Contract Documents.

B. The Contractor shall stop work whenever a work procedure or a condition at a work site is deemed unsafe.

C. On Site Employees: 10-Hour OSHA Construction Safety Program: All personnel shall be trained in and bear certification of satisfactory completion of training in an approved 10 Hour OSHA Construction Safety Program as outlined in RIGL 28-20-35.

D. 40-Hour OSHA HAZWOPER: All personnel working on the Tidewater property shall be trained in and bear certification of satisfactory completion of training in an approved 40 Hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) course.

E. Reference Codes, Standards and other applicable Documents
1. OSHA - U.S. Department of Labor, Occupational Safety and Health Administration, Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S, Section 1926.800, “Underground Construction”, final rule dated June 2, 1989.

2. OSHA - U.S. Department of Labor, Occupational Safety and Health Administration, Construction Standards and Interpretations, 29 CFR Part 1910.120 "Hazardous Waste Operations and Emergency Response"
3. FEMA – Federal Emergency Management Agency, Emergency Operations Plan Requirements
4. CERCLA - Comprehensive Environmental Response, Compensation and Liability Act, National Contingency Plan, Section 105
5. U.S. Department of Labor, Occupational Safety and Health Act of 1970, as amended.
6. NFPA Standard for Fire Prevention During Welding, Cutting, and Other Hotwork, 1994 edition
7. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations, 1996 Edition
8. U.S. Department of Labor, Construction Safety Act of 1969, as amended.
9. Rhode Island Fire Laws and Rules, Annotated, 2000-2001
10. Rhode Island Fire Prevention Code (NFPA 1 Fire Prevention Code, 1997 Edition as amended)
11. All applicable Rhode Island State Health and Safety Regulations, including:
    a. Rhode Island Department of Environmental Management (RIDEM) Air Pollution Control (APC) Regulation No. 5, Fugitive Dust
    b. RIDEM APC Regulation No. 17, Odors
    c. RIDEM APC Regulation No. 22, Air Toxics
    d. RIDEM, Rules and Regulations for Hazardous Waste Management ("Hazardous Waste Regulations", current edition/
12. City of Pawtucket Code of Ordinances, current edition
13. National Grid Environmental Procedures and Guidance Documents, include in Appendix X of the Specifications.
14. National Grid Specifications and Guidelines included in Appendix X of the Specifications.
15. All other Federal, State and Local requirements and regulations in effect at the time of construction, including new regulations or modifications to existing regulations introduced during the Contract Time.

1.03 SUBMITTALS

A. CONTRACTORS HEALTH AND SAFETY MANUAL - GENERAL REQUIREMENTS:

1. The Contractor shall submit its Health and Safety Manual to the Program Manager no later than 30 days after the issuance of a Notice to Proceed. No work shall be performed until the Health and Safety Manual has been accepted by the Program Manager.
2. The Contractor's Health and Safety Manual shall be reviewed and stamped by a third-party Certified Industrial Hygienist (CIH) engaged by the Contractor.
2. The Health and Safety Manual shall be appropriate to the scope of work to be performed. General policies and procedures will be supplemented and updated appropriately to address the specific conditions, methods, and equipment to be used for the work. The Manual shall include as a framework for safety and health programming the following basic elements and plans in sufficient detail to provide a clear guideline for a safe working environment:

a. A statement signed by an Officer of the Firm of the Contractor's commitment to (1) provide a safe and healthful project and (2) to implement its Safety and Health Program.

b. Specific assignments of safety and health-related roles and responsibilities. An explanation of the procedures that safety and project management personnel will follow to rectify unsafe working conditions or hazards when they are identified.

c. Detailed procedures for:
   1. Training of site supervision.
   2. Safety and Health Project Orientation for workers.
   3. On-going Safety and Health training for workers.
   4. Providing safety and health information to the Contractor's employees.
   5. Safety and health inspections on the project.
   6. Disciplinary action.
   7. Safety and Health Project Orientation for visitors.
   8. Accident-related record keeping, investigation and surveillance.

d. An Emergency Action plan addressing all types of emergencies, with which the Contractor may reasonably and predictably be confronted.

e. A list of required heath and safety related permits for specific construction operations.

f. Job hazard analyses:
   1. A procedure for identifying how and under what circumstances job hazard analyses shall be conducted.
   2. Guidelines for the preparation and review of job hazard analyses and handling recommendations resulting from the analyses.
   3. Job hazard analyses as they are developed and updated.

g. Reporting formats for required reports and submissions.

h. All detailed site-specific procedures shall include requirements for mandatory eye and head protection and adherence to 6-foot fall protection requirements. Site-specific procedures shall require all chainsaws used on-site to be equipped with kickback guards/breaks and require all other power tools to be equipped with all protective features as provided by the manufacturer. Detailed Site Specific Procedures for conducting safe working conditions (including the designation of "competent persons" as required by OSHA) associated with:
   1. Blasting
   2. Compressed air and gases
   3. Concrete work
   4. Confined spaces/permit-required confined spaces
   5. Crane operations and maintenance
   6. Rigging operations, equipment inspection and testing
   7. Electrical hazards
   8. Excavation and excavation support
   9. Fall Protection
   10. Fire Protection and Prevention
   11. First aid, CPR and Blood borne Pathogens
   12. Hand and power tools
   13. Hazard Communication
   14. Housekeeping
   15. Scaffolding, Ladders and Walking and Working Surfaces

16. Lockout/Control of Energy Sources
17. Materials handling and storage
18. Mechanized equipment
19. Construction Health Hazard Monitoring
20. Personal Protective Equipment and clothing
21. Hearing protection
22. Respiratory Protection
23. Sanitation
24. Welding and cutting
25. Confined Space Procedures
26. Underground Excavation
27. Underground Construction
28. Traffic Control Program

i. Hazardous material handling.

1. A silica exposure plan to limit exposure of workers to silica dust. The plan shall include the applicable preventative measures recommended and contained in NIOSH ALERT: 1996 Publication 96-112 "Preventing Silicosis and Deaths in Construction Workers".
2. The Contractor shall develop a written chemical safety plan to address all chemicals used during construction, including Contractor's construction water treatment systems. This safety plan shall include detailed procedures to prevent chemical accidents to the maximum extent possible during chemical transport, transfer, storage, use and disposal. Include appropriate MSDS sheets.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SAFETY PROGRAM ADMINISTRATION

A. The Contractor shall be fully responsible for the safety and health of its employees, its subcontractors, and lower tier subcontractors during the performance of the Work. The Contractor shall be directly responsible for establishing and implementing the project-specific Contractor Safety and for the protection of its workers, the workers of its Subcontractors, the Program Manager/Construction Manager, Program Manager, NBC and the general public.

B. The Contractor shall be directly responsible for ensuring the work is performed in a safe and healthful manner.

END OF PROJECT SAFETY AND HEALTH SPECS

SECTION 01067

FEDERAL AND STATE REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL STATE AND FEDERAL REQUIREMENTS

A. The Contractor shall comply with all applicable Federal and State Requirements. See Information for Bidders for additional information.

B. The following documents are included as part of this specification

1. State Revolving Fund (SRF) Program Contract Specification Package.
2. SRF Project Sign Requirements
3. EPA Good Faith Efforts and EPA DBE Forms
4. Davis-Bacon Prevailing Wage Requirements

1.02 STATE REVOLVING FUND (SRF) PROGRAM

A. State Revolving Fund (SRF) Program Contract Specification Package (1 Page) (ATTACHMENT A)

B. Federal Requirements (ATTACHMENT A)

1. Employment Standards Administration Office of Federal Contract Compliance Programs - Executive Order 11246.
   a. OFCCP fact sheet. (2 pages)
   b. Equal Opportunity Clause and the Standard Federal Equal Employment Specifications. (6 pages)
   c. Non-discrimination in employment notice. (1 page)
2. Assurance of compliance with Title VI of the Civil Rights Act of 1964 and Section 13 of the FWPCA Amendments of 1972 (EPA form 4700-1). (1 page)
3. Affirmative steps for soliciting MBE/WBE (40 CFR 31.36(e)) (1 page)

C. State Requirements (ATTACHMENT A)

1. RIGL Title 37
   a. Chapter 2.1 - Domestic Steel (2 pages)
   b. Chapter 12 - Contractor's Bonds (4 pages)
   c. Chapter 12.1 - Substitution of Security for Retained Earnings of Architects and Engineers (1 page)
   d. Chapter 13 - Labor and Payment of Debts by Contractors (9 pages)
   e. Chapter 14.1 - Minority Business Enterprise (7 pages)
   f. Chapter 16 - Public Works Arbitration (7 pages)
2. RIGL Title 45
   a. Chapter 55 - Award of Municipal Contracts (6 pages)
3. Project Signs (2 pages)

D. EPA Good Faith Efforts (ATTACHMENT B)

1. Good Faith Efforts (2 pages)
2. EPA Form 6100-2 DBE Subcontractor Participation Form (2 pages)
3. EPA Form 6100-3 DBE Subcontractor Performance Form (2 pages)
4. EPA Form 6100-4 DBE Subcontractor Utilization Form (2 Pages)

E. Davis-Bacon Prevailing Wage Requirements (ATTACHMENT C)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

PART 4 ATTACHMENTS

ATTACHMENT A – STATE REVOLVING FUND PROGRAM (CONTRACT SPECIFICATIONS PACKAGE, PROJECT SIGNAGE)

ATTACHMENT B – EPA GOOD FAITH EFFORTS

ATTACHMENT C – DAVIS-BACON PREVAILING WAGE REQUIREMENTS

END OF FEDERAL AND STATE REQUIREMENTS

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 RELATED SECTIONS:

A. Contract Agreement, Section CA.

1.02 QUALITY CONTROL:

A. Conform to reference standard by date of issue current on date of Bid Opening.

1.03 SCHEDULE OF REFERENCES:

A. AA: Aluminum Association, 818 Connecticut Avenue, N.W., Washington, DC 20006.

B. AABC: Associated Air Balance Council, 1000 Vermont Avenue, N.W., Washington, DC 20005.

C. AASHTO: American Association of State Highway and Transportation Officials, 444 North Capitol Street, N.W., Washington, DC 20001.

D. ACI: American Concrete Institute, Box 19150, Redford Station, Detroit, MI 48219.

E. ADC: Air Diffusion Council, 230 North Michigan Avenue, Chicago, IL 60601.

F. AFBMA: Antifriction Bearing Manufacturers Association, 1101 Connecticut Avenue, N.W., Suite 700, Washington, DC 20036.

G. AGA: American Gas Association.

H. AGC: Associated General Contractors of America, 1957 "E" Street, N.W., Washington, DC 20006.

I. AGMA: American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, VA 22314.

J. AI: Asphalt Institute, Asphalt Institute Building, College Park, MD 20740.

K. AIA: American Institute of Architects, 1735 New York Avenue, N.W., Washington, DC 20006.

L. AISC: American Institute of Steel Construction, 400 North Michigan Avenue, Eighth Floor Chicago, IL 60611.

M. AISI: American Iron and Steel Institute, 1000 16th Street, N.W., Washington, DC 20036.

N. AITC: American Institute of Timber Construction, 333 W. Hampden Avenue, Englewood, CO 80110.

O. AMCA: Air Movement and Control Association, 30 West University Drive, Arlington Heights, IL 60004.

P. ANSI: American National Standards Institute, 1430 Broadway, New York, NY 10018.

Q. AOAC: Association of Official Agriculture Chemists.

R. APA: American Plywood Association, Box 11700, Tacoma, WA 98411.

S. API: American Petroleum Institute, 1220 "L" Street, N.W., Washington, DC 20005.

T. ARI: Air-Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Arlington, VA 22209.

U. ASCE: American Society of Civil Engineers, 345 E. 47th Street, New York, NY 10017.

V. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E., Atlanta, GA 30329.

W. ASME: American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

X. ASNS: American Standard for Nursery Stock.

Y. ASPA: American Sod Producers Association, 4415 West Harrison Street, Hillside, IL 60162.

Z. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

AA. AWI: Architectural Woodwork Institute, 2310 South Walter Reed Drive, Arlington, VA 22206.

BB. AWPA: American Wood-Preservers' Association, 7735 Old Georgetown Road, Bethesda, MD 20014.

CC. AWS: American Welding Society, 550 LeJeune Road, N.W. Miami, FL 33135.

DD. AWWA: American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

EE. BIA: Brick Institute of America, 11490 Commerce Park Drive, Reston, VA 22091.

FF. CDA: Copper Development Association, 57th Floor, Chrysler Building, 405 Lexington Avenue, New York, NY 10174.

GG. CEMA: Conveyor Equipment Manufacturer’s Association

HH. CFR: Code of Federal Regulations.

II. CLFMI: Chain Link Fence Manufacturers Institute, 1101 Connecticut Avenue, N.W., Washington, DC 20036.

JJ. CRSI: Concrete Reinforcing Steel Institute, 933 Plum Grove Road, Schaumburg, IL 60195.

KK. CS: Commercial Standard

LL. DHI: Door and Hardware Institute, 7711 Old Springhouse Road, McLean, VA 22101.

MM. EJCDC: Engineers' Joint Contract Documents Committee, American Consulting Engineers Council, 1015 15th Street, N.W., Washington, DC 20005.

NN. EJMA: Expansion Joint Manufacturers Association, 25 North Broadway, Tarrytown, NY 10591.

OO. FGMA: Flat Glass Marketing Association, 3310 Harrison, White Lakes Professional Building, Topeka, KS 66611.

PP. FM: Factory Mutual System, 1151 Boston-Providence Turnpike, P.O. Box 688Norwood, MA 02062.

QQ. FS: Federal Specification, General Services Administration, Specifications and Consumer Information Distribution Section (WRSIS), Washington Navy Yard, Building 197, Washington, DC 20407.

RR. GA: Gypsum Association, 1603 Orrington Avenue, Evanston, IL 60201.

SS. JIC: Joint Industrial Council, c/o National Machine Tool Builders Association, 7901 Westpark Drive, McLean, VA 22102.

TT. HIS: Hydraulic Institute Standards.

UU. IBR: Institute of Boiler and Radiator Manufacturers, aka Hydronics Institute, P. 0. Box 218, 35 Russo Place, Berkeley Heights, NJ 07922.

VV. ICBO: International Conference of Building Officials, 5360 S. Workman Mill Road, Whittier, CA 90601.

WW. IEEE: Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, NY 10017.

XX. IMIAC: International Masonry Industry All-Weather Council, International Masonry Institute, 815 15th Street, N.W., Washington, DC 20005.

YY. MBMA: Metal Building Manufacturer's Association, 1230 Keith Building, Cleveland, OH 44115.

ZZ. MFMA: Maple Flooring Manufacturers Association, 60 Rivere Drive Northbrook, IL 60062.

AAA. MIL: Military Specifications, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

BBB. ML/SFA: Metal Lath/Steel Framing Association, 221 North LaSalle Street, Chicago, IL 60601.

CCC. NAAMM: National Association of Architectural Metal Manufacturers, 221 North LaSalle, Street Chicago, IL 60601.

DDD. NBS: National Bureau of Standards

EEE. NCMA: National Concrete Masonry Association, P.O. Box 781, Herndon, VA 22070.

FFF. NEBB: National Environmental Balancing Bureau, 8224 Old Courthouse Road, Vienna, VA 22180.

GGG. NEC: National Electric Code.

HHH. NEMA: National Electrical Manufacturers' Association, 2101 "L" Street, N.W. Washington, DC 20037.

III. NFPA: National Fire Protection Association, P.O. Box 9101, Quincy, MA 02269.

JJJ. NFPA: National Forest Products Association, 1619 Massachusetts Avenue, N.W., Washington, DC 20036.

KKK. NSWMA: National Solid Wastes Management Association, 1730 Rhode Island Avenue, N.W. Washington, DC 20036.

LLL. NTMA: National Woodwork Manufacturers Association, 205 W. Touhy Avenue, Park Ridge, IL 60068.

MMM. PCA: Portland Cement Association, 5420 Old Orchard Road, Skokie, IL 60077.

NNN. PCI: Prestressed Concrete Institute, 201 North Wells Street, Chicago, IL 60606.

OOO. PS: Product Standard, U.S. Department of Commerce, Washington, DC 20203.

PPP. PTI: Post Tensioning Institute.

QQQ. RIS: Redwood Inspection Service, One Lombard Street, San Francisco, CA 94111.

RRR. RCSHSB: Red Cedar Shingle and Handsplit Shake Bureau, 515 116th Avenue Bellevue, WA 98004.

SSS. SAE: Standard Automotive Engineering.

TTT. SDI: Steel Deck Institute, P.O. Box 9506, Canton, OH 44711.

UUU. SDI: Steel Door Institute, 712 Lakewood Center North, 14600 Detroit Avenue, Cleveland, OH 44107.

VVV. SIGMA: Sealed Insulating Glass Manufacturers Association, 111 East Wacker Drive, Chicago, IL 60601.

WWW. SJI: Steel Joist Institute, 1205 48th Avenue North Suite A, Myrtle Beach, SC 29577.

XXX. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, 8224 Old Court House Road, Vienna, VA 22180.

YYY. SSPC: Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213.

ZZZ. TCA: Tile Council of America, Inc., Box 326 Princeton, NJ 08540.

AAAA. UL: Underwriters' Laboratories, Inc., 333 Pfingston Road, Northbrook, IL 60062.

BBBB. USS Gage: United States Standard Gage

CCCC. WCLIB: West Coast Lumber Inspection Bureau, 6980 S.W. Varns Road, Box 23145, Portland, OR 97223.

DDDD. WWPA: Western Wood Products Association, 1500 Yeon Building, Portland OR 97204.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF REFERENCE STANDARDS

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SECTION 01100

MISCELLANEOUS AND SPECIAL PROJECT REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes restrictions on Contractor hours of operation, site noise, and other special project requirements.

B. Related Work Described Elsewhere:

1. General Specifications, Section 01000
2. Summary of Work, Section 01010
3. Construction Facilities and Temporary Services, Section 01500.
4. Traffic Regulations, Section 01570

1.02 CONSTRUCTION WORK HOUR RESTRICTIONS BY PROGRAM MANAGER AND OWNER

A. Except as otherwise specifically allowed elsewhere in the Contract Documents, normal construction activity shall take place only between the hours of 7:00 am to 5:00 pm excluding, Saturdays, Sundays and legal holidays. The Contractor shall plan the Work to avoid working beyond these hours. However, if despite the Contractor's diligent efforts, the Contractor believes that overtime work is necessary in order for the Contractor to complete the Work, the Contractor may apply to the Program Manager and to the Owner for approval to perform overtime work, which approval may be withheld in their sole discretion. No additional compensation or time extension shall be due to the Contractor whether approval is granted or denied.

B. If the Contractor believes that overtime work is necessary, it shall obtain prior approval from the Program Manager and the Owner. The Contractor shall file a request for such approval in writing and shall include the specific reasons therefore and the time that the overtime work is expected to be concluded. Overtime work will normally be limited to evening hours (5:00 p.m. to 8:00 p.m.) Monday through Friday and daytime hours (7:00 a.m. to 5:00 p.m.) on Saturdays except in special circumstances approved by the Program Manager and the Owner.

1.03 CONSTRUCTION WORK HOUR RESTRICTIONS BY CITY OF PAWTUCKET

A. The Contractor's construction operations shall comply with all Laws, Permits and applicable local ordinances. Should the Contractor sustain any delay or damages in the prosecution of the Work due to the Contractor's failure to conform with the requirements of the Permit, Laws or Ordinances as determined by City of Pawtucket, or other regulatory agency, the Contractor shall not be entitled to an extension of Contract Time or Contract Price.

1.04 TIDEWATER PROPERTY REQUIREMENTS

A. The Contractor’s occupation of the work site or portions thereof and its operations throughout the course of the Work may be affected by the operations of others adjacent to and within the work site. National Grid occupies the Tidewater Site and operates an active electric substation and natural gas regulator facility. In addition, ongoing construction contracts within the contract limits include:

- National Grid: Sitewide Remedy Design
- Fortuitous Partners: Tidewater Landing

B. Contractor shall be responsible for site specific Air Monitoring Requirements as specified in Section _____;

C. Contractor shall control vapor emissions and fugitive dust so that perimeter action levels are not exceeded as specified in Section_____

1. Action levels for the upgrading and downgrading of worker levels of protection shall be based upon information published by the American Conference of Governmental Industrial Hygienists (ACGIH), OSHA, and the United States Environmental Protection Agency (EPA). Action levels shall be based upon established OSHA Permissible Exposure Limits (PELs), ACGIH Threshold Limit Values (TLVs) and ACGIH Short-Term Exposure Limits (STELs). Action levels shall be established for each work activity and each contaminant present. A table summarizing each activity, the contaminant(s) to be monitored, monitoring instruments, frequency and duration of monitoring, action levels and required response action shall be included in the Contractor's HASP, submitted in accordance with Section 01065 – Project Safety and Health Specifications.
2. Air monitoring results shall be cataloged and maintained by the Safety Representative and shall be provided to Engineer daily.
3. Work Zone and Work Zone boundary air monitoring equipment shall be provided by Contractor and shall be maintained and calibrated according to OSHA and National Institute for Occupational Safety and Health (NIOSH) analytical methods or the manufacturers' instructions, or both. Calibration field checks using the appropriate reference standards shall be made on the Site at the minimum frequency of twice per shift (pre and post sampling). A daily log of all instrument readings, as well as field reference checks and calibration information must be maintained in the Contractor's record documents.
4. The Safety Representative shall be responsible for operating, maintaining, and calibrating all air monitoring equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF MISC. AND SPECIAL PROJECT REQUIREMENTS

SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment and perform all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Section, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.

B. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.

C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area.

D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

E. All phases of sedimentation and erosion control shall comply with and be subject to the approval of the Rhode Island Department of Environmental Management. Contractor shall provide erosion and sedimentation controls in accordance with the Drawings and project specifications.

1.02 APPLICABLE REGULATIONS

A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement.

1.03 NOTIFICATIONS

A. The Program Manager will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Program Manager, of any non-compliance with State or local requirements. After receipt of such notice from the Program Manager or from the regulatory agency through the Program Manager, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject

of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.04 IMPLEMENTATION

A. Prior to commencement of the work, meet with the Program Manager to develop mutual understandings relative to compliance with these provisions and administration of the environmental pollution control program.

B. Remove temporary environmental control features, when approved by the Program Manager and incorporate permanent control features into the project at the earliest practicable time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures, such as siltation basins, hay check dams, mulching, jute netting and other equivalent techniques, shall be used as appropriate. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored to original condition or new final condition as shown on the Drawings.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

A. Take all precautions to prevent, or reduce to a minimum, any damage to any stream or surface water from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Divert such waters through a settling basin or filter before being directed into streams or surface waters.

B. Do not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.

C. Take all preventative measures to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Rhode Island Department of Environmental Management. Submit two copies of approved contingency plans to the Program Manager.

D. Water being flushed from structures or pipelines after disinfection, with a residual chlorine concentration of 2 mg/l or greater, shall be either discharged to the chlorine contact tank or treated with a dechlorination solution, in a method approved by the Program Manager, prior to discharge.

3.03 PROTECTION OF LAND RESOURCES

A. Restore land resources within the project boundaries and outside the limits of permanent work to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Drawings.

B. Outside of areas requiring earthwork for the construction of the new facilities, do not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Program Manager. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.

C. Before beginning operations near them, protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping or other operations, by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.

D. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored to their original condition. The Program Manager will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.

1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Program Manager, shall be immediately removed and replaced.

E. The locations of the Contractor's storage and other construction buildings, required temporarily in the performance of the work, shall be in cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Program Manager and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the Program Manager.

F. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, he shall submit the following for approval at least ten days prior to scheduled start of such temporary work.

1. A layout of all temporary roads, excavations, embankments and drainage to be constructed within the work area.
2. Details of temporary road construction.
3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
4. A drawing showing the proposed restoration of the area in accordance with the Drawings and Specifications. Indicate the proposed removal of any trees and shrubs outside the limits of existing clearing area. Indicate locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged. The Drawing shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final

condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Program Manager. No unauthorized road construction, excavation or embankment construction including disposal areas will be permitted.

G. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the Program Manager. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon.

H. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

A. Burning - The use of burning at the project site for the disposal of refuse and debris will not be permitted.

B. Dust Control - Maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.

C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides may be permitted with approval from the Program Manager.

D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Program Manager.

3.05 NOISE CONTROL

A. Make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

3.06 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

A. Maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

END OF ENVIRONMENTAL PROTECTION PROCEDURES

SECTION 01115

EMERGENCY RESPONSE PLAN REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. The Emergency Response Plan applies to personal injuries sustained on the site and to the discovery of and/or including personal injuries sustained as a result of contact with hazardous material that could be detrimental to human health or the environment including asbestos. The Emergency Response Plan required by this Section does not relieve the Contractor from the requirements of OSHA regulations as referenced elsewhere in these specifications and the requirements of the Sections of these specifications.

B. The procedure requirements contained herein are intended to address unanticipated contact with chemicals or hazardous materials during the project. The Emergency Response Plan will also address the Contractor's/Subcontractor's responsibilities should workers sustain personal injuries on-site or the threat of personal injuries exist on the site related to unanticipated contact with chemicals or hazardous materials.

C. Should an unanticipated incident occur that is considered serious and/or an imminent hazard by the Contractor's Site Safety and Health Officer (SSHO), work within the area influenced by the incident will be suspended until the emergency situation has been brought under control, the incident has been evaluated, and site conditions which contributed to the emergency have been mitigated.

D. An emergency situation or imminent hazard includes, but is not limited to, the following:

1. buried drum(s) with unknown or known toxic contents
2. groundwater or soils of an unnatural color
3. levels of volatile organic compounds (as measured by a photoionization detector) in excess of critical action levels established by the Contractor's Certified Industrial Hygienist (CIH) in the Hazardous Materials Health and Safety Plan
4. spills or leaks of chemicals or petroleum products on-site
5. other perceived threats
6. loss of negative pressure during asbestos abatement

E. Site personnel shall report all incidents to the Contractor's SSHO and the Owner’s on-site representative as soon as possible. The Contractor's SSHO will determine the appropriate steps to be taken subject to the Owner’s concurrence. All site incidents will be investigated and documented by Owner or their designated representative. Specific mitigation actions to deal with the emergency are not included within these procedures.

F. The Emergency Response Plan shall be submitted by the Contractor in conjunction with the Contractor’s site-specific Health and Safety Manual required in Section 01065 – Project Safety and Health Specifications..

1.02 DESCRIPTION OF REQUIREMENTS

A. The site-specific Emergency Response Plan shall be submitted to the Program Manager for review before any work covered in the specific procedures is initiated. It is the Contractor's responsibility to implement appropriate emergency response actions to protect his/her workers safety. Therefore,

the Program Manager will not approve the Emergency Response Plan but only review to verify that items specified in this section are addressed. The Contractor shall implement, maintain and enforce these procedures at the appropriate time prior to and during all phases of the Work.

B. The Contractor shall utilize the services of an industrial hygienist certified by the American Board of Industrial Hygienists (ABIH) to develop and implement the Emergency Response Plan.

1.03 REGULATORY REQUIREMENTS AND APPLICABLE PUBLICATIONS

A. The site specific Emergency Response Plan shall be consistent with the requirements of:
   1. National Contingency Plan, Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
   2. FEMA (Federal Emergency Management Agency) Emergency Operations Plan Requirements.
   3. OSHA (Occupational Safety and Health Administration) Standards and Regulations contained in Title 29 Code of Federal Regulations, Part 1910.120 "Hazardous Waste Operations and Emergency Response".
   4. OSHA (Occupational Safety and Health Administration) Standards and Regulations contained in Federal Regulations, Part 1910.146 "Permit - Required Confined Spaces".
   5. Environmental Protection Agency (EPA) Regulations contained in Title 40, Code of Federal Regulations, Part 112, "Spill Prevention Control and Countermeasure Plan."
   6. Rhode Island Department of Environmental Management and Rhode Island Department of Health.

B. The Emergency Response Plan shall include, but not necessarily be limited to, the following components as required by OSHA 29 CFR 1910.120(i)(J):
   1. Site Description and Evaluation.
   2. Names of key personnel and alternates responsible for safety and health (responsibilities and chain of command).
   3. Emergency Equipment and First Aid Requirements.
   4. Emergency Response Plan and Contingency Procedures.
   5. Spill Prevention Control Countermeasure Plan in accordance with EPA 40 CFR 112.

C. The site specific Emergency Response Plan shall be submitted to the Program Manager within 30 days after the Notice-To-Proceed. No work shall be performed until the Emergency Response Plan has been accepted by the Program Manager.

D. Any disregard for the provision of these specifications shall be deemed just and sufficient cause for termination of the Contract without compromise or prejudice to the rights of the Contractor.

1.04 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

A. The Contractor shall develop an emergency response and contingency plan for on-site and off-site emergencies, as specified in OSHA 29 CFR 1910.120 (1), which shall address at a minimum:
   1. Pre-emergency planning
   2. Personnel roles, lines of authority, training and communication
   3. Emergency recognition and prevention
   4. Safe distances and places of refuge
   5. Site security and control
   6. Evacuation routes and procedures
   7. Decontamination
   8. Emergency Medical treatment and first aid
   9. Emergency alerting and response procedures
   10. Critique of response and follow-up

11. Personal Protection Equipment and emergency equipment

B. In the event of any emergency the Contractor shall, without delay: take diligent action to remove or otherwise minimize the cause of the emergency; alert the Program Manager; and institute whatever measures might be necessary to prevent any repetition of the conditions or actions leading to, or resulting in, the emergency.

C. Should the emergency be related to the contact of unanticipated contaminated material, the Contractor shall enact emergency response activities or shall evacuate the area until the emergency is otherwise mitigated in compliance with the Emergency Response Plan.

D. Emergency medical care services shall be prearranged at a nearby medical facility with established emergency routes.

E. The Contractor shall establish emergency communications with health and emergency services. The names of the services and their facilities, name of contact, emergency routes and emergency communications arrangements shall be posted at the site. The posted list shall include the following minimum points:
   1. Ambulance service and fire department telephone numbers.
   2. Procedure to prompt notification of Program Manager and Owner.
   3. Location of emergency showers/eye wash facilities.
   4. Location of self-contained breathing devices.
   5. Specific procedures for handling personnel with excessive exposure to chemicals or contaminated soil.

F. All emergency contact names and telephone numbers shall be posted at all project phones.

G. All designated site emergency vehicles shall be equipped with route maps providing directions to the off-site medical facility. All drivers of support vehicles shall become familiar with the emergency route and the travel time required.

H. In the event that an accident or some other incident such as an explosion, or an exposure to toxic chemical levels occurs during the course of the project, the Program Manager and Owner shall be telephoned immediately and receive a written notification within 2 hours. The report shall include the following items:
   1. Name, organization, telephone number, and location of the Contractor.
   2. Name and title of the person(s) reporting.
   3. Date and time of accident/incident.
   4. Location of accident/incident, i.e. site location, facility name.
   5. Brief summary of accident/incident giving pertinent details including type of operation ongoing at time of accident.
   6. Cause of accident/incident, if known.
   7. Casualties (fatalities, disabling injuries).
   8. Details of any existing chemical hazard or contamination.
   9. Estimated property damage, if applicable.
   10. Nature of damage, effect on contract schedule.
   11. Action taken by Contractor to insure safety and security.
   12. Other damage or injuries sustained (public or private).

I. Contingency Planning: Procedures and Contractor personnel responsibilities for potential emergencies shall be identified in the Emergency Response Plan. Emphasis in the contingency planning section shall be placed on procedures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF EMERGENCY RESPONSE PLAN REQUIREMENTS

SECTION 01200

MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

A. After the bids have been opened but prior to the start of the construction there will be a preconstruction conference to discuss the phasing and scheduling of the construction project. The specific time and place of the conference will be arranged by Owner after the Contract has been awarded.

1.02 PROGRESS MEETINGS

A. During the course of the construction project, the Contractor shall attend routine progress meetings as scheduled by the Program Manager. The frequency and location for these meetings is to be determined by Owner. The attendance of subcontractors and suppliers may be required during the progress of the work. The Contractor's delegate to the meeting shall be prepared and authorized to discuss the following items:

1. Progress of Work in relation to Contract Schedule.
2. Proposed Work activities for forthcoming period.
3. Resources committed to Contract.
4. Coordination of Work with others.
5. Status of procurement of equipment and materials.
6. Status of Submittals.
7. Outstanding actions, decisions, or approvals that affect Work activities.
8. Security issues.
9. Quality Issues
10. Potential Claims
11. Contract Changes
12. Costs & Budget
13. Mitigation Measures

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF MEETINGS

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SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals: Shop Drawings, Product Data, and other information as specified herein. Detailed submittal requirements will be specified in the technical specification sections.

B. All submittals shall be clearly identified by reference to Specification Section, Paragraph, Drawing No. or Detail as applicable. Submittals shall be clear and legible and of sufficient size for sufficient presentation of data.

1.02 SCOPE OF WORK

A. The Contractor shall submit shop drawings on all equipment and materials, structural details, piping layouts and all miscellaneous items to be incorporated into the Work. All shop drawings shall be submitted using the transmittal form furnished by the Program Manager.

B. Such drawings shall be project-specific and shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, 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 Contract.

C. When so specified or if considered, in advance, by the Program Manager to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted in place of shop and working drawings.

D. 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. Prior to the submittal of any shop drawings, the Contractor shall submit a schedule of proposed shop drawing transmittals. The schedule shall identify the subject matter of each transmittal, the corresponding specification section number and the proposed date of submission. During the progress of the Work the schedule shall be revised and resubmitted as necessary.

E. The Contractor shall review shop drawings and product data, including those by subcontractors, prior to submission to determine and verify the following:

1. Field measurements
2. Field construction criteria
3. Catalog numbers and similar data
4. Conformance with the Specifications

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 approved 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 approvals have 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 Program Manager by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them.

I. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished by the Program Manager and provide a description of the deviations in a letter attached to the submittal.

J. The review of shop and working drawings hereunder will be general only, and shall not 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.

K. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, he 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.

1.03 SHOP DRAWINGS AND PRODUCT DATA

A. Shop drawings as specified in individual work Sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Work.

B. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns (submitted as physical units or color chips, painted coupons, etc. – photocopies of colors shall not be accepted), manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, production or quality control inspection and test reports and certifications, and mill reports as applicable to the Work.

1.04 SUBMITTAL PROCEDURES

A. Contractor shall upload all submittals to the project Submittal Exchange website. Submittals will be downloaded by Program Manager for review and uploaded back to the Submittal Exchange website once review is complete. Hardcopies or electronic submissions by means other than as noted herein (e.g., email, compact disc, USB drive) will not be accepted.

B. Submittals of a physical nature, such as material samples, shall be delivered to Program Manager at their place of business or Contractor shall arrange for sample pickup by Program Manager at the project site. In these instances, Contractor shall upload transmittal cover page to the Submittal Exchange website for tracking purposes.

C. Contractor shall retain one hardcopy of each approved submittal at the project site for reference during the work.

D. Transmit all submittals with cover page provided by the Program Manager. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.

E. Sequentially number the transmittal cover page. Resubmittals shall have original number with an alphabetic suffix.

F. Identify Contract, Contractor, Subcontractor and/or Supplier; pertinent drawing sheet and detail number(s), and specification section number, as appropriate. Clearly indicate model and options being proposed and strike out all non-relevant data. Identify the building, equipment or structure to which the drawing applies.

G. All submittals must be cross-referenced to the section of the specifications to which they relate to.

H. Only drawings that have been checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Program Manager, the Contractor shall stamp and sign them certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

I. All technical submittals or calculations shall bear the stamp and signature of a Professional Engineer registered in the State of Rhode Island.

J. Schedule submittals in accordance with the Progress Schedule. Coordinate submission of related items.

K. Identify variations from Contract Documents and product which may be detrimental to successful performance of the completed Work.

L. Revise and resubmit submittals within 14 days. Identify all changes made since previous submittal.

M. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

N. The Contractor shall check all subcontractor's shop drawings to verify measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission to the Program Manager for approval.

O. All details on shop drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the work

depends upon field measurements, such measurements shall be made and noted on the drawings before submitted for approval.

P. Project work, materials, fabrication, and installation shall conform with approved shop drawings and product data.

1.05 SUBMITTALS REQUIRED

A. Submit a list of Shop Drawings indicating specification section number, contents, proposed numbering system, and time schedule for preparation and submission for all Shop Drawings for the Contract. This list shall be provided within 30 days after the Notice to Proceed.

B. Submittals shall include, where applicable,:
1. The date of submission and the dates of any previous submissions.
2. The Project title and number
3. Contractor identification.
4. The names of:
   a. Contractor
   b. Supplier
   c. Manufacturer
5. Identification of the product, with the specification section number, page and paragraph(s).
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. A blank space suitably sized for the Contractor and the Program Manager stamps.

1.06 REVIEW OF SHOP DRAWINGS, PRODUCT DATA AND WORKING DRAWINGS

A. The review of shop drawings and data will be for general conformance with the design concept and Contract Documents. They shall not be construed:
1. as permitting any departure from the Contract requirements;
2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
3. as approving departures from details furnished by the Program Manager, except as otherwise provided herein.

B. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.

C. If the shop drawings or data as submitted describe variations and show a departure from the Contract requirements which the Program Manager finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Program Manager may return the reviewed drawings without noting an exception.

D. Submittals will be returned to the Contractor with a code indicating whether or not the submittal was approved and whether or not it has to be resubmitted.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct the Program Manager's attention, by use of revision triangles or other clear, written notation, to revisions other than the corrections requested by the Program Manager on previous submissions. Such revisions shall be so noted on the letter of transmittal and on the resubmitted shop drawings. All such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections as may be required by the Program Manager to all work done because of this type revision that is not in accordance with the Contract Documents.

F. Partial submittals may not be reviewed. The Program Manager will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor and will be considered "Not Approved" until resubmitted. The Program Manager may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

G. Repetitive Review
   1. Shop drawings and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at times convenient to the Program Manager and at the Contractor's expense, based on the Program Manager's then prevailing rates. The Contractor shall reimburse the Owner for all such fees invoiced to the Owner by the Program Manager. Submittals are required until approved.
   2. Any need for more than one resubmission, or any other delay in obtaining Program Manager's review of submittals, will not entitle Contractor to extension of the Contract Time.

H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Program Manager at least seven working days prior to release for manufacture.

I. When the shop drawings have been completed to the satisfaction of the Program Manager, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Program Manager.

1.07 DISTRIBUTION

A. Distribute reproductions of approved shop drawings and copies of approved product data, where required, to the job site file.

1.08 GENERAL PROCEDURES FOR SUBMITTALS

A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

1.09 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

A. If specifically required in other related Sections, submit a P.E. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SUBMITTALS

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a professional engineer registered in the State of Rhode Island and that he/she has been employed by

_____ to design
(Name of Contractor)

_____
(Insert P.E. Responsibilities)

in accordance with Section _____ for the

_____.
(Name of Project)

The undersigned further certifies that he/she has performed the design of the _____

_____, that said design is in conformance
Name of Project)

with all applicable local, state and federal codes, rules, and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the

_____
(Insert Name of Owner)

or Owner's representative within seven days following written request therefor by the Owner.

_____	_____
P.E. Name	Contractor's Name
_____	_____
Signature	Signature
_____	_____
Address	Title
	_____
	Address

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SECTION 01311

CONSTRUCTION SCHEDULING

PART 1 GENERAL

1.01 PROGRAM DESCRIPTION

A. A Bar Chart construction schedule shall be used to control the work of this Contract and to provide a definitive basis for determining job progress. The construction schedule and updates shall be prepared by the Contractor. All work shall be done in accordance with the established schedule and the Contractor and his subcontractors shall be responsible for cooperating fully with the Program Manager and the Owner in effectively utilizing the schedule.

B. Within 14 days following the receipt of the Notice to Proceed, the Contractor shall submit two prints of the proposed schedule to Owner for review. Following review by Owner, the Contractor shall incorporate the Program Manager's comments and submit five prints of the revised schedule.

C. Approval of the schedule by Owner is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work within the contract completion date. Omissions and errors in the approved schedule shall not excuse performance less than that required by the Contract. Approval by Owner in no way makes Owner an insurer of the schedule's success or liable for time or cost overruns flowing from its shortcomings.

D. Progress under the approved schedule shall be evaluated monthly by the Contractor, updated as appropriate and forwarded to the Owner for review and comment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF CONSTRUCTION SCHEDULING

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SECTION 01370

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit to the Owner a Schedule of Values allocated to the various portions of the work, within 30 days after date of Notice to Proceed.

B. Upon request of the Owner, support the values with data which will substantiate their correctness.

C. The Schedule of Values, when approved by Owner, shall be used as the only basis for the Contractor's Applications for Payment.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SCHEDULE OF VALUES

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SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for providing photographs for existing conditions and the Work proposed under this Contract.

1.02 REQUIREMENTS

A. The Contractor shall employ at his own expense a fully competent and qualified commercial photographer demonstrating at least three (3) years professional experience in the field of commercial photography. The purpose of this employment shall be to take preconstruction and construction photographs at locations and times designated by the Engineer.

1.03 SUBMITTALS

A. Submit to the Engineer all requested qualifications, experience records, and examples of the photographer's work, for review. Only after the review of the photographer's qualifications and approval thereof by the Engineer shall the Contractor finalize such employment.

1.04 SCHEDULING

A. Prior to commencement of any work or at any time during the construction, directed by the Engineer, the Contractor and photographer shall consult with the Engineer for instructions concerning views required at each specific work site. The photographs shall show the existing conditions prior to and during construction as require by the Engineer and shall be taken from locations or views designated by the Engineer to adequately illustrate the state of the project and/or conditions of construction. The Contractor shall also arrange with the photographer adequate photographic coverage throughout the duration of this Contract, at the times requested by the Engineer, having said photographer on 24-hour call when services are required.

PART 2 PRODUCTS

2.01 PHOTOGRAPHS

A. The Owner shall be allowed a minimum of **[Insert number of views required]** photographed views and shall furnish to the Engineer **[Insert the number of prints required]** prints of each view designated. All photographs shall be a factual presentation of the views designated and shall be taken using correct exposure and focusing techniques insuring high resolution and sharpness, maximum depth-of-field, and minimum distortion. All photograph negatives shall remain the property of the photographer. All prints shall be

color, 8 inch by 10 inch size, smooth surface with glossy finish, and paper weight being single. Identification of each print is required giving the following information:

1. Name of Project.
2. Description of view.
3. Time and date of exposure.
4. Climatic conditions (temperature and weather conditions).
5. Name and address of photographer.
6. Photographer's numbered identification of exposure.

B. The Contractor shall insure delivery of all prints on a monthly basis, or as otherwise requested, to the Owner through the Engineer. These deliveries must be made prior to the payment of monthly progress estimates. The Contractor shall pay all costs associated with employing said photographer and furnishing all construction photographs, tapes, and prints, complete as specified, including all incidentals necessary at no additional expense to the Owner.

C. The photographer hereby agrees to properly file and maintain all photograph negatives associated with this Contract for a period of two (2) years from the date of final completion of the project as shown on the final estimate. The photographer must also agree to furnish promptly upon request, additional prints during this specified time period, to the Owner and his Engineer at the commercial rates applicable at the time of the request.

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01381

AUDIO VIDEO RECORDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for color audio video recording of all existing site, roadway and right-of-way conditions.

1.02 REQUIREMENTS

A. Pre-Construction recording

1. Furnish to Owner an original and one copy of a continuous color audio video recording. Take recording prior to any construction activity.
2. Recordings to be of sufficient detail to accurately and clearly show the existing, preconstruction conditions of the entire area of the Work. Each recording to include an audio description of the area being video recorded.
3. Coverage shall include, but not be limited to, all existing roadways, sidewalks, curbings, driveways, buildings, structures, above ground utilities, landscaping, trees, signage and other physical features located within the zone of influence of the Work. The coverage may be expanded if directed by Owner.
4. All recordings will be done during daylight hours. No recording shall be performed if weather is not acceptable, such as rain, fog, etc.

B. The Owner reserves the right to reject any recordings because of poor quality.

C. Any recordings rejected by the Owner shall be re-recorded at no additional cost.

1.03 SUBMITTALS

A. Provide references of similar projects for review by the Owner, including project owner contacts and telephone numbers.

1.04 QUALITY CONTROL

A. The recording shall be performed by a qualified, established audio video recording firm knowledgeable in construction practices and inspection procedures.

PART 2 PRODUCTS

2.01 AUDIO VIDEO MEDIA

A. Recording media shall be a USB device capable of playback on Microsoft Windows computers.

PART 3 EXECUTION

3.01 AUDIO AND VIDEO RECORDING

A. Each recording shall begin with the Owner's name, Contract name and number, Contractor's name, date and location information such as street name, direction of travel, viewing side, etc.

B. Information appearing on the recording must be continuous and run simultaneously by computer generated transparent digital information. No editing or overlaying of information at a later date will be acceptable.

C. Digital information will be as follows:

1. Upper left corner
    a. Name of Contractor
    b. Day, date and time
    c. Name of Project
2. Lower left corner
    a. Street or route of travel
    b. Viewing side
    c. Direction of travel
    d. Stationing

D. Time must be accurate to within 1/10 of a second and continuously generated.

E. Written documentation must coincide with the information on the recording so as to make easy retrieval of locations sought for a later date.

F. The video system shall have the capability to transfer individual frames of video electronically into hard copy prints or photographic negatives or digital image files in commonly accepted image file formats (e.g. .jpg, .tif, etc.).

G. Audio shall be recorded at the same time as the video recording and shall have the same information as on the viewing screen. Special commentary will be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, etc.

H. All USBs shall bare labels with the following information:

1. USB Number
2. Owner's Name
3. Date of Recording
4. Project Name and Number
5. Location and Standing Limit of recording

END OF AUDIO VIDEO RECORDING

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SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.01 RELATED SECTIONS:

A. Summary of Work and Contract Milestones, Section 01010.

B. Reference Standards, Section 01090.

C. Submittals, Section 01300.

D. Schedule of Values, Section 01370.

E. Materials and Equipment, Section 01600.

F. Contract Closeout, Section 01650.

1.02 QUALITY CONTROL AND CONTROL OF WORK:

A. The Contractor is responsible for controlling the quality of Work including work of its Subcontractors and suppliers and for ensuring that the specified quality is achieved. The Contractor and its Subcontractors and suppliers shall be responsible for developing and maintaining a quality control program which is responsive to the requirements of this specification section and which includes implementing procedures necessary to ensure compliance with the requirements of the Contract. The Contractor's QC (CQC) program shall be submitted within 30 days after receipt of Notice to Proceed. The CQC program shall explain the Contractor's and its Subcontractors' approach to on-site quality control, off-site quality control, the CQC organization, documentation of quality control activities, and provide all other information necessary to demonstrate to the Program Manager that the Contractor and its Subcontractors and suppliers will provide quality control services that ensure compliance of the Work with the Contract Documents. The CQC program shall identify the Contractor's individuals responsible for the execution of the program and identify those subcontractors/suppliers working to the CQC program and those working to their own Quality Control (SQC) program. The Quality Control programs shall apply to the control of quality throughout all areas of contract performance including the procurement, identification, stocking, and issue of material; the entire process of construction; and the installation and testing of equipment. The CQC program will include the elements of a required CQC Program listed in Attachment A. The CQC program will also identify those procedures that will require inspection checklists that will be completed by the Contractor, an example of which is included in Attachment B.

B. Overall administration of the CQC program shall be vested in a responsible, authoritative element of the contractor's organization, hereinafter referred to as the QC Organization, under a qualified on-site QC Manager acceptable to the Program Manager who has clear access to senior level offsite home office management and to Subcontractors' officers responsible for the execution of the SQC Program. The QC Manager may be the Program Manager or superintendent and may have other on-site duties, provided the requirements of this specification are met. The QC Manager's duty is to manage and administer the CQC program unless otherwise authorized in writing by the Program Manager. Such authorization can be withdrawn at any time. The QC Manager shall be assigned for the duration of the Contract on a full-time basis and any change is subject to Program Manager approval.

C. Written quality control inspection and test procedures shall be used for all operations involving permanent work. These procedures shall contain instructions for performing the required inspection or test, contain the accept/reject criteria for each inspection or test activity (i.e. applicable drawing, specification section, industry code or standard), shall establish the frequency for performing the inspection or test, and shall provide for recording the results of inspections and tests on checklists acceptable to the Program Manager. These procedures shall be kept current and shall be available at all locations where inspections and tests are to be performed.

D. The Contractor shall maintain control over procurement sources to ensure that materials, equipment and services conform to specified requirements. The Contractor's procurement documents shall require subcontractors and suppliers to implement their own (SQC) program, as required by paragraph 1.03 of this Specification Section, or require them to implement the CQC Program. The Contractor and its subcontractors shall comply fully with manufacturers' instructions, including completing each step in sequence. Should manufacturers' instructions conflict with Contract Documents, the contractor is to request clarification from the Program Manager before proceeding.

E. Work to be done away from the construction site is subject to inspection by the Program Manager on behalf of NBC during its fabrication, manufacture, testing, or before shipment. The Contractor shall give notice to the Program Manager of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Program Manager at least 48 hours prior so that the necessary arrangements for inspections and witnessing of shop tests can be made. The Program Manager has the right but not the responsibility to perform inspection or to witness tests. The Program Manager’s right to perform inspection or to witness tests does not relieve the Contractor of the obligation to comply with the requirements of the Contact Documents. At all locations and all times, the Contractor shall ensure that the Program Manager has clear and safe access to all Work being performed, whether it be on site or off site.

F. The Program Manager has the right but not the responsibility to perform inspections, witness tests, or otherwise monitor or assess the Work and activities. The Program Manager and NBC's right to perform inspections, witness tests, or monitor or assess the Work and activities does not relieve the Contractor or its Subcontractors, and sellers of their obligation to comply with the requirements of the Contract Documents.

G. Means and methods shall be established for controlling the identification, inspection status, handling, and storage of raw and fabricated material. These controls shall be maintained from the time of receipt of the material until delivery to the Program Manager, in order to protect the material from damage, deterioration, loss or substitution.

H. The Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements. In-process and final inspection and testing of construction shall be performed in accordance with implementing written quality control inspection and test procedures to ensure that contract requirements have been met. The results of in-process and final inspections shall be recorded on inspection check lists furnished by the Contractor, which shall include a similar level of detail and elements as those contained as examples in Attachment A and approved by the Program Manager. Payment will not be processed for an item of work until checklists are completed and provided to the Program Manager.

I. Means and methods shall be established to ensure conformance with requirements for special process specifications such as welding, heat treating and nondestructive testing of materials. Weld inspection shall include fit-up inspection and final weldment inspection on all welds and in process inspection on welds selected by the Program Manager for each welder and weld process used. Welds requiring intermediate weld layers shall be selected first for in process inspection and the inspection shall ensure compliance with the welding procedure and welder's performance qualifications. Certifications for personnel, procedures, and equipment shall be maintained as required to meet the requirements of the Contract Documents and all applicable codes.

J. Procedures shall provide for the identification and control of unsatisfactory or nonconforming material or conditions and for the prompt notification to the Program Manager with recommendations for corrective action. An "Unsatisfactory Condition" is a deficiency which deviates from Contract Document requirements or renders the quality of an item indeterminate but can be corrected to meet such requirements without an engineering determination. A "Nonconformance" is a condition which deviates from Contract Document requirements and cannot be corrected to meet such requirements or otherwise requires an engineering determination.

K. The CQC and SQC programs are subject to quarterly (approximately every three months) audit by NBC or the Program Manager as its representative to assure compliance with the Contract Documents. The Contractor will make their QCM available to the CM as well as all of their quality plan files, materials and documentation. This review/audit will be conducted in the Contractor's field office in space provided by the Contractor. The Audit will include a review of the quality plan and if it is being implemented in the field operations. The activities include (but are not limited to): determining if quality activities are being conducted; Auditing records to see if all activities are being documented correctly; determining if quality activities are attended by the proper parties; determining if quality activities are being approved by the proper parties; Auditing records to see of proper notice is given to all parties attending quality activities; Auditing records to determine if they are providing the required daily and monthly quality reports to the owner and Program Manager.

L. The Contractor shall issue monthly quality control reports to the Program Manager as a prerequisite to processing requests for payments. Payments will not be processed until the contractor submits the monthly quality control report. These reports shall include: status of the contractor quality control program including procedure development, status of subcontractor/supplier quality control programs and procedures, number of inspections and tests performed during the month, unsatisfactory and nonconforming items identified as well as those that remain open or were closed during the month, a list of quality control activities planned for next month based on planned project schedule activities, and copies of all completed quality forms, checklists, and logs.

1.03 QUALITY ASSURANCE/CONTROL OF SUBCONTRACTORS/SUPPLIERS

A. The Contractor is responsible for controlling the quality of work performed by its subcontractors and suppliers. Subcontractors and suppliers may implement their own quality control (SQC) program if the program is approved by the Contractor and the Program Manager. Otherwise the Contractor will instruct the subcontractor or supplier to implement the CQC program on all work performed and will perform the Quality Control inspections of the subcontractor's or supplier's Work and activities at their facilities. Program Manager approval of supplier QC Programs may be waived at the discretion of the Program Manager except when specifically required by the technical specifications. Such waivers can be withdrawn at any time. The CQC program shall list all Subcontractors and suppliers and identify which quality program, CQC or SQC, they are to implement. The Contractor shall have responsibility to provide and ensure access to all subcontractor or supplier facilities for the purpose of inspections.

B. SQC programs which are responsive to the requirements of this section including the attached QC program elements (Attachment A) shall be required of Subcontractors and Suppliers pursuant to the same requirements outlined in paragraph 1.02 herein for CQC's.

1.04 REFERENCES

A. The Contractor and its Subcontractors and sellers shall conform to reference standards current on bid opening date.

B. The Contractor and its Subcontractors and sellers shall indicate any instance where specified reference standards conflict with Contract Documents and request clarification from Program Manager before proceeding.

C. American Society for Nondestructive Testing:

1. SNT-TC-1A: Recommended Practice for Nondestructive Testing Personnel Qualification and Certification.

D. American Welding Society:

1. AWS QC1: Standard and Guide for Qualification and Certification of Welding Inspectors.

1.05 CONTRACTOR'S ON-SITE QUALITY CONTROL TESTING AND INSPECTION

A. The Contractor and its Subcontractors shall perform inspections, tests, and other services as required by the Contract Documents, their approved QC programs, and in accordance with laws, codes, rules, and regulations and document the results on checklists as described in paragraph 1.02 I. herein.

B. The Contractor shall provide 24-hour notice to the Program Manager so that the Program Manager may witness Contractor and/or Subcontractors on site inspections and tests. Inspections and tests to be witnessed by the Program Manager shall be identified as hold/notification points on the Contractor’s checklists. The Program Manager's witnessing of inspections and tests does not relieve the Contractor and its Subcontractors of their obligation to comply with the requirements of the Contract Documents.

C. The Contractor and its Subcontractors shall develop an inspection and test index identifying all required inspections and tests as indicated in the Contract Documents and their approved QC program. This index shall be submitted to the Program Manager for approval and be included as part of the QC program. The Contractor shall provide one copy of inspection and test results to the Program Manager representative witnessing the inspection or test and retain and file the original inspection and test results in an orderly manner so that the Contractor can readily turn over such records to the Program Manager and demonstrate to the Program Manager at Contract Closeout that the Work has been satisfactorily performed and tested.

1.06 ENGINEER QUALITY CONTROL ACTION ITEMS

A. Unless otherwise directed in writing by NBC or the Program Manager, the Contractor shall promptly undertake appropriate action at no additional cost to NBC to respond and correct any unsatisfactory, nonconforming, or otherwise deficient conditions reported to the Contractor by the Program Manager. These conditions may be identified as a result of Program Manager inspections, audits or surveillances.

B. The Contractor's refusal, failure or neglect to take appropriate action or to submit a written response within the time period requested shall constitute reasonable evidence that the Contractor is not prosecuting the Work or separable part, with the diligence that will ensure its acceptable quality within the applicable Contract requirements and shall constitute sufficient basis for the Program Manager to decline to recommend payment or to recommend withholding any payment otherwise due in accordance with the General Conditions or to identify and order alternate actions or inspections at Contractor expense on the basis of the information in the Contract.

1.07 CONTRACTOR'S TESTING LABORATORY

A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform all of the testing of earth work and concrete (i.e. soil density; concrete strength, slump, temperature, and air content) and perform other inspections and tests required by the specifications or referenced codes and standards. The independent laboratory must be a CCRL (Cement and Concrete Reference Laboratory) approved facility. Personnel performing inspections and tests must be certified by the ACI (American Concrete Institute).

B. The Contractor shall protect concrete test specimens during initial curing and storage from time of fabrication until receipt by the testing laboratory and shall provide transportation of the specimens to the laboratory.

C. Reports will be submitted by the independent testing firm to the Contractor and the Program Manager simultaneously indicating observations and results of inspections and tests and indicating compliance or non-compliance with Contract Documents. Test results that yield strengths below the specified limits must be reported immediately by e-mail to the Program Manager.

D. If inspection and testing by the independent laboratory indicates that Contractor's and/or Subcontractors work fails to conform to the specified requirements, Contractor and/or Subcontractors shall correct the defective work, develop suitable procedures to ensure that any new work will be in conformance with specifications, and perform additional inspections and tests to verify that the corrected work and new procedures are in compliance with the specifications, all at no additional cost to NBC.

1.08 PROGRAM MANAGER/CONSTRUCTION MANAGER QA TESTING LABORATORY:

A. The Program Manager/Construction Manager will employ and pay for the services of an independent testing laboratory to perform random Quality Assurance (QA) testing of earth work and concrete (i.e. soil density; concrete strength, slump, temperature, and air content) and perform random inspections and tests of other areas previously completed and inspected by the Contractor at the request of the Program Manager.

B. Reports will be submitted by the independent testing firm to the Program Manager indicating observations and results of inspections and tests and indicating compliance or non-compliance with Contract Documents.

C. The Contractor and Subcontractors shall cooperate with the independent testing firm procured by PM/CM; furnish samples of materials and assistance as requested.

D. The Contractor shall provide reasonable notice (at least 24 hours) to the Program Manager prior to expected time for operations requiring independent testing laboratory services.

E. If inspection and testing by the independent laboratory procured by PM/CM indicates that Contractor's and/or Subcontractors work fails to conform to the specified requirements, Contractor and/or Subcontractors shall correct the defective work, develop suitable procedures to ensure that any new work will be in conformance with specifications, and perform additional inspections and tests to verify that the corrected work and new procedures are in compliance with the specifications, all at no additional cost to NBC.

1.09 MANUFACTURERS' FIELD INSTALLATION SERVICES AND REPORTS

A. When specified in the Contract Documents, the Contractor and its Subcontractors shall require material or product suppliers and manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, (test, adjust, and balance of equipment) and to provide instructions when necessary.

B. The Contractor shall report to the Program Manager in writing any observations and site decisions or instructions given by the manufacturers' representative to the Contractor that are supplemental or contrary to manufacturers' written instructions.

C. The Contractor shall submit manufacturer's representative's reports within 10 days of each field visit, to the Program Manager for review. Reports shall be posted to the project's Submittal Exchange website. If the durations of field visits are greater that one week, the contractor shall submit weekly reports. Final report shall certify that the equipment or systems have been satisfactorily installed and are functioning correctly.

1.10 SUBMITTALS

A. Within 30 days after receipt of the Notice to Proceed, the Contractor shall submit to the Program Manager for approval the Contractor's CQC program, including the inspection and test index described in 1.05C.

B. Prior to their use, the Contractor shall submit any revisions or changes to the CQC program or implementing procedures previously submitted to and approved by the Program Manager.

C. Qualifications of Contractor's Independent Testing Laboratory, certifications of personnel, and written Procedures and Quality Control Manual for all field and laboratory tests to be performed.

D. Prior to their commencement of work, the Contractor shall submit the resume of their QC Manager.

E. Prior to subcontractors' and suppliers' commencement of work for which their own quality control (SQC) program will be implemented, the Contractor shall review, approve and submit to the Program Manager for approval the SQC to be used.

F. During performance of contract work, the Contractor shall submit the following to the Program Manager for information and as a condition of payment:

1. Monthly quality control reports as described in paragraph 1.02.L.
2. Copies of inspection and test results.
3. Manufacturers representative's reports (in duplicate) within 10 days of each field visit per paragraph 1.09 including final reports which certify that equipment or systems have been satisfactorily installed and are functioning correctly. If the duration of field visits is greater than one week, the Contractor shall submit weekly reports.

G. At contract close out and prior to release of retainage, the Contractor shall submit to the Program Manager all completed QA/QC documentation including the original inspection and test records demonstrating that the work has been satisfactorily performed and tested.

PART 2 PRODUCTS

2.01 The products of this section are Quality Control programs, Procedures and Records and the services of this section are Quality Program management and administration and independent quality control inspections. The CQC program and SQC programs shall define all quality records that are to be developed and turned over to the Program Manager as a result of implementing the quality program and procedures. The list of records shall be submitted to the Program Manager for approval and be included as part of the QC program.

PART 3 EXECUTION

3.01 NBC reserves the right to have the Program Manager either prepare or assist the Contractor or its Subcontractors and Suppliers in the preparation of quality control program and implementing procedure submittals which are overdue by more than fifteen (15) days, or to take appropriate action to correct any unsatisfactory, nonconforming, or otherwise deficient condition reported to the Contractor by the Program Manager when the Contractor refuses, fails, or neglects to take action within the time period requested and the Contractor shall reimburse NBC for all associated direct, indirect or consequential costs. In the event the Contractor fails to pay those costs within thirty (30) days after receipt of an invoice from NBC, NBC shall be entitled to a decrease in Contract Price or to withhold a set-off against any amounts recommended for payment. Program Manager's assistance with quality control program and implementing procedure preparation or in correcting unsatisfactory, nonconforming, or otherwise deficient conditions shall not relieve the Contractor of its responsibilities for determination of the methods, techniques, and sequences for the performance of the Work.

3.02 Pursuant to the General Conditions, the Program Manager may refuse to recommend the whole or part of any payment if, in the Program Manager's opinion, the Contractor's or its Subcontractors' failure, refusal or neglect to provide the required quality control program and implementation precludes a proper evaluation of either quality control activities or the quality of work. NBC may refuse to make payment of the full amount recommended by the Program Manager and NBC may withhold from any payment a set-off if, in NBC's opinion, the Contractor's or its Subcontractors' failure, refusal or neglect to provide the required quality control program and implementation precludes a proper evaluation of whether or not the Contractor or its Subcontractor is prosecuting the quality control program and controlling the quality of the work with diligence that will ensure its completion within the Contract requirements.

3.03 These remedies for the Contractor's failure, neglect or refusal to comply with the requirements of this Section are in addition to, and not in limitation of, those provided under the Agreement and the General Conditions.

3.04 Inspections and tests shall be made by the Contractor and its subcontractors and the appropriate documentation produced as each element of work is executed. Program Manager will require completion of all required QA/QC documentation for an item as a condition of payment for that particular item. Program Manager will also require that all documentation be complete as a condition precedent to release of retainage.

3.05 The Contractor shall utilize First Material Delivery and Benchmark Inspections to ensure the highest level of performance throughout the project. First Material Inspections are conducted on all new material and equipment entering the jobsite that will be incorporated into the permanent work. Benchmarking Inspections are conducted on all first in-place construction for each type of work to insure adherence and conformance to the Contract Documents.

A. The Contractor must provide the Program Manager with a minimum 48-hour advance notice of completed work activities and arrival time of first deliveries to allow for timely inspections. The Contractor must participate in all inspections. First Material and Benchmark Inspection forms are to be completed with all appropriate information and submitted to the Program Manager a minimum of 48 hours prior to the time of inspection. No inspections will be performed without proper notice.

B. First Delivery of Material / Equipment Inspection

1. The Contractor notifies the Program Manager of the first delivery of each type of material or equipment.
2. The Contractor and Program Manager inspects, and the Contractor documents the first delivery of equipment or materials to site for conformance or deficiencies. The Contractor documents the first delivery on forms developed by the Contractor and approved by the Program Manager.
3. The delivery will be verified against the requirements of the design documents and the approved shop drawings.
4. Non-conforming materials and/or equipment will not be allowed to be set into place and will be removed from the site immediately.
5. This inspection establishes the basis for judging all future deliveries of like materials/equipment but shall not relieve the Contractor in any way from meeting specification requirements.

C. Bench Marks

1. Before start of construction for each type of work, the Contractor will review the contract documents, submittals, shop drawings, codes and referenced standards to verify the requirements. Bench marks will be used for operations related to the permanent, finished product.
2. The Program Manager and Contractor will establish the extent of the first work of a specific type constructed in the normal progress of the work for use as a benchmark.
3. The Contractor notifies the Program Manager that the work is complete, and the Program Manager calls for a benchmark review.
4. The Contractor and Program Manager inspection team comment on and/or approve the work for conformance to the specifications and drawings. The Contractor documents the Benchmark Inspection on a form developed by the Contractor and approved by the Program Manager.
5. This inspection establishes the basis for judging all future work of a like type.

PART 4 ATTACHMENTS

ATTACHMENT A - ELEMENTS OF A QUALITY CONTROL PROGRAM
Provided as an example of the topics which must be addressed in a Quality Control Program.

ATTACHMENT B - QUALITY CONTROL CHECK LIST CRITERIA – SAMPLE
Provided as an example of criteria that constitutes a typical quality control check list.

END OF QUALITY CONTROL

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SECTION 01400 - ATTACHMENT A

ELEMENTS OF A QUALITY CONTROL PROGRAM

INTRODUCTION

The Quality Control Program is the basic quality document for the construction of a Project, and it identifies quality program commitments. The Quality Control Program assigns responsibilities, authority levels, and interface requirements for activities which affect quality. Activities which affect quality are those activities which affect the features and characteristics important to the quality of an item, such as soil compaction, concrete curing, etc. The Quality Control Program serves as the basis for Quality Control Procedures, which contain the administrative and implementation requirements for quality control activities. The Quality Control Program will incorporate first material delivery inspections, checklists, concrete placement sign-offs, and benchmark inspections. The Contractor will maintain documentation to this effect. Include appropriate forms and samples in the Quality Control Program.

A Quality Control Program must address the following program topics/elements as they relate to the equipment, material or service being furnished:

1. Organization
2. Quality Assurance Program
3. Design Control
4. Control of Procurement Documents
5. Instruction and Procedures
6. Control of Documents
7. Control of Material, Equipment, and Services
8. Survey/Field Coordination
9. Control of Special Processes
10. Inspection and Tests
11. Unsatisfactory/Nonconformance Control
12. Quality Control Records
13. Surveillance and Audits
14. Attachments
    - A. Inspection Report
    - B. Nonconformance Report
    - C. List of Procedures
    - D. List of Subcontractors and Suppliers and applicable QC program
    - E. List of inspections, tests and checklists
    - F. List of QA Records
    - G. First Delivery of Material Inspection
    - H. Benchmark Inspection

SECTION 01400 - ATTACHMENT B

QUALITY CONTROL CHECK LIST CRITERIA – SAMPLE (CONCRETE)

THIS SAMPLE IS **NOT** INTENDED TO BE ALL INCLUSIVE

BUT TO BE A GUIDE TO CRITICAL ISSUES, CAUSE QUESTIONS TO BE ASKED, AND SERVE AS A GENERAL GUIDE FOR CONTRACTOR TO DEVELOP CHECKLISTS.

This document includes items concerning **Formwork, Reinforcing Steel, Concrete Delivery, Placement and Finishing**

GENERAL

1. First Delivery of Material inspections identified?
2. Benchmarks identified?
    a. Excavation and subgrade
    b. Forms, ties and bracing
    c. Approved shop drawings being used
    d. Reinforcing and imbeds
    e. Concrete delivery, placement and vibration
    f. Deck installation
    g. Testing methods
    h. Concrete finishing
    i. Curing
    j. Shoring and re-shoring
3. Concrete subcontractor approved?
4. Ready-mix supplier, source of aggregate and cement approved?
5. Concrete design mix, materials and additives approved?
6. Reinforcing steel shop drawings being expedited?
7. Schedule for preparation and approval of shop drawings conform to concrete placement schedule?
8. Samples approved?
    a. additives, admixtures
    b. reinforcing steel accessories
    c. water-stop
    d. expansion joints
    e. patching materials
    f. form ties and accessories
    g. grout
    h. floor hardener
    i. and so on

9. Reinforcing steel splicing system approved?
10. Concrete testing laboratory under contract?
    a. Inspectors assigned?
    b. Report format approved?

FORM-WORK

11. Forms been designed in accordance with local codes, plans and specifications?
12. Form-work drawings at the job-site?
    a. Form-work drawings stamped and signed by a registered P.E.?
    b. Forms erected in accordance with drawings?
13. Form materials and faces in accord with specifications?
14. Forms in adequate condition for continued use?
15. Embedded items been placed prior to concrete placement?
16. Do dimensions reflect allowance for tolerance of concrete surface and facing material?
17. Mud-sills in place?
18. Power buggies being used?
    a. Form-work drawings indicate special requirements?
    b. Provisions make to protect forms, steel, imbeds?
    c. Safe buggy fill area provided?

REINFORCING STEEL

19. Rods sufficiently tied to prevent displacement?
20. Chairs and/or other accessories in accordance with requirements?
21. Adequate to carry the personnel, material and equipment for placement?
22. Dowel size, spacing and projection checked?
23. Reinforcing installed in accordance with approved shop drawings?
    a. Correct size and number?
    b. Proper spacing and clearances?

CONCRETE DELIVERY AND PLACEMENT

24. Delivery scheduled to meet placement requirements and prevent delays and/or overtime?
25. Cold or hot weather requirements being complied with?
26. Approved concrete additive being used?
27. Forms swept, blown and/or washed clean prior to concrete placement?
28. Bonding agent available used properly?
29. Slumps of concrete within tolerance?
30. Are concrete placement cards to be used?

31. Cylinders being made in correct number, handled and stored in compliance with specification and ACI. requirements?
32. Trucks been rejected? If so, why and documented?
33. Rate of concrete placement conforms to form-work drawings and ambient temperature?
34. Excessive deflection of forms?
    a. Remedial measures taken and documented?
35. Concrete delivery in accordance with requirements?
36. In case of breakdowns or interruptions in delivery or conveying has a cold joints procedure been approved?
    a. Specific location and conditions are to documented
    b. Identify any cylinders taken in the area
    c. Method of preparation of the potential cold joint should be included
    d. Are water stops to be installed?
37. Sufficient number of working vibrators at the site?
38. Workers using them properly?
39. Tremies or "elephant trunks" used for placing concrete in walls?
40. Sleeves, inserts, reinforcing rods, and so on installed in accord with the requirements?
41. Damage during placement? Was it repaired?

FINISHING

42. Elevation reference in area of placement and verified?
43. Wet screeds being utilized to establish grades?
44. Materials as approved?
45. Level and flat tolerances met?
46. Texture of the slab finish in accordance with the requirements?
47. Surface additives required?
48. "Bird baths" identified during finishing?
49. Corrective action taken and documented?
50. Approved curing method being used?
    a. Compatible with succeeding finish?
    b. Chemical compound
    c. Water and plastic sheets
    d. Insulation, heat or cooling
51. Stripping in accord with requirements and codes?
    a. Test cylinders broken as required?
    b. Low strengths documented and tracked for explanation?
52. Slabs re-shored in accord with requirements?
53. Surfaces patched in approved manner?
54. Surfaces rubbed as required?

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Qualification, duties and responsibilities of testing laboratories.
2. Coordination and scheduling responsibilities of the Contractor.

B. Related Sections

1. Section 01600 - Materials and Equipment

1.02 PAYMENT PROCEDURES

A. Initial Testing

1. The Owner will pay for initial testing services required by the Engineer, unless noted otherwise.

B. Retesting

1. When initial tests indicate noncompliance with the Contract Documents, subsequent retesting occasioned by the noncompliance shall be performed by the same testing agency, and costs thereof will be deducted by the Owner from the Contract Sum.

C. Contractors Convenience Testing

1. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.04 REQUIREMENTS

A. Work included:

1. Cooperate with the Owner's selected testing agency and all others responsible or testing and inspecting the Work.
2. Provide other testing and inspecting as specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.
3. Where no testing requirements are described, but the Owner directs testing, the Contractor shall provide testing under the requirements of this Specification.

B. Work not included:

1. Selection of testing laboratory: The Owner will select a qualified independent testing laboratory.

1.05 QUALITY ASSURANCE

A. Qualifications

1. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329.

B. Regulatory requirements

1. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.
2. Regulatory Requirements Inspections and tests required by codes or ordinances, or by a plan approved authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01600 - Materials and Equipment.

B. Promptly process and distribute, to the Engineer, required copies of test reports and instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

1.07 SCHEDULING

A. Establishing schedule

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
2. Provide all required time within the construction schedule.
3. Coordinate testing activity with the appropriate testing laboratory.

B. Revising schedule

1. When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule

1. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Site Tests

1. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.
2. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

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SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY SERVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide all temporary facilities necessary for the proper completion of the work, as necessary and as specified.

B. The Contractor's attention is directed to the requirements of Sections 01000 – General Specifications and 01501 – Weather Protection Standard.

1.02 FIELD OFFICES

A. The Contractor shall maintain a temporary field office near the work for his own use.

B. Field offices shall be maintained by Contractor for the duration of construction. Readily accessible copies of all contract documents shall be maintained at Contractor’s field office.

C. Field offices shall be located where they will not interfere with the progress of the work as approved by the Program Manager and have available power, heat, air conditioning, and bathroom facilities. In charge of this office there shall be a competent superintendent of the Contractor as specified in the Agreement, under Article CA.5.

1.03 WATER FOR CONSTRUCTION PURPOSES

A. The Contractor shall make arrangements with Pawtucket Water Supply Board (PWSB), as required, to use available water supplies for construction purposes.

B. The express approval of the PWSB shall be obtained before water is used. Hydrants shall only be operated under supervision of PWSB personnel.

C. The Contractor is required to meter all water use and the Contractor will be charged for this use.

D. If a water ban is instituted, the Owner reserves the right to discontinue the Contractor's use of public water supply.

1.04 TEMPORARY HEAT

A. If temporary heat is required for the protection of the Work, the Contractor shall provide and install suitable heating apparatus, shall provide adequate and proper fuel, and shall maintain heat as required.

1.05 TEMPORARY ELECTRICAL

A. The Contractor shall make all necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for the proper completion of the Work and during its entire progress. The Contractor shall provide and pay for all temporary wiring, switches, connections, and meters.

B. The Contractor shall provide sufficient electric lighting so that all work may be done in a workmanlike manner when there is not sufficient daylight.

1.06 TEMPORARY FENCING

A. Provide commercial grade chain link fence to prevent trespass by workmen and suppliers onto private property and the public from the construction site.

1.07 FIRE EXTINGUISHERS

A. Provide portable UL-rated, Class A fire extinguishers for all temporary offices and similar spaces. In other locations, provide portable UL-rated Class ABC dry chemical extinguishers a combination of NEPA recommended Classes for the exposure. Comply with NEPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF CONSTRUCTION FACILITIES AND TEMPORARY SERVICES

SECTION 01501

WEATHER PROTECTION STANDARD

PART 1 GENERAL

1.01 DESCRIPTION

A. It is the intent of these standards to require the General Contractor to provide temporary enclosures and heat to permit construction work to be carried on during the months of November through March, as required.

B. "Weather Protection" shall mean the temporary protection of that work adversely affected by moisture, wind and cold by covering, enclosing and/or heating. This protection shall provide adequate working areas during the months of November through March as determined by the Program Manager and consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations. The General Contractor shall furnish and install all "weather protection" material and be responsible for all costs. These provisions do not supersede any specific requirements for methods of construction and/or curing of materials.

B. Within 30 calendar days after this award of contract, the General Contractor shall submit in writing to the Program Manager for approval, three (3) copies of his proposed methods of "Weather Protection".

C. In the event of inclement weather, the Contractor and subcontractors shall protect the Work and materials from damage or injury from the weather. If, in the opinion of the Program Manager, any portion of the Work or materials has been damaged by reason of failure on the part of the Contractor or subcontractors to so protect the Work, such Work and materials shall be removed and replaced with new materials and Work to the satisfaction of the Program Manager.

D. The Contractor is responsible for snow removal required to maintain access to the construction site and to perform his work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF WEATHER PROTECTION STANDARD

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SECTION 01510

PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.01 DESCRIPTION

A. The work in this section includes the protection of existing utilities, trees and plantings, and archaeological and paleontological finds susceptible to effects from the construction operations.

B. Related Work Described Elsewhere:
   1. General Specifications, Section 01000
   2. Miscellaneous and Special Project Requirements, Section 01100
   3. Construction Facilities and Temporary Services, Section 01500

1.02 CONTRACTOR SUBMITTALS TO OWNER

A. Copies of correspondence with utilities impacted by construction.

B. Copies of all correspondence with property owners affected by construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROTECTION OF WORK AND PROPERTY

A. The Contractor shall:
   1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
   2. Not cut off any residence or business from vehicular traffic for a period exceeding 1 hour unless special arrangements have been made.
   3. Maintain in continuous service all existing oil and gas pipelines; underground power, telephone or communication cable; water mains; irrigation lines; sewers; poles and overhead power; and all other utilities encountered along the line of work, unless other arrangements satisfactory to owners of said utilities have been made.
   4. Coordinate all activities with owner of said utility and perform all work to their satisfaction where completion of Work requires temporary or permanent removal and/or relocation of an existing utility.
   5. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
   6. Keep fire hydrants and water control valves free from obstruction and available for use at all times.

7. In areas where Contractor's operations are adjacent to or near a utility such as gas, telephone, television, electric power, water, sewer, or irrigation system and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection thereof have been made by Contractor.
8. Notify property owners and utility offices that may be affected by construction operations at least 2 days in advance. Before exposing a utility, the Contractor shall obtain the utility owner's permission. Should service of utility be interrupted due to the Contractor's operation, the Contractor shall notify the proper authority immediately. He shall cooperate with said authority in restoring service as promptly as possible and bear costs incurred.
9. Not impair operation of existing sewer systems, and shall prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.
10. Maintain site drainage at all times.

B. For all trees and plantings, the Contractor shall:
   1. Protect from damage and preserve trees, shrubs, and other plants outside the limits of the Work and within limits of the Work, which are designated on the Drawings to remain undisturbed.
   2. All work affecting/impacting trees shall be coordinated with the appropriate City department head in advance.
   3. The Contractor shall:
      a. Employ hand excavation as necessary to prevent tree injury.
      b. Not stockpile materials or permit traffic within drip lines of trees.
      c. Provide and maintain temporary barricades around trees.
      d. Water vegetation as necessary to maintain health.
      e. Cover temporarily exposed roots with wet burlap and keep the burlap moist until soil is replaced around the roots.
      f. Not remove trees, except those specifically shown on Drawings to be removed.
      g. Dispose of removed trees in a legal manner off the site.
      h. Not burn trees or waste materials.
   4. Ball and burlap trees that are to be moved and replanted, in conformance with the recommended specifications set forth in the American Standards for Nursery Stock, published by American Association of Nurserymen. All balls shall be firm and intact. Handle ball and burlap trees by the ball and not by the top.
   5. In the event of damage to bark, trunks, limbs, or roots of plants that are not designated for removal, treat damage by corrective pruning, bark tracing, application of a heavy coating of tree paint, and other accepted horticultural and tree surgery practices as authorized by the City Forester.
   6. Replace each plant that was to remain but dies as a result of construction activities.

C. Existing Structures: Where Contractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with the Contractor's operations, he shall obtain approval of the property owner and Owner. Replace those removed in a condition equal to or better than original.

D. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.

E. For any archaeological and paleontological finds the following conditions are in effect:
   1. The Contractor shall immediately notify NBC and Program Manager/Construction Manager and proceed in accordance with the Contract Agreement should finds of an archaeological or paleontological nature be made within the limits of the site. Continue Work in other areas without interruption.
   2. Archaeological Finds are defined as evidence of human occupation or use of an area within the contract limits prior to the Year 1680. Evidence may consist of skeletons, stone, or other utensils, or evidence of habitations or structures.
   3. Paleontological Finds are defined as evidence of prehistoric plant or animal life, such as skeletons, bones, fossils, or casts and other indications such as pictographs.
   4. NBC may order Work stopped in other areas if, in NBC's opinion, the find is more extensive than may appear from uncovered material.
   5. The Contractor shall provide protection of finds as follows:
      a. Cover, fence, or otherwise protect finds until notice to resume Work is given.
      b. Cover finds with plastic film held in place by earth, rocks, or other weights placed outside the find. Should additional backfilling be necessary for safety or to prevent caving, place backfill material loosely over the plastic film.
      c. Sheet or shore as necessary to protect excavations underway. Place temporary fence to prevent unauthorized access.
      d. Dewater finds made below the water table as necessary to protect construction Work underway. Divert groundwater or surface runoff away from find by ditching or other acceptable means.
   6. The Contractor shall abide by the following requirements regarding removal of finds:
      a. Unless otherwise determined by the NBC, all finds are the property of the NBC. Do not remove or disturb finds without the NBC's written authorization.
      b. Should NBC elect to have a find removed, provide equipment, labor, and material to permit the safe removal of the find without damage. Provide transportation for delivery to individuals, institutions, or other places as the NBC may find desirable, expedient, or required by law.

F. For endangered species, the Contractor shall abide by the following:
   1. Take precautions necessary and prudent to protect native endangered flora and fauna.
   2. Notify Program Manager/Construction Manager of construction activities that might threaten endangered species or their habitats.

END OF PROTECTION OF EXISTING FACILITIES

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SECTION 01540

SECURITY

PART 1 GENERAL

1.01 SECURITY PROGRAM

A. Protect work from theft, vandalism and unauthorized entry.

B. Initiate security program at Contractor mobilization.

C. Maintain security program throughout construction period until Owner acceptance precludes the need for contractor security.

D. The Contractor and Subcontractors are wholly responsible for the security of their site office, storage compound, and laydown area for all its plant, material, equipment and tools at all times.

E. The Contractor's overall security program must be coordinated with the Owner's security system, as specified herein. All personnel are required to abide by the Owner's security system.

F. National Grid maintains temporary controls to limit access in and around the electrical substation which may impact the Contractor's access around the project area. The Contractor shall coordinate site access needs with National Grid at regular intervals throughout the project to ensure suitable access and security of the site is maintained.

1.02 ENTRY CONTROL

A. Allow entrance to assigned work and staging areas only to authorized persons.

1.03 NARRAGANSETT BAY COMMISSION RULES AND REGULATIONS

A. The following restrictions apply to all project personnel while on Narragansett Bay Commission property. These restrictions shall apply to all project sites, including those on property not owned by the Narragansett Bay Commission, to the extent they are applicable. Failure to comply will be cause for dismissal or denial of access to the Project.

B. Prohibited Items or Actions
   1. Firearms and lethal weapons.
   2. Possession of alcoholic beverages, non-prescription depressant or stimulant drugs, and being under the influence thereof. Any persons under the influence or in possession of either alcohol or non-prescription or illegal drugs shall be immediately removed from the project and will be subject to permanent access denial and/or dismissal.
   3. Gaming devices and the use thereof, including but not limited to playing cards, dice, etc.
   4. Sabotage, vandalism, or negligently operating equipment or vehicles.
   5. Fighting. Participants will be subject to immediate removal and/or dismissal.
   6. Theft of unauthorized removal of tools or material.
   7. Failure to use sanitary facilities.
   8. Entering unauthorized areas.
   9. Violating safety rules.
   10. Making false statements or falsifying records or reports.

11. Horseplay.
12. Littering.
13. Negligently damaging property of the Owner.
14. Hot plates, stoves or open fires.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECURITY

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for cleaning, maintenance of the site, barriers and fences required during construction.

1.02 CLEANING DURING CONSTRUCTION

A. Unless otherwise specified under the various trade Sections of the Specifications, the General Contractor shall perform clean-up operations during construction as herein specified.

1. Control accumulation of waste materials and rubbish; periodically dispose of off-site. Bear all costs, including fees resulting from disposal.
2. Clean interior areas prior to start finish work and maintain areas free of dust and other contaminants during finishing operations.
3. Maintain project in accordance with all local, State and Federal Regulatory Requirements.
4. Store volatile wastes in covered metal containers, and remove from premises.
5. Prevent accumulation of wastes that create hazardous conditions.
6. Provide adequate ventilation during use of volatile or noxious substances

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on site.
2. Do not dispose or 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.
4. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
5. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.
6. Execute cleaning to ensure that the buildings, the sites, and adjacent properties are maintained free from accumulations of waste materials and rubbish and wind blown debris, resulting from construction operations.
7. Provide on-site containers for collection of waste materials, debris, and rubbish.
8. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas off the construction site.
9. Handle material in a controlled manner with as little handling as possible. Do not drop or throw materials from heights.
10. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not damage surrounding surfaces.
11. During its progress, the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

12. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes, structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc. shall, upon completion of the work, be left in a clean and neat condition.

1.03 DUST CONTROL

A. Provide adequate means for the purpose of preventing dust caused by construction operations throughout the period of the construction contract.

B. This provision does not supersede any specific requirements for methods of construction or applicable general conditions or performance obligations of the General Contractor.

1.04 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts for clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Construct sediment control devices for discharge from dewatering trenches.

G. Construct all sedimentation control devices shown on the plans.

1.05 NOISE CONTROL

A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum.

B. Execute construction work by methods and by use of equipment which will reduce excess noise.

1. Equip air compressors with Silencers, and power equipment with mufflers.
2. Manage vehicular traffic and scheduling to reduce noise.

1.06 POLLUTION CONTROL

A. Special care shall be taken to prevent contamination or muddying up or interfering in any way with the stream flows, if any along the line of work. No waste matter of any kind will be allowed to discharge into the stream flows or impounded water of any pools or other bodies of water.

1.07 SURFACE WATER CONTROL

A. Take all precautions to prevent damage to the work or equipment by high waters or by storms. The Engineer with the approval of the Owner may prohibit the carrying out of any work at any time when in his judgment, high water or storm conditions are unfavorable or not suitable, or at any time, regardless of the weather, when proper precautions are not being taken to safeguard previously constructed work or work in progress.

B. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Engineer may require, at no additional expense to the Owner.

1.08 BARRIERS AND ENCLOSURES

A. Fences and Barricades

1. Provide and maintain temporary fences, barriers, lights, guardrails, and barricades as indicated in the Contract Documents, or as necessary to secure the Work and adjacent property, and protect persons and property.
2. Obtain necessary approvals and permits and provide temporary expedients as necessary to accommodate tasks requiring items mentioned herein.

B. Protection of Trees

1. The Contractor shall take care not to harm trees along the sides of roads or with in the existing facility in which the construction work is to be done or trees on adjacent lands except as indicated on the drawings or with the written permission of the Owner and any other owner of the trees involved. Care shall be taken not to cut tree roots so as to harm the growth of trees to remain.
2. If, in the opinion of the Engineer, any trees damaged during construction can be repaired, the Contractor shall satisfactorily repair same at no further cost to the Owner.
3. If, in the opinion of the Engineer, any tree damaged during construction cannot be repaired and should be removed, the Contractor shall satisfactorily remove and replace, in kind, same at no further cost to the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01570

TRAFFIC REGULATIONS

PART 1 GENERAL

1.01 SCOPE

A. This Section specifies the general requirements for traffic regulation, minimum performance criteria for maintenance and protection of traffic, road closures, and coordination with other parties for the duration of the Work.

B. The Contractor shall be responsible for the maintenance and protection of traffic on public roadways impacted by its operations for the duration of the Work. The Contractor shall bear all costs for designing, furnishing, and maintaining traffic control facilities for the duration of the Work.

C. The Contractor shall obtain permission from the City of Pawtucket to temporarily close lanes and for other temporary traffic control measures required in performing the Work.

D. The Contractor shall coordinate its traffic control facilities with the schedule restrictions and construction operations of other parties as specified herein and specified by Section 01010 and Section 01100.

E. Related work described elsewhere:
1. General Specifications, Section 01000
2. Summary of Work and Contract Milestones, Section 01010
3. Permits and Regulatory Requirements, Section 01060
4. Miscellaneous and Special Project Requirements, Section 01100
5. Construction Facilities and Temporary Services, 01500
6. Policing, Section 01576

1.02 REFERENCE STANDARDS

A. Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

B. Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction.

PART 2 PRODUCTS

2.01 TRAFFIC DEVICES AND MARKINGS

A. Traffic devices and markings shall conform to Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction Divisions I & III and the FHWA Manual on Uniform Traffic Control Devices (MUTCD), latest edition.

2.02 TRAFFIC CONTROL FACILITIES

A. Temporary traffic control equipment shall be furnished by the Contractor at the start of construction, adjusted as needed throughout the course of the Work and removed or restored at the completion of the Work and shall include, but shall not be limited to traffic barriers, channelizing devices, signage, re-striping, work zone warnings and flashing arrow boards.

B. The Contractor shall restore all public roadways, highways, and traffic control devices to a condition equal to, or better than that that existed prior to the Work.

PART 3 EXECUTION

3.01 MAINTENANCE OF TRAFFIC AND TRAFFIC CONTROL DEVICES

A. The Contractor shall not close any State or City streets or rights-of-way without prior permission from the Rhode Island Department of Transportation and/or City of Pawtucket. The Contractor shall maintain existing traffic flows to all areas adjacent to the work areas. The Contractor shall not close or obstruct any portion of a street, road, or private way that shall be rendered unsafe by the Contractor's operations. Instead, the Contractor shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.

B. Streets, roads, private ways, and walks not closed, shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for adequacy and safety of provisions made therefore.

C. The Contractor shall, at least seven (7) days in advance, notify the Owner and PM/CM in writing if the closure of a street or road is necessary and at least two (2) days in advance, notify the Police and Fire Department in writing, with a copy of written notice provided to PM/CM and Owner. The Contractor shall cooperate with the Police Department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

D. Throughout the duration of the Work, the Contractor shall maintain all temporary and permanent traffic control facilities, signs, barricades and other protective devices in a sturdy, clean, legible condition and at the locations designated by the Maintenance and Protection of Traffic (MPOT) Plan. The Contractor shall cover or remove signs not in use. Maintenance of devices will include repairing; adjusting; washing; repainting, and the re-application of reflective sheeting.

E. Care shall be exercised such that weeds, shrubbery, and construction materials, equipment, and spoils do not obscure the message of any sign, light, or barricade.

F. No defective and/or damaged devices shall be installed. Devices showing defects or damage shall be either repaired or removed and replaced at no additional cost to the Owner.

G. Any and all costs, including Owner and Program Manager's costs, of fines levied for violation of any permit requirements which are a direct result of Contractor's performance or non-compliance with issues, permits, or applicable regulations shall be paid by Contractor at no cost to the Owner.

3.02 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Maintenance and Protection of Traffic (MPOT) procedures shall be implemented so that the duration and physical extent of any temporary lane closure is minimized. The MPOT procedures and the Contractor's use of laydown shall also be designed to minimize the need for Police details to be provided in accordance with Section 01576.

B. It is anticipated that the Work proposed be completed using a combination of typical lane shift and typical lane closure setups, as depicted on Sheet T-2 of the Drawings. However, the means of MPOT shall be established by the Contractor and approved by the City of Pawtucket.

3.03 PARKING

A. The Contractor shall be responsible for managing employee parking throughout the duration of the Contract. The Contractor shall secure and establish parking at the work site in a legal and safe manner that does not adversely affect traffic flows on public roads.

B. The Contractor is responsible for all cost associated with no parking postings.

3.04 ROAD MAINTENANCE AND SITE ACCESS

A. Contractor shall establish entrances and exits to the site that are acceptable to Owner and do not adversely affect traffic flows on public roads.

B. Contractor shall install and maintain wheel wash facilities at all project work areas.

C. The Contractor shall retain the services of a street sweeper to remove all muck and dust tracked onto public roadways due to its operations. Sweeping shall be conducted to the satisfaction of the Owner in accordance with project requirements.

3.05 SEQUENCE OF CONSTRUCTION

A. In accordance with Section 01810.

END OF TRAFFIC REGULATION

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SECTION 01576

POLICING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. When, in the opinion of the Owner or the Program Manager, public safety or convenience requires the services of police, the Owner or Program Manager may direct the Contractor to provide manpower to direct traffic within the location of work under this Contract.

B. When so directed, the Contractor shall make all arrangements for obtaining the necessary manpower. All costs for policing will be paid by the Owner. The Contractor shall pay all incidental costs related to the coordination for these services. Contractor shall obtain police detail slips and transmit with applications for payment.

C. Contractor will be responsible to pay all fines, fees, and costs imposed due to sudden cancellation of police details.

D. The intent is to ensure public safety by police direction of traffic. Police are not to serve as watchmen to protect the Contractor's equipment and materials, or to warn pedestrians of such hazards as open trenches.

E. Nothing contained herein shall be construed as relieving the Contractor of any of his responsibilities for protection of persons and property under the terms of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF POLICING

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SECTION 01580

PROJECT SIGNS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for fabricating and erecting Project and State Revolving Fund signs.

B. Related Sections

1. Section 01067 – Federal and State Requirements

2. Appendices

1.02 SEQUENCING

A. Signage to be in place prior to construction.

PART 2 PRODUCTS

2.01 FABRICATION

A. Project Sign

1. Construct and illustrate signage as detailed in the Appendices of the Specification.

B. State Revolving Fund Sign

1. Construct and illustrate signage as detailed in Specification SECTION 01067. Insert the following names into the appropriate locations on the sign.

   a. Chairman – Merrill W. Sherman
   b. Executive Director – Jeffrey R. Diehl
   c. Governor – Gina M. Raimondo
   d. Director – RIDEM – Janet L. Coit

PART 3 EXECUTION

3.01 ERECTION

A. Erect in accordance with the details in the Specifications.

3.02 INSTALLATION

A. Install at the location designated by the Owner.

END OF SECTION

SECTION 01590

FIELD OFFICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Contractor's and Engineer's field offices.

1.02 CONTRACTOR'S FIELD OFFICE

A. Maintain a temporary field office near the work for his own use during the period of construction at which readily accessible copies of all contract documents shall be kept. Locate field office where it will not interfere with the progress of the Work. In charge of this office there shall be a responsible contractor superintendent.

1.03 ENGINEER'S FIELD OFFICE

A. Prior to starting work at the site, provide and equip a suitable office for the exclusive use of the Engineer, and maintain this office until the completion of the Work under this Contract. This office shall be a separate building located, as directed, where it will not interfere with the progress of the work. An approved, suitably constructed and equipped trailer of adequate size and design for the purpose may be furnished as the Engineer's office. The office, furniture, equipment, and services necessary shall be satisfactory to the Engineer.

B. The office shall be of suitable height and of ample size to accommodate the furniture and equipment listed below, without crowding (at least 400 sq. ft. of floor area). It shall be weather tight; the walls and roof shall be insulated with at least 1/2-in. insulating board suitably ventilated; and the floor shall be tight and of double-thick construction. The office shall have at least three screened windows which can be both opened and locked shut and the door shall have a cylinder lock with two keys. There also shall be a screen door.

C. Provide acceptable toilet facilities within the office for the exclusive use of the Engineer. The Contractor shall make all water and sewer connections and pay all charges for such connections.

D. Furnish the following furniture, equipment, supplies, and services:

1. One plan table or sloping plan shelves, each about 3 ft. by 5 ft., with a reasonably smooth top, and two suitable swivel stools.
2. 8 foot long conference table with 10 chairs.
3. Shelves as directed.

4. Electric lights and outlets as directed. The Contractor shall pay all charges for the energy used.
5. Broom and dustpan.
6. Two desks for general office use, each about 3 ft. by 5 ft., one with desk chairs of the armchair swivel type.
7. Plan rack, as directed.
8. One fireproof four-drawer, legal size, metal filing cabinets, each with lock.
9. Private line telephone and one extension telephones. The Contractor shall pay all charges.
10. Carbon dioxide type fire extinguisher of at least 4-lb. capacity.
11. Telephone answering machine.
12. A printer/copy/scanner machine with supplies and service.
13. Facsimile machine with supplies, and dedicated telephone line. The Contractor shall pay all charges.
14. Supply of drinking water in a suitable cooler or other approved container.
15. Janitor service.
16. Paper cups, paper towels, liquid soap, and toilet paper; each with suitable dispenser or holder.
17. Thermostatically controlled heating unit or system of adequate capacity to maintain a minimum temperature of not less than 68 degrees. F. under all cold weather conditions.
18. Thermostatically controlled, refrigerant type, air conditioners of adequate capacity to maintain a maximum temperature of not more than 72 degrees F. under all hot weather conditions.
19. Metal clothing lockers, each 12-in. wide by 8-in. deep by 72-in. high, minimum dimensions, or suitable closet.
20. Modem with Internet service.
21. Wireless router

1.04 REMOVAL OF OFFICES

A. Remove the Engineer's field office and all other temporary facilities from the site, after the date of completion of the Work as stated in the final estimate, unless otherwise directed by the Engineer. The field office and temporary facilities shall become the Contractor's property and the premises shall be left in a condition acceptable to the Engineer.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

END OF SECTION

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SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Install equipment and materials as specified and as indicated in accordance with the requirements of the specification sections in Divisions 2 through 16, and in accordance with the general installation requirements specified herein.

B. Provide transportation, handling, storage, and protection of all materials and equipment as specified herein.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically required by the Contract Documents.

B. Where similar Products (such as grease fittings, flexible couplings, etc.) are used on different pieces of equipment or in different areas within the Work, standardize the Products by providing all Products from the same supplier.

2.02 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

A. These requirements shall constitute the acceptable minimum standards for the equipment specified herein. Should these requirements conflict with the Supplier's recommendations or the requirements in Divisions 2 through 16, or in any way be less stringent than Supplier's requirements or the requirements in Divisions 2 through 16, they shall be superseded by the more stringent of the Supplier's requirements or the requirements in Divisions 2 through 16.

B. Bolts, Anchor Bolts and Nuts:

1. Furnish bolts, anchor bolts, nuts, washers, plates and bolt sleeves. Anchor bolts shall have washers and hexagonal nuts.
2. Provide stainless steel anchor bolts, nuts, washers, plates, and bolt sleeves unless otherwise indicated or specified.
3. Furnish expansion bolts with malleable iron and lead composition elements.
4. Unless otherwise specified, stud, tap, and machine bolts and nuts shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307-80. Use Hexagonal nuts of the same quality of metal as the bolts. All threads shall be clean cut and shall conform to ANSI Standard B1,1-1974 for Unified Inch Screw Threads (UN and UNR Thread Form).
5. Bolts, anchor bolts, nuts, and washers specified to be galvanized shall be zinc coated, after being threaded, by the hot-dip process in conformity with the ASTM Standard Specifications for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip, Designation A123-78, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153-80.

6. Bolts, anchor bolts, nuts, and washers specified to be stainless steel shall be certified SAE Type 316 stainless steel.

C. Grease Fittings

1. Provide extension fittings and tubing on all grease fittings that are installed so that equipment can be lubricated from the operating level without the use of ladders, staging, or shutting down the equipment. Tubing shall be of corrosion resistant materials compatible with the material to which it is attached.

D. Concrete Inserts

1. Use concrete inserts for hangers to completely support the maximum load that can be imposed by the hangers used in the inserts. Provide inserts for hangers of a type which will permit adjustment of the hangers both horizontally (in one plane), and vertically, and locking of the hanger head or nut. Galvanize all inserts by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shape, Plates, Bars and Strip, Designation A123-78, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel hardware, Designation A153-80.
2. Inserts cast in concrete shall be furnished by the Subcontractor for the trade whose work requires them and delivered to the Contractor for installation.

E. Sleeves

1. Unless otherwise indicated or specified, form openings for the passage of pipes, conduits, and circular ducts through floors and walls using sleeves of standard weight, galvanized-steel pipe conforming to ASTM A53. Provided sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit expansion. Provide sleeves that are flush at the walls and at the bottom of slabs. Sleeves must project one inch above the finished floor surface. Threaded nipples shall not be used as sleeves.
2. Sleeves in exterior walls below ground or in walls that have liquids on one or both sides shall have a 2-inch annular fin of 1/8 in. plate welded with a continuous weld completely around the sleeve at mid-length. Sleeves shall be hot-dipped galvanized after the fins are attached.
3. Sleeves cast in concrete shall be furnished by the Subcontractor for the trade whose work requires them and delivered to the Contractor for installation.
4. Sleeves in masonry walls shall be furnished by the Subcontractor for the trade whose work requires them and delivered to the Masonry subcontractor for installation.
5. Submit plan drawing on sleeves.

F. Equipment Drive Guards

1. Provide all equipment driven by open shafts, belts, chains, or gears with all-metal guards enclosing the drive mechanism. Construct guards of galvanized sheet steel, galvanized woven wire, or expanded metal set in a frame of galvanized steel members. Secure guards in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform to all safety codes and regulations.

G. Protection Against Electrolysis

1. Where dissimilar metals are used in conjunction with each other, provide insulation between adjoining surfaces to eliminate direct contact and any resultant electrolysis. Provide bituminous insulation, heavy bituminous coatings, nonmetallic separators or washers, impregnated felt, or similar arrangement.

H. Equipment Foundations

1. The Contractor shall furnish the necessary materials and construct suitable concrete foundations for all equipment installed by him, 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.
2. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

PART 3 EXECUTION

3.01 TRANSPORTATION, DELIVERY, AND HANDLING

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 one month prior to installation without written authorization from the Program Manager.

C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.

D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storage, unpacking, protecting and installing.

E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.

F. Provide necessary equipment and personnel to unload all items delivered to the site.

G. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. Notify Program Manager verbally, and in writing, of any problems.

3.02 STORAGE AND PROTECTION

A. Store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible.

B. At least 30 days prior to storing equipment, submit to the Program Manager for approval, a protective maintenance schedule, based on Supplier's instructions, detailing proposed procedures for each piece of equipment placed into storage. On equipment placed in storage, permanently attach equipment maintenance record card. The record card shall indicate the protective procedure to be taken, the date work is actually performed, and signature of the Contractor's technician actually

performing the work. Equipment will not be approved for release from storage unless all record cards are signed and dated.

C. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

D. 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 accumulations of dirt and grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner 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 and cracking and keep spalling to a minimum.

E. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) shall be stored in a weathertight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Program Manager. Building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.

1. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer.
2. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". 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.
3. 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.

F. Prior to installation of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty 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. All materials which, in the opinion of the Program Manager, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work and the Contractor shall receive no compensation for the damaged material or its removal.

H. Storage locations must be approved by the Program Manager.

3.03 GENERAL MATERIAL AND EQUIPMENT INSTALLATION REQUIREMENTS

A. These requirements shall constitute the acceptable minimum standards for installing the equipment specified herein. Should these requirements conflict with the Supplier's recommendations or in any way be less stringent than the Supplier's requirements, they shall be superseded by the Supplier's requirements.

B. Bolts, Anchor Bolts, and Nuts

1. Set anchor bolts and expansion bolts as indicated and as specified. If anchor bolts are set before the concrete has been placed, use templates. Where indicated, or specified, provide anchor bolts with square plates at least 4 in. by 4 in. by 3/8 in., or with square heads and washers set in the concrete forms with pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, do all drilling and grouting or caulking without damaging the structure or finish by cracking, chipping, or spalling.

C. Equipment Foundations and Grouting

1. In setting pumps, motors, and other grouted equipment, make an allowance of at least one inch for grout under the equipment bases. Use steel shims to level and adjust the bases. Shims may be left embedded in the grout, in which case they shall be installed neatly and inconspicuously in the completed work. Use non-shrinking grout.
2. Mix and place grout in accordance with the recommendations of the Supplier and as specified. Place grout through the grout holes in the base, work outward and under the edges of the base, and across the rough top of the concrete foundation to a peripheral form to provide a chamfer around the top edge of the finished foundation.
3. After the grout has hardened, remove all forms, hoppers, and excess grout. Patch all exposed grout surfaces, give a burlap-rubbed finish, and paint with at least two coats of an acceptable paint in accordance with specifications.

D. Sleeves and Openings

1. Provide all chases or openings for the installation of the Work or cut the same in existing Work. Provide all sleeves or forms at the Work, and set them as indicated and as specified, and in ample time to prevent delays. Locate all chases, openings, and sleeves as specified and indicated. If the location is not specified or indicated locate all openings to avoid interference with equipment and piping.
2. If these openings and/or sleeves were not provided prior to concrete placements, the Contractor shall provide and set them afterwards at no additional cost to the Owner. Confine the cutting to smallest extent possible. In no case shall piers or structural members be cut without the written consent of the Program Manager.
3. Fit around, close up, repair, patch, and point around the work specified herein to the satisfaction of the Program Manager.
4. Perform all of this work by workman using small hand tools. Do not use power tools except where, in the opinion of the Program Manager, the type of tool proposed can be used without damage to any work or structures and without interference with the operation of any facilities. The Program Manager's concurrence with the type of tools shall not in any way relieve or diminish the responsibility of the Contractor for such damage, or interference resulting from the use of such tools.
5. Do not cut or alter the work of any subcontractor or any other contractor, nor permit any subcontractor to cut or alter the work of any other contractor or subcontractor, except with the written consent of the contractor or subcontractor whose work is to be cut or altered, and with the written consent of the Program Manager. All cutting and patching or repairing made necessary by the Contractor or any subcontractors shall be done at no additional cost to the Owner.

END OF MATERIALS AND EQUIPMENT

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SECTION 01630

SUBSTITUTIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes the requirements related to substitutions.

1.02 EQUIVALENT MATERIALS AND EQUIPMENT

A. Whenever a material, article or method is specified or described by using the name of a proprietary product or the name of a particular manufacturer(s) or vendor(s), the specific item mentioned shall be understood as establishing the type, function, dimension, appearance, and quality desired and is to be the basis upon which bids are to be prepared. Other manufacturer's materials, articles and methods not named will be considered as substitutions provided required information to determine conformance with the specifications is submitted in accordance with Section 01300 and provided substitution will not require substantial revisions of the Contract Documents. This applies to specific construction methods when such are required by the Contract Documents.

1.03 BASIS OF BIDS

A. Bids shall be based on materials, articles and methods named and specified in the Contract Documents.

1.04 PROGRAM MANAGER'S DECISION

A. The Program Manager will determine whether or not the material or article submitted is equal to the named material or article. The Program Manager's decisions regarding evaluation of substitutions shall be considered final and binding. Request for time extensions and additional costs based on submission of acceptance or rejection of substitutions will not be allowed.

1.05 REJECTION OF PROPOSED SUBSTITUTION

A. The Program Manager's decision regarding evaluation of substitutions shall be final and binding. Request for time extensions and additional costs based on rejection of substitutions will not be allowed.

B. Substitutions will not be considered at any time if:
   1. Acceptance will require substantial revision of Contract Documents.
   2. Acceptance will create problems in stocking of repair parts or future maintenance by Owner.
   3. The Program Manager determines that the material or article submitted is not equal to the named material or article.
   4. Additional costs are incurred by the Owner.
   5. A time extension is required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SUBSTITUTIONS

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SECTION 01631

USE OF OTHER THAN FIRST NAMED MANUFACTURERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes requirements related to the Contractor's responsibilities when using a named manufacturer or product other than the first named.

1.02 EQUIVALENT MATERIALS AND EQUIPMENT

A. Whenever a material, article, or method is specified or described by using the name of a proprietary product or the name of a particular manufacturer(s) or vendor(s), followed by the phrase "or equal," the specific item mentioned shall be understood as establishing the type, function, dimension, appearance, and quality desired and is to be the basis upon which bids are to be prepared, subject to the provisions of this Section.

B. In every instance, the design was completed using criteria required to accommodate the first named manufacturer. When practical, other named manufacturers were included in the Technical Specifications based upon performance and design criteria comparable to the first named. However, in some instances, the size, shape, loadings, configuration, and/or other design criteria for other named manufacturers may require redesign of the Work. Other named manufacturers may be used subject to the requirements of this Section.

C. When the Contractor uses any manufacturer or product other than the first named in the specifications, which use requires modification to the Work, the Contractor shall, to the satisfaction of the Program Manager, review and revise the design of the Work, including coordination with other Technical Specification sections to ensure that all component units fit and function as a whole, to properly accommodate the use of that product.

D. The Contractor shall bear the costs and liability for all redesigned elements of the Work necessary to properly accommodate the proposed item.

1.03 SUBMITTALS

A. In addition to the requirements of Section 01300, the Contractor shall submit complete data and engineering documents that provide a complete analysis of the proposed item and the extent of the redesign of the Work necessary to properly incorporate the proposed item into the Work. The Contractor shall:

B. Identify each and every element of the design of the Work that must be modified to:

1. Accommodate the proposed item.
2. Coordinate the proposed item with the overall design, inclusive of all related disciplines.
3. Ensure the proper functioning of the entire system in which the item is to be incorporated.

C. Include complete engineering drawings, bearing the seal of a Professional Engineer registered in the State of Rhode Island, addressing all requirements in 1.02 above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF USE OF OTHER THAN FIRST NAMED MANUFACTURERS

SECTION 01650

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Closeout procedures.

2. Final cleaning.

3. Adjusting.

4. Project as-built documents

5. Spare parts and maintenance materials

B. Contract closeout shall verify that construction work is complete and in conformance with the plans and specifications and shall permit the formal contract documentation to be completed.

1.02 DEFINITION

A. Contract Closeout is a planned series of activities that shall verify the completed construction and installed work for the Contract.

B. The Contract Closeout will be comprised of the following components:

1. Substantial Completion

2. Final Completion

3. Guarantee Period

1.03 SUBSTANTIAL COMPLETION:

A. There will be a date of substantial completion certified by the PM/CM. Substantial completion will be determined as follows:

1. The construction must be complete. For this purpose, completion of construction shall be defined in accordance with the following guidelines:

a. The Contractor has completed all site and structure demolition as shown on the Contract drawings and as specified herein.

b. The Contractor has completed the construction and erection of the Work in conformance to the Contract drawings and specifications.

c. The Contractor has disconnected all utilities to the site, as shown on the Contract drawings and as specified herein.

d. The Contractor has completed all site restoration required by the Contract drawings and specifications

2. All shop drawings must have final approval.

1.04 FINAL COMPLETION

A. Prior to final completion, the following tasks must be completed:

1. All items in the punch list must be completed.

2. The Contract closeout documentation must be submitted to and approved by Owner.

3. A response plan to address warranty issue must be submitted and approved by Owner.

1.05 GUARANTEE PERIOD

A. During the guarantee period as defined in General Conditions, the Contractor shall correct all deficiencies.

B. Corrective work will be identified by Owner. The Contractor will be notified of the item(s) requiring corrective work.

C. The Contractor shall begin work on all corrective work within 72 hours of being notified of the deficiency by Owner and will then work continuously until the deficiency is corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Owner detailing a description of the deficiency and the corrective action that was taken. If the Contractor does not begin work within 72 hours of being notified or does not then work continuously to correct the work, the Owner may have the work completed by others and have all costs deducted from money that would otherwise be due to the Contractor.

D. The Contractor will coordinate all corrective work with Owner.

1.06 RECORD DOCUMENTS

A. Throughout the Contract Time, maintain on site, one set of the following Record Documents. Actual revisions to the Work shall be recorded in these documents:

1. Contract Drawings.

2. Specifications.

3. Addenda

4. Change Orders and other Modifications to the Contract Documents.

5. Reviewed shop drawings, product data, and samples, including all sketches, drawings, diagrams, details and tables prepared or used by Contractor to construct or illustrate any portion of the Work.

6. Written interpretations and clarifications.

7. Field Orders.

8. Field test reports properly verified.

9. Photographs.

B. Store As-Built Documents separate from documents used for construction and protect from fire, vandalism, and theft.

C. Record information concurrent with construction progress. Establish survey control onsite and conduct site survey of existing conditions and as-built conditions. Final survey data will be stamped by a Land Surveyor registered in the State of Rhode Island.

D. Record Documents and Shop Drawings: Upon commencement of work and request by the Contractor, one set of reproducible Contract Drawings will be provided to the Contractor for use and reference. If any Drawings are reissued during construction due to approved changes in the Work, a revised copy of affected drawings in the same reproducible form will also be provided to the Contractor. If Contractor requests an electronic CAD version of the Drawings, a copy of CAD files in the latest version of AutoCAD software format will be provided for the Contractor's convenience in establishing a CAD system. CAD files will be provided as a courtesy only and are not part of the contract documents nor are they guaranteed or warranted for accuracy or completeness in any manner. The Contractor shall be fully responsible for any costs associated with use of the CAD files. Contractor solely assumes all risk in using the provided CAD files. If any Drawings are reissued during construction by Owner due to approved changes in the Work, an updated CAD file will also be provided to the Contractor in AutoCAD format to which all of the aforementioned provisions will also apply. For record documentation, the Contractor is required to legibly mark the reproducible Contract Drawings, and all shop drawings and construction drawings to record actual construction including:

1. Measured depths of excavations in relation to finish floor/invert datum.

2. Measured horizontal and vertical locations of excavation limits, underground tunnels, pipelines, utilities, and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

4. Field changes of dimension and detail.

5. Details not on original Contract Drawings.

6. Make the complete set of Record Documents available to Owner for review prior to each Application for Payment. For each review, highlight changes made since the previous review by boldly encircling the change and by describing the change and change number in the revision block at the bottom of the Drawings. Updating the Record Documents by the Contractor is a condition precedent to acceptance of the Application for Payment by the Owner.

7. Prior to submittal of the Contractor's Final Application for Payment, submit two prints of all marked documents. The Owner or its designated representative, upon completion of all work, will record information of the permanent project as-built document based upon documentation furnished by the Contractor, PM/CM, and Program Manager.

8. Point to point wiring diagrams and construction sketches which the electrical contractors have developed to detail project wiring.

9. Lighting circuit wiring which was field designed and not on Contract Drawings.

10. Layout shop drawings for field run construction such as piping, conduit, etc.

11. Field changes to manufacturer's shop drawings.

12. Referencing Request for Information (RFI) of field change notice numbers on as-built drawings.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name, address and telephone number and product model and serial number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and Modifications.

F. Submit Record Documents to Owner with claim for final Application or Payment.

1.07 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Owner inspection.

B. Accompany Owner in inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform with Contract Documents. Punch list items will include work items that are missing, incomplete, damages, not the correct item, or improperly installed or constructed. The Contractor shall correct the punch list items by re-work, modification, or replacement, as appropriate, until the items do conform to the Contract Documents. The punch list shall be produced and maintained by the Contractor, with copies to the Owner and their designated representatives.

C. Provide submittals to Owner that are required by governing or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment, Release and Waiver of Liens and Claims, Affidavit of Payment of Debts and Claims, and remaining releases, waivers, guarantees, and all data required by the Contract Documents.

1.08 FINAL CLEANING

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion:

1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise directed by the Owner.

3. Grade site to provide drainage flow to an approved catch basin or drainage system.

1.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF CONTRACT CLOSEOUT

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SECTION 01800

MAINTENANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for maintaining work completed under this Contract.

1.02 MAINTENANCE PERIOD

A. The general maintenance period for all construction or materials under this Contract shall be one (1) year subsequent to the date of the acceptance of the work by the Owner, or as provided by other sections of this Specification.

B. If the Owner puts any structure or equipment to use prior to acceptance of all work under the Contract, the maintenance period for such structures or equipment shall be calculated from the time use begins.

C. Contractor agrees to replace the material which does not conform to the Contract requirements, and to repair any damage of material or work without cost to the Owner, to satisfaction of Program Manager, in conformance with Contract Documents provided orders for replacement and/or repairs are received in writing by the Contractor within the one-year period.

D. This Section shall in no way limit the duration of the Contractor's responsibility for the correction of any defect due to workmanship or materials provided by the Contractor which are not in compliance with the Contract Documents.

1.03 ABUSE OF WORK

A. Contractor is not obligated to perform work of replacement or repair that he may prove is required because of abuse by parties other than the Contractor, after the date the Owner puts to continuous use the work requiring replacements or repair, or after date the Owner has approved the Certificate of Completion.

1.04 EMERGENCY REPAIRS

A. If the Owner deems necessary, the Owner shall order replacement or repairs be undertaken within 24 hours.

B. If the Contractor delays or fails to make the ordered replacement or repairs within the time specified, the Owner shall have the right to make such replacements or repairs and the expense shall be deducted from moneys due the Contractor, or moneys of the Contractor retained by the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF MAINTENANCE

SECTION 01810

MAINTENANCE OF OPERATIONS AND SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 GENERAL PROVISIONS

A. The existing combined sewers, sanitary sewers, drains, water mains, gas service, electrical service, telephone, and other existing utilities will be maintained in continuous operation by the NBC, Pawtucket Water Supply Board, National Grid, Verizon, City of Pawtucket Department of Public Works, etc. at all times during the entire construction period. The Contractor shall schedule his operations to conform to the requirements specified herein and shall include in his construction progress schedule all events which will impact operation of the existing facilities.

B. The Contractor shall at all times conduct his operations so as to interfere as little as possible with existing utilities. All 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, even though it may be necessary to work outside of normal working hours to meet these requirements. Before starting work which will interfere with the operation of existing facilities, the Contractor shall perform all preparatory work and shall see that all labor, tools, materials, and equipment are made ready and at hand.

C. The Contractor shall make minor modifications in the work relating to existing structures as may be necessary to satisfactorily complete the work, without additional compensation.

1.02 RELATED WORK

A. Section 01000 - General Specifications

B. Section 01010 - Summary of Work and Contract Milestones

C. Section 01300 - Submittals

D. Section 01311 - Construction Scheduling

E. Section 01510 – Protection of Existing Facilities

1.03 SCOPE OF WORK

A. The general items of work included in this construction contract are described in Section 01010 – Summary of Work.

1.04 CONTRACTOR'S AND OWNER'S RESPONSIBILITIES AND LIMITATIONS

A. The Contractor's construction activities shall not disrupt operation of existing utilities, no matter how minor, without the approval of Owner and the utility. Existing infrastructure removed and disposed of as part of the work must be replaced as soon as possible so that service and/or drainage within the area under construction is not adversely affected.

B. The Contractor shall notify the Program Manager in writing of any construction activity that will affect any operations of the Owner, municipality, or public water supplier. Contractor shall also notify Program Manager if he requires assistance from the Owner, municipality, or public water supplier in operating any existing facilities. This notification shall be received at least one week prior to the planned construction work. The request shall clearly detail the Contractor's planned work, how his work will affect the operation of the existing facilities, the estimated duration of the work, and any assistance required of the Owner.

C. The Contractor shall coordinate and cooperate with the public water supplier and local fire department to maintain water distribution and fire protection capability.

D. The Contractor shall notify the Owner, public water supplier, and the local fire department at least forty-eight (48) hours in advance of the time of connecting and disconnecting temporary and permanent facilities so that representatives of the water supplier and fire department may be present at installation or removal of permanent and temporary connections and to permit the public water supplier to inform customers and users as they deem necessary. Pressure testing and/or chlorination shall require a two (2) business day notification. A representative from the public water supplier must witness all testing.

E. Contractor shall be required to submit a temporary bypass plan to the Program Manager for review and approval prior to commencement of work when water bypass is required. The Contractor shall review available water distribution plans to determine the extent of the by-pass necessary, especially where dead ends and division gates may require bypass piping.

F. It is emphasized that the operations of the existing facilities take precedence over all construction activities. Denials of requests from the Contractor for assistance of the Owner, municipality, or public water supplier in modifying their operations shall not be a basis for any claim by the Contractor. Any approved assistance given to the Contractor from the Owner, municipality, or public water supplier will be provided when the parties' schedule and manpower permit. The Contractor shall also provide access to Owner, municipality, and public water supplier to all existing facilities at all times throughout the construction period.

1.05 SEQUENCE OF CONSTRUCTION

A. The detailed schedule for construction shall be based upon the schedule submitted by the Contractor and approved by Owner as specified above. However, as a guide for bidders in the preparation of their bid and for the Contractor in the preparation of his schedule, scheduling requirements and anticipated sequence of construction are described below. Some construction activities may occur simultaneously.

1. Mobilization

2. Construct access road and Erosion & Sedimentation Controls
3. Install dewatering and associated groundwater treatment system for open cut excavations.
4. Construct SOE systems for microtunnel operations
5. Construct OF-217 Outfall Pipe and Structures between the revetment opening and the OF-217 Diversion Structure.
6. Relocate water main on Tidewater Street in the vicinity of OF-217 relocation structure.
7. Demolish Tank Holder #8 as required.
8. Construct working shafts MH 217-7 and MH 217-6
9. Install consolidation conduit by microtunneling between MH 217-7 and the receiving shaft near former Tank Holder #8.
10. Install consolidation conduit by microtunneling between MH 217-6 and MH 217-7.
11. Install OF-217 Diversion Structure and construct consolidation conduit between structure and receiving shaft. Connect OF-217 outfall pipe to OF-217 Diversion Structure.
12. Install consolidation conduit by microtunneling between MH 217-6 and MH 217-5.
13. Construct consolidation conduit between OF-217 Diversion Structure and OF-217 Relocation Structure.
14. Install OF-217 Relocation Structure and connect pipes to structure.
15. Construct consolidation conduit between MH 217-5 and MH 217-4.
16. Final pavement and site restoration.

B. The order of construction shall be subject to the approval of the Owner; such approval or direction, however, shall in no way relieve the Contractor's responsibility to perform the work in strict accordance with the Contract Documents. The Contractor shall note the requirements of Section 01010 and as provided on the drawings with regard to the phasing of construction when developing his work sequence. The Contractor's work sequence must be specifically detailed in a bar chart schedule, which is required under Section 01311.

C. Contractor should note that other investigations being performed under separate contracts may be underway at the time this contract is awarded (e.g., environmental sampling and analysis). Contractor shall coordinate activities, as required, to minimize conflicts with other activities being performed at the site or in the project area.

END OF MAINT. OF OPERATIONS AND SEQ. OF CONSTRUCTION

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DIVISION 2

SITE WORK

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SECTION 02075

SOIL MANAGEMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section includes work associated with soil management and management of contaminated materials within the Right-of-Way and on City Property, as defined herein. The Contractor shall be responsible for excavation, handling, stockpiling, characterization, transport, and disposal of contaminated materials in accordance with applicable federal state and local regulations governing disposal of urban fill and jurisdictional waste.

B. Portions of the project take place within two known contaminated areas:

- **Tidewater:** The Tidewater property is owned by National Grid and is a former manufactured gas plant (MGP). The property is known to have soil and groundwater contamination associated with its former use and is listed as a "state Site" under RIDEM's Remediation Regulations (RIDEM Case No. 95-022). Specification Section 02076.

- **Right-of-Way:** Portions of the project outside the Tidewater property are referred to as the Right-of-Way. This area includes the City of Pawtucket's Town Landing property.

C. Proper controls for worker health and safety protection shall be taken during soil excavation. Excavated soil materials may be re-used on-site as fill within the public right-of-way or publicly owned land, provided the material meets the requirements in Section 02200 EARTHWORK. The Contractor shall be responsible for the disposal of excess and/or unsuitable excavated materials in accordance with applicable Federal, State, and local regulations governing the disposal and reuse of urban fill.

D. The Contractor shall dispose of contaminated materials encountered on City Property and within City Streets in accordance with all applicable laws.

E. In the event of Contractor generated contamination, the Contractor shall be solely responsible for response, notification procedures, clean-up, removal, and disposal at no expense to the Owner. The Contractor shall not be allowed any compensation for "down time" while a determination is made.

F. In the event that the Contractor excavates material for its convenience or temporary facilities outside the limits of excavation and such materials are found to be contaminated and/or hazardous, the Contractor shall be wholly responsible for disposal of the material.

G. Related work and activities associated with the management of contaminated soils are described in the following Sections:

1. Section 01000, General Specifications
2. Section 01060, Permits and Regulatory Requirements
3. Section 01065, Project Safety and Health Specifications
4. Section 01300, Submittals
5. Section 01500, Construction Facilities and Temporary Services
6. Section 02076, Soil Management - Tidewater

7. Section 02100, Mobilization, Site Preparation, and Demobilization
7. Section 02200, Earth Excavation, Backfill, Fill and Grading
8. Section 02240, Construction Water Handling
9. Section 02370, Stormwater Pollution Prevention

1.02 DEFINITIONS

A. Category 1 Soil – Material that exceeds RIDEM R DEC concentrations but is suitable for reuse as alternate daily cover at a non-hazardous solid waste facility (in accordance with RIRRC Alternative Cover Policy or as defined in DEP Policy #COMM-97-001 if the material is proposed for reuse at a Massachusetts landfill).

B. Category 2 Soil – Material which is suitable for solid waste disposal at a non-hazardous solid waste facility, such as the RIRRC Central Landfill.

C. Category 3 Soil: Material tested as being a hazardous waste as defined by the Toxic Substances Control Act (TSCA) or Resource Conservation and Recovery Act (RCRA). Such waste must be disposed off-site as a hazardous waste at an appropriately permitted RCRA facility.

D. Category 4 Soil: Material which tests positive for asbestos (i.e., containing greater than one percent (1%) asbestos) must be handled and disposed at an appropriately permitted facility. Dust mitigation shall be performed during excavation of asbestos-containing material.

E. Suspect Soil: material that exhibits indicators (olfactory, visual, or field screening) of contamination inconsistent with the results of previous investigations.

1.03 SUBMITTALS

A. Submittals shall be made in compliance with the requirements of Section 01300 except as provided for herein.

B. No Work will be permitted to proceed until the required submittals have been received and approved by the PROGRAM MANAGER/CONSTRUCTION MANAGER. In the event the PROGRAM MANAGER/CONSTRUCTION MANAGER requests additional information, it shall be the CONTRACTOR's responsibility to provide such additional information in a complete and timely manner, so that construction can proceed by the date stipulated in the Notice to Proceed.

C. Contaminated soil will be encountered during the work. Prior to the commencement of work, the CONTRACTOR shall submit the following to the PROGRAM MANAGER/CONSTRUCTION MANAGER for approval:

1. Submittal of required certifications demonstrating that personnel are properly trained and qualified to perform the Work in accordance with applicable OSHA regulations and laws governing the Work.

2. Names and qualifications of proposed subcontractors, if any, identifying the tasks to be performed by each proposed Subcontractor.

3. A Proposed Soil Management Plan, including a description of the proposed equipment and decontamination procedures, identification of staging areas for the loading of the contaminated soil, and project schedule.

4. The CONTRACTOR's Site-Specific Health & Safety Plan pursuant to OSHA 1910.120 requirements.

5. Landfills/facilities identified to accept the four categories of soil

D. Approval of submittals by the PROGRAM MANAGER/CONSTRUCTION MANAGER shall not impose any liability upon the PROGRAM MANAGER/CONSTRUCTION MANAGER, nor shall any such approval relieve the CONTRACTOR of his/her responsibilities to meet the requirements and comply with applicable laws, regulations and other applicable requirements under this Contract.

E. The Contractor shall submit to the Program Manager copies of all bills of lading or manifests accompanying any wastes or soils designated for disposal, analytical data, permits and any documents submitted to RIDEM.

1.04 EXISTING ENVIRONMENTAL CONDITIONS

A. Appendix B contains figures, tables, and other summaries of analytical data characterizing anticipated soils contamination along the alignment.

B. The CONTRACTOR shall satisfy himself/herself as to the conditions existing at the Site, the type of equipment required to perform this Work, and the quality and quantity of the materials to be removed.

C. Failure of the CONTRACTOR to become fully acquainted with the available information will not relieve him/her of the responsibility to completely and properly perform the work in full compliance with the Contract Documents. The PROGRAM MANAGER/CONSTRUCTION MANAGER assumes no responsibility for any conclusion or interpretation made by the CONTRACTOR on the basis of information made available by the Owner or PROGRAM MANAGER/CONSTRUCTION MANAGER.

1.05 NOTIFICATION FOR SUSPECT SOIL

A. It shall be the responsibility of the Contractor to immediately notify the Program Manager upon encountering any suspect soil; and to advise as to whether such materials could represent a Reportable Concentration for Soil as defined by RIDEM. It shall also be the responsibility of Contractor to notify RIDEM office of Compliance and Inspection in the event of an emergency release or spill.

1.06 APPLICABLE LAWS AND REGULATIONS

A. The CONTRACTOR is advised that Work under this Section may need to be performed under the requirements of RIDEM's remediation regulations.

B. Work under this Section shall be performed in strict compliance with applicable Federal, State and local laws, rules, regulations related to the handling and off-sitemanagement of contaminated wastes and regulated soil.

C. Pertinent Federal and State Authorities having jurisdiction over this project include:

1. Occupational Safety and Health Administration (OSHA)
2. U.S. Environmental Protection Agency (EPA)
3. Rhode Island Department of Environmental Management (RIDEM)

D. The following OSHA regulations will apply:

1. Occupational Safety and Health Standards, Hazardous Waste Operations and Emergency Response - 29 CFR 1910.120.
2. Safety and Health Regulations for Construction - 29 CFR 1926.

1.07 REFERENCES

A. Rhode Island Department of Environmental Management (RIDEM) Regulations:

1. Rules and Regulations for Hazardous Waste Management (4/19/92, as amended);
2. Rules and Regulations for Investigation and Remediation of Hazardous Materials (8/96, as amended);
3. Oil Pollution Control Regulation (1/31/91); and
4. Solid Waste Regulation No. 1 General Requirements (1/97).

B. OSHA regulation 29 CFR 1910.120.

C. The Occupations Safety & Health Act of 1970, 29 U.S.C. 651 et seq., as amended.

D. Documents

1. "Drop Shaft 213 Consolidation Conduit & OF-217 Consolidation Conduit, Phase III CSO Program: Contract IIIA-4 & IIIA-5, Environmental Technical Memorandum", dated June, 2020, prepared by BETA Group, Inc.

E. All other applicable Federal, State, or local regulations.

PART 2 PRODUCTS

2.01 GENERAL

A. The Contractor shall provide all employees and Subcontractors with personal protective equipment and protective clothing, and training and hazard awareness consistent with the levels of protection for this Work consistent with anticipated soils and groundwater concentrations summarized in Appendix B. The Work shall be coordinated and specifically addressed in Contractor's Health and Safety Program in accordance with Section 01065.

2.02 MATERIALS

A. Polyethylene Sheeting: The material shall be UV resistant and cold crack resistant to –40 degrees F. The material shall be manufactured in a minimum 12-ft seamless width. Label on rolls shall identify thickness, length, width, and manufacturer's mark number. Provided below are material specifications:

1. Bottom Layer – minimum twenty (20) mils thick.
2. Top Layer – minimum ten (10) mils thick

B. Use suitable rope, weighted with tires or sandbags, for hold-downs ties.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall perform excavation of contaminated materials in accordance with Contractor's Health and Safety Program and Section 02200. Contaminated soil excavation work may include contaminated soils excavation, test pits, removal of obstructions, and any incidental work.

B. Excavated soil materials may be re-used on-site as fill within NBC Property, public right-of-way, or publicly owned land, provided the material meets the requirements outlined in Section 02200. Excavated soil materials on privately owned land shall not be reused on-site as fill. Excavated materials shall be disposed of in accordance with all applicable laws and shall be the responsibility of the Contractor.

C. The Contractor shall maintain all required field controls as specified herein throughout the performance of the work.

D. All site health and safety controls shall be fully established and in operation prior to beginning any soil excavation.

3.02 PREPARATION

A. Temporary Storage Areas: Prior to storing contaminated soils in stockpiles at temporary storage areas approved by the Program Manager, the Contractor shall install berm or other perimeter controls around the base of the stockpile area as specified in approved plan.

3.03 EXCAVATION

A. Work and decontamination procedures in areas containing contaminated materials shall be performed in accordance with standard engineering practices.

B. The Contractor shall employ appropriate methods to isolate contaminated soils from non-contaminated areas.

C. The Program Manager may direct the Contractor to excavate additional soils outside the defined area. The Contractor shall perform the Work in accordance with paragraph 3.08 and Bid Allowance.

3.04 STORAGE AND HANDLING OF EXCAVATED MATERIAL

A. The Contractor shall provide a suitable on-site location, located on the work site for the temporary storage/stockpiling of contaminated soils for appropriate laboratory analytical testing prior to disposal. The Contractor shall temporarily stockpile excavated contaminated soil on the construction site in stockpiles pending soil characterization and analytical results. Soil shall be stockpiled in accordance with this Section. The Contractor shall prevent stormwater pollution from stockpiled material by employing perimeter controls, check dams, temporary dewatering and stilling basins as detailed by Section 02370.

B. Prior to storing uncontainerized contaminated soils in stockpiles at temporary storage areas approved by the Program Manager, the Contractor shall install berm or other perimeter controls around the base of the stockpile area as specified in approved plan.

C. Polyethylene sheeting shall cover the stockpiles and appropriate perimeter controls shall be constructed to prevent generation and migration of leachate and diversion of stormwater runoff.

D. Place appropriate bottom layer polyethylene sheeting beneath all stockpiles with a minimum overlap of 18-inches. The polyethylene sheeting shall extend past the limits of the berm a minimum of 12-inches.

E. The Contractor shall inspect perimeter controls at least twice per week, and provide immediate maintenance as necessary.

F. At a minimum, the storage location must be of sufficient size to stockpile those soils and material which are anticipated to be contaminated, separately from those which are not anticipated to be contaminated. The Contractor shall maintain appropriate space between separated piles for the soil volumes expected by the Contractor to be in storage at any one time based on the Contractor's projected work rate, the environmental site conditions described in the reference materials, and the laboratory testing requirements in this section.

G. Off-site storage of contaminated soils is not permitted without prior written approval of the Program Manager.

H. Contaminated soils shall in no case be stockpiled for more than ninety (90) days.

I. The Stockpiles shall be securely barricaded and clearly labeled.

J. Soils shall be suitably dewatered prior to their leaving the site, to prevent free water from developing during transport to the disposal facility

K. Hay bales shall be placed around the stockpile as per Section 02370.

L. The Contractor shall also maintain appropriate dust control, per Section 01500.

M. If stockpiles contain oily soils or debris, the Contractor shall place a minimum 8-inch diameter continuous oil absorbent boom around the entire perimeter of the stockpile.

N. The Contractor shall inspect perimeter controls at least twice per week and provide immediate maintenance as necessary.

3.05 CLEAN FILL

A. Contractors will be required to demonstrate that all imported fill material brought onto the site, or any on-site material proposed to be reused as clean fill, is free of contaminants exceeding the RIDEM R DEC concentrations.

1. Contractor shall indicate source of all imported soil and fill materials proposed for use on the project.
2. Imported and/or onsite soils proposed for reuse shall be sampled and analyzed at a minimum frequency of one sample per 1,000 cubic yards, and at least two samples shall be analyzed for each source. Analysis shall be performed by a laboratory certified in the State of Rhode Island.
3. Contractor shall furnish certificates of analysis and chain of custody documentation of all soil sampling and analysis and shall certify that the material meets project requirements through comparison to the RIDEM R DEC concentrations (including that it meets all other physical requirements stipulated elsewhere in the project specifications). The Contractor shall provide to the Program Manager on a daily basis during excavation copies of field records documenting the location of stockpiled material and stockpile identification data.

3.06 SOIL TRACKING

A. The Contractor shall provide to the Program Manager on a daily basis during excavation copies of field records documenting the location of stockpiled material and stockpile identification data.

B. The Contractor shall document and track all contaminated soils from excavation to final off-site disposal.

3.07 SOIL CHARACTERIZATION

A. Soil and fill material shall be classified based on the criteria established in the accepted SWMP.

B. A summary of existing conditions and investigation findings performed by the Program Manager/Construction Manager during design, including a summary of analytical results, shall be available to the Contractor.

C. The Contractor shall review all the existing conditions information supplied by others. The Contractor shall use the information and shall either perform independent sampling and characterization of soil/fill waste strata to be encountered during construction in advance of excavation such that excavated soil can be segregated and directly transported to an appropriate facility or the contractor shall make the necessary arrangements to secure a staging area(s) suitable for storing soil stockpiles pending analyses, at no additional cost to the Owner.

D. Soil characterization shall be the responsibility of the Contractor. The Contractor shall be responsible for determining the characterization requirements of each disposal facility in advance to facilitate timely disposal and to adequately estimate the disposal costs. The Contractor shall perform additional segregation based on disposal requirements. Disposal or off-site reuse of the material shall depend on sampling and characterization analytical results. At the request of the Program Manager/Construction Manager or Owner, the Contractor shall provide a split sample. The Contractor shall perform or observe all sampling and shall provide notice in advance to the Program Manager/Construction Manager so that the Program Manager/Construction Manager may observe the sampling procedure.

E. Stockpiles within the staging area shall be sampled and characterized within a timely manner so as not to impede construction activities or preclude the reuse of soil/fill on site. If soil/fill cannot be reused on site due to the Contractor's delay in sampling material, the Contractor shall dispose of the soil/fill at no additional cost to the Owner including the additional cost of imported fill material used in its place to meet project requirements.

F. The Contractor shall perform analyses on stockpiles or *in situ* as necessary to fulfill any disposal testing requirements of the approved facilities.

1. The Contractor shall perform sampling and analyses for those tests required by the facilities in excess of those previously performed by the Program Manager.

2. The Contractor shall submit a copy of all sampling analyses to the Program Manager within 2 days of receipt of the laboratory report. Analytical data shall be kept confidential, distributed to facility, Program Manager and RIDEM only.

3. The Contractor shall provide disposal facility letters of final waste acceptance, addressed to RIDEM, based on the stockpile or *in situ* sample analysis.

3.08 EQUIPMENT AND VEHICLE DECONTAMINATION

A. The Contractor shall design and construct a decontamination pad to be used to decontaminate equipment and vehicles existing from contaminated areas. The Contractor

shall be responsible for the maintenance and operation of the decontamination station (decontamination pad and wash down equipment, if necessary) throughout the duration of the work activities. The Contractor shall collect, treat and dispose of decontamination pad wash water, if necessary. At the completion of the project, the Contractor shall dismantle and properly dispose of the decontamination pad and resulting contaminated waste products.

3.09 DISPOSAL

A. The Contractor shall be responsible for disposal of Contaminated Material as documented in Appendix B. The Contractor shall be responsible for preparing and submitting to the Program Manager for review all waste profile applications and questionnaires, and coordination, with disposal facilities and all Federal and State environmental agencies.

B. The Contractor shall submit to the Program Manager, prior to receiving payment, documentation certifying that all materials were transported to, accepted, and disposed of, at the selected disposal facility.

C. Dispose of materials described herein shall be in accordance with all Federal, State, and Local regulations.

D. The Contractor shall perform analyses on stockpiles or *in situ* as necessary to fulfill any disposal testing requirements of the approved facilities. At a minimum, the Contractor shall sample at a frequency of one per 1,000 CY of excavated material. The Contractor shall submit a copy of all sampling analyses to the Program Manager/Construction Manager within 2 days of receipt of the laboratory report. The Contractor shall provide disposal facility letters of final waste acceptance, based on the stockpile or *in situ* sample analysis.

E. The Contractor shall provide to the Program Manager copies of all manifests and truck load forms, with original certified scale weight slips, both tare and gross, for every load weighted and disposed of at the accepted landfills. Individual truck load weight slips shall be tracked by the original manifest document number that was assigned by the Program Manager at the site.

F. Failure to provide manifests and other required forms, truck load tracking sheets, and the weight slips required as payment request backup, may be cause for the Program Manager to withhold payment in an amount which the Program Manager determines is equivalent to the work until such documentation is provided the Contractor.

G. The Contractor shall be responsible for preparing and submitting to the Program Manager for review all waste profile applications and questionnaires, and coordination, with disposal facilities and all Federal and State environmental agencies.

H. The Contractor shall be responsible for preparing all waste profiles, hazardous waste manifests and bills of lading with all applicable analytical backup, notification, and control forms. Contractor shall submit these to the Program Manager for review and approval at least 5 days before transport.

I. The Contractor shall also provide certified tare and gross weight slips for each load received at the designated disposal facility which shall be attached to each returned manifest and bill of lading.

J. The Contractor shall furnish all copies of the waste manifests to the Program Manager for submittal to appropriate Federal and/or State Environmental Agencies and to retain for the Owner's records.

K. The Contractor shall submit to the Program Manager, prior to receiving payment, documentation certifying that all materials were transported to, accepted, and disposed of, at the selected disposal facility.

L. Disposal of materials described herein shall be in accordance with all Federal, State, and Local regulations. The Contractor shall select excavation techniques that will minimize the

amounts of excavated material and shall select the most economical disposal option allowable in accordance with Federal, State, and local environmental agencies having jurisdiction.

3.10 SUSPECT SOIL

A. In the event that the Contractor suspects it has encountered suspect soil, the Contractor shall immediately discontinue its work and make safe the work area. The Contractor shall immediately notify the Program Manager, notify RIDEM in accordance with Section 5.0 of the RIDEM's Rules and Regulations of Hazardous Material Releases and implement the Contractor's Environmental Response Plan for Contaminated Media as required by Section 01065, PROJECT SAFETY AND HEALTH SPECIFICATIONS. Prior to recommencing work at the site of the suspected contamination the Contractor shall be responsible for submitting and receiving approval for its proposed actions from both RIDEM and the Program Manager.

3.11 DUST CONTORL

A. Dust shall be controlled during excavation of soil/fill waste material to limit potential spread of contaminants and potential exposure of contaminants to workers and the public.

B. During construction, real-time dust monitoring shall be conducted under windy and/or excessively dry working conditions or when directed by the Program Manager/Construction Manager. The monitoring shall consist of total dust testing using MIE, INC. MINIRAM PDM-3 DUST MONITORS, or like instruments. The total dust criteria at the site shall conform to the requirements of the HASP. Should fugitive dust quantities exceed 20 percent of the ambient level or action levels indicated within the HASP, the Contractor shall perform additional measures to reduce the total dust concentrations.

C. Nuisance dust levels shall be reduced by pre-wetting the surface soils and by establishing and maintaining clean access roads. The Contractor's Dust, Vapor, and Odor Control Plan shall describe the procedures and materials to minimize dust. At a minimum, the Contractor shall provide clean water, free from salt, oil, and other deleterious materials.

D. Areas of exposed earth to be excavated shall be lightly sprayed with water before excavation if there is potential for nuisance dust generation. Additional water spray may be utilized only when any indication of excessive dust is observed. To the extent feasible, the Contractor shall minimize the use of water within the limits of excavation.

E. Unimproved access roads shall be sprayed with water on a regular basis to minimize the generation of dust.

END OF SECTION

SECTION 02076

SOIL MANAGEMENT – TIDEWATER SITE

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section includes work associated with management of excavated materials within the Tidewater property, as defined herein. The Contractor shall be responsible for excavation, handling, stockpiling, characterization, transport, and disposal of materials generated during excavation activities on the Tidewater Property. Work shall be done in accordance with applicable National Grid guidelines and federal, state and local regulations governing disposal of excavated materials.

B. Proper controls for worker health and safety protection shall be taken during excavation activities in accordance with National Grid guidelines. Contractor shall maintain access to natural gas and electrical substation infrastructure by National Grid employees at all times during the performance of the Work. No separate payment will be made to the Contractor for providing this access or for delays caused by on-going Site operations.

C. Contractor shall coordinate with National Grid electric to temporarily support distribution and transmission poles when excavation is performed adjacent to this electrical infrastructure. Contractor shall perform all Work in a manner to not exceed the ground vibration and movement displacement limits.

D. Contractor shall furnish all labor, equipment, materials, tools, supervision, transportation, and incidentals necessary to characterize, handle, manage, stockpile, dewater, stabilize, segregate, containerize and transport all excess materials to a National Grid-approved reuse, salvage, recycling, treatment and/or disposal facility in accordance with all applicable Laws and Regulations.

E. Contractor is responsible for all fees and other costs, including but not limited to, all tipping fees, state, local and federal taxes, and facility surcharges related to transportation and off-Site disposal.

F. The list of National Grid-approved facilities is included as an attachment to this Section.

G. Contractor shall engage a National Grid-approved, independent testing laboratory to perform all sampling and analytical testing of all excess materials as necessary for waste characterization, handling, transportation, and recycling/treatment/ disposal at National Grid-approved disposal facilities.

H. Contractor shall be responsible for preparation of all waste profiles, Bills of Lading (BOLs), manifests, and other shipping documents. Contractor shall allow a minimum of 14-days for preparation of all disposal documentation requiring National Grid signature.

I. National Grid will arrange for appropriate signatures on all necessary waste profiles and shipping documents as the Generator.

J. All waste transporters shall possess valid licenses and permits issued by authorities having jurisdiction over transporting impacted wastes.

K. Contractor shall contract directly with National Grid-approved facilities to facilitate the off-Site transportation and reuse, salvage, recycling, treatment and/or disposal of all excess materials generated during the Work. Excavated materials may be re-used on-site at the discretion of National Grid. The Contractor shall be responsible for coordination with National Grid, including identifying acceptable stockpile location, preparation of stockpile area and unloading and storing material ready for use by National Grid.

L. Material that cannot be reused on site, at the discretion of National Grid, shall be stockpiled, sampled and loaded and hauled off site at a National Grid approved landfill location. Contractor shall be responsible for coordinating stockpile location, preparing and maintaining stockpile, identification of landfill from National Grid approved list of Landfills and conducting the appropriate sampling, loading and hauling of material to the landfill and completing the appropriate paperwork in coordination with National Grid.

M. In the event of Contractor generated contamination, the Contractor shall be solely responsible for response, notification procedures, clean-up, removal, and disposal at no expense to the National Grid. The Contractor shall not be allowed any compensation for "down time" while a determination is made.

N. In the event that the Contractor excavates material for its convenience or temporary facilities outside the limits of excavation, the Contractor shall be wholly responsible for disposal of the material.

O. Work harmoniously with Site personnel, Program Manager / Construction Manager, the City of Pawtucket, adjacent property National Grids, Contractors performing ongoing construction on the site and all entities engaged by National Grid.

P. Coordinate performance of the Work with all local authorities including police and fire officials.

Q. Related work and activities associated with the management of contaminated soils are described in the following Sections:

1. Section 01000, General Specifications
2. Section 01060, Permits and Regulatory Requirements
3. Section 01065, Project Safety and Health Specifications
4. Section 01300, Submittals
5. Section 01500, Construction Facilities and Temporary Services
6. Section 02075, Soil Management
7. Section 02100, Mobilization, Site Preparation, and Demobilization
7. Section 02200, Earth Excavation, Backfill, Fill and Grading
8. Section 02240, Construction Water Handling
9. Section 02370, Stormwater Pollution Prevention

1.02 DEFINITIONS

A. Excess materials that may be encountered or generated during the Work include, but are not limited to, the following:

1. Impacted Waste – includes waste materials generated during the Work that contain contaminants. These wastes may include: grubbing wastes, demolition debris and excavated materials (soils or sediment). Impacted Grubbing Waste and Debris shall be transported off-Site for disposal. Impacted Soil and Sediment shall be stabilized (as necessary) on-Site and at the discretion of National Grid may be used as fill onsite. Excess material shall be disposed off site at a National Grid Landfill.
2. Scrap Steel – includes non-hazardous and non-impacted steel that has been or always was segregated from non-impacted debris, soil, or sediment. Scrap Steel shall be transported off-Site for recycling.
3. Impacted Asphalt, Brick and Concrete (ABC) and Other Debris (Non-Hazardous) – includes asphalt, brick, and concrete materials or other debris excavated during the Work that are non-hazardous and having come into contact with impacted soil, or sediment, which cannot be sufficiently decontaminated for shipment to a solid waste landfill or ABC recycling facility. Impacted Asphalt and Other Debris shall be transported off-Site for disposal. Impacted Brick and Concrete may be processed to 6-inch minus and used as fill at the discretion of National Grid.
4. Treated/Impacted Wood Waste – includes treated, coal tar impacted, or stained/coated wood waste, including piles and utilities poles excavated and/or pulled/removed during the Work. Includes wood containing or likely to contain asbestos, wood containing chemical preservatives such as, but not limited to, creosote or pentachlorophenol; wood containing paints, stains or other coatings, or adhesives. Treated/Impacted Wood Waste shall be disposed off-Site.
5. Impacted Soil/Sediment – includes soil and/or sediment excavated and/or removed during the Work that has been processed, either by drying, dewatering, bulking, blending, solidifying, stabilizing, sizing, segregating, or other technique, such that, prior to and during transportation and disposal, the soil and/or sediment meets all local, state, and federal transportation requirements and all recycling facility and/or disposal facility requirements, including both physical and analytical requirements. Impacted Soil/Sediment will be either Non-hazardous or Hazardous. These materials shall be further categorized consistent with the following:
   a. Impacted Soil or Sediment - Non-hazardous – includes soil and/or sediment excavated and/or removed during the Work that is nonhazardous. Material may be used as on-site fill material at the discretion of National Grid. Excess material shall be designated for disposal at a National Grid National Grid approved thermal desorption facility or Non-hazardous landfill.
   b. Impacted Soil or Sediment - Hazardous – includes soil and/or sediment excavated and/or removed during the Work that is classified as a hazardous waste. These materials shall be disposed of at a National Grid approved facility.

6. Unsuitable Site Materials – earthen materials (sands, clay, silts, gravels, boulders, etc.) that are Impacted Soils/Sediments (Hazardous or Non-Hazardous) shall be disposed of at a National Grid approved facility.

1.03 SUBMITTALS

A. Submittals shall be made in compliance with the requirements of Section 01300 except as provided for herein.

B. No Work will be permitted to proceed until the required submittals have been received and approved by the PROGRAM MANAGER / CONSTRUCTION MANAGER. In the event the PROGRAM MANAGER / CONSTRUCTION MANAGER requests additional information, it shall be the CONTRACTOR's responsibility to provide such additional information in a complete and timely manner, so that construction can proceed by the date stipulated in the Notice to Proceed.

C. Contaminated soil will be encountered during the work. Prior to the commencement of work, the CONTRACTOR shall submit the following to the PROGRAM MANAGER / CONSTRUCTION MANAGER for approval:

1. Submittal of required certifications demonstrating that personnel are properly trained and qualified to perform the Work in accordance with applicable OSHA regulations and laws governing the Work.
2. Names and qualifications of proposed subcontractors, if any, identifying the tasks to be performed by each proposed Subcontractor.
3. A Proposed Soil Management Plan, including a description of the proposed equipment and decontamination procedures, identification of staging areas for the loading of the contaminated soil, and project schedule.
4. The CONTRACTOR's Site-Specific Health & Safety Plan pursuant to OSHA 1910.120 requirements.
5. Landfills/facilities identified to accept the four categories of soil

D. Approval of submittals by the PROGRAM MANAGER / CONSTRUCTION MANAGER shall not impose any liability upon the PROGRAM MANAGER / CONSTRUCTION MANAGER, nor shall any such approval relieve the CONTRACTOR of his/her responsibilities to meet the requirements and comply with applicable laws, regulations and other applicable requirements under this Contract.

E. The Contractor shall submit to the Program Manager copies of all bills of lading or manifests accompanying any wastes or soils designated for disposal, analytical data, permits and any documents submitted to RIDEM.

F. Action Submittals

1. Product Data: Submit material specifications for all proposed material drying agents not less than 21 days prior to start of Work.

G. Informational Submittals:

1. Impacted Waste Management Plan: Submit plan for managing impacted materials within 14 days of Notice to Proceed and before removing any such materials from the Site. At a minimum, the plan shall include the following:
   a. List of National Grid-approved waste disposal/recycling facilities to be used.
   b. Procedures for managing and separating waste.
   c. Procedures and materials to be used to process, dewater, bulk, blend, solidify, or stabilize excess materials on-Site prior to off-Site transportation.
   d. Description of containers including size, type, and labeling.
   e. Procedures for loading waste materials onto vehicles.
   f. Procedures for loading demolition debris onto vehicles.
2. Waste Profiles:
   a. Submit preliminary waste profiles for each disposal/recycling facility for National Grid signature not less than 14 days prior to disposal.
   b. Submit final waste profile counter-signed by disposal/recycling facility within 7 days of disposal.
3. Contractor shall submit to Program Manager / Construction Manager, within 24 hours of testing completion, a copy of all chain-of-custody forms demonstrating complete record of custody during time of handling and transport for all samples sent to National Grid-approved laboratory
4. Contractor shall submit a copy of analytical testing results from National Grid-approved laboratory, including specific location for each sample identified on a plan, along with the date and time when samples were obtained and other pertinent information to the Program Manager / Construction Manager within 24 hours of testing completion.
5. Contractor shall submit daily disposal truck logs to Program Manager / Construction Manager and include within Daily Activity Reports in accordance with Section 01 32 26 – Construction Progress Reporting. Logs shall include date, waste type, transporter, disposal facility identification and location, BOL or manifest number, vehicle number, driver, and approximate volume and weight of waste.
6. Disposal Receipts: Prior to submission of a progress payment for Work including material disposal, and within 5 days of transportation from the Site, Contractor shall document actual disposal of the waste at the designated facility by providing disposal receipts from the facility to the Program Manager / Construction Manager in accordance with 01300 - Submittal Procedures. Such certificates and receipts shall bear the printed name of the facility operator and shall specify the date of delivery, specify quantity and type of material delivered, weight tickets, and shall be signed by a representative of the facility operator. Payment may be withheld at the discretion of Program Manager / Construction Manager for the disposal of materials for which there are no signed disposal receipts. Where applicable, receipts with tare weights from

certified scales shall be obtained within 2 hours of dumping the load for disposal.

7. Contractor shall submit certificates of recycle for all recycled materials generated during course of Work within Daily Activity Reports. Certificates of recycle shall include date, recycle facility, identification and location, approximate volume, and/or weight of material, and description of recycle methods.

1.04 REQUIREMENTS FOR VEHICLES TRANSPORTING CONTAMINATED WASTE

A. Vehicles transporting contaminated waste shall comply with Laws and Regulations, and shall be permitted, licensed, or certified, as appropriate, by authorities having jurisdiction.

B. Vehicles transporting contaminated waste shall be water-tight and structurally sound, and shall possess functioning tailgate locks and solid, water-proof tarpaulins. License plates and placards shall be properly affixed and visible at all times.

C. Line each vehicle with not less than 6-mil polyethylene sheeting prior to loading contaminated waste.

1.05 EXISTING ENVIRONMENTAL CONDITIONS

A. Appendix D contains figures and tables summarizing data characterizing soils along the alignment. Additional information is available here. http://www.tidewatersite.com/

B. The CONTRACTOR shall satisfy himself/herself as to the conditions existing at the Site, the type of equipment required to perform this Work, and the quality and quantity of the materials to be removed.

C. Failure of the CONTRACTOR to become fully acquainted with the available information will not relieve him/her of the responsibility to completely and properly perform the work in full compliance with the Contract Documents. The PROGRAM MANAGER / CONSTRUCTION MANAGER assumes no responsibility for any conclusion or interpretation made by the CONTRACTOR on the basis of information made available by the National Grid or PROGRAM MANAGER / CONSTRUCTION MANAGER.

1.06 REFERENCES

A. United States Environmental Protection Agency (USEPA) SW-846 Method 9095 Paint Filter Liquids Test.

B. Laws and Regulations applying to the Work under this Section include, but are not limited to the following:

1. 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response.
3. 29 CFR 1926.65 - Hazardous Waste Operations and Emergency Response.
4. 29 CFR 1926.600 through 29 CFR 1926.606, Subpart O - Motor Vehicles, Mechanized Equipment, and Marine Operations.
6. 33 CFR 161, Navigation Safety Regulations.
7. 40 CFR 261.3, 264, and 265, Resource Conservation and Recovery Act (RCRA).
8. 49 CFR 106, Rule-Making Procedures.
9. 49 CFR 107, Hazardous Materials Program Procedures.
10. 49 CFR 171 through 49 CFR 185, Subchapter C – Hazardous Materials Regulations.
11. USEPA 40 CFR 268.
12. Rhode Island Department of Environmental Management (RIDEM) Office of Waste Management, Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (the "Remediation Regulations").
13. RIDEM, Rules and Regulations for Hazardous Waste Management, amended June 2010.
14. RIDEM Air Pollution Control (APC) Regulation No. 5, Fugitive Dust
15. RIDEM APC Regulation No. 9, Air Pollution Control Permits.
16. RIDEM APC Regulation No.17, Odors.
17. RIDEM APC Regulation No. 22, Air Toxics.
18. Posted Weight Limits on Tolls and Bridges.
19. Applicable USEPA Analytical Methods.
20. Remedial Action Work Plan (RAWP), National Grid Former Tidewater Facility, 200 Taft Street, Pawtucket, Rhode Island, RIDEM Site Remediation No. SR-26-0934A (formerly RIDEM Case No. 95-022), June 2018.
21. Remedial Action Work Plan Addendum, Site Remediation No. SR-26-0934A (formerly RIDEM Case No. 95-022), Former Tidewater Facility, 200 Taft Street, Pawtucket, Rhode Island, May 31, 2019.

C. Obtain required permits and approvals for contaminated waste transportation and disposal operations.

D. Comply with hauling and disposal Laws and Regulations of authorities having jurisdiction.

PART 2 PRODUCTS

2.01 GENERAL

A. The Contractor shall provide all employees and Subcontractors with personal protective equipment and protective clothing, and training and hazard awareness consistent with the levels of protection for this Work consistent with requirements of National Grid. The Work shall be coordinated and specifically addressed in Contractor's Health and Safety Program in accordance with Section 01065.

2.02 MATERIALS

A. Polyethylene Sheeting: The material shall be UV resistant and cold crack resistant to –40 degrees F. The material shall be manufactured in a minimum 12-ft seamless width. Label on rolls shall identify thickness, length, width, and manufacturer's mark number. Provided below are material specifications:

1. Bottom Layer – minimum twenty (20) mils thick.
2. Top Layer – minimum ten (10) mils thick

B. Use suitable rope, weighted with tires or sandbags, for hold-downs ties.

C. Drying Agent shall be Soil and sediment drying agent shall be non-biodegradable sorbent complying with 40 CFR 264.314(d)(1). Inorganic minerals, if used, shall contain no more than 50 percent reactive (free) calcium oxide and magnesium oxide by weight.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall perform excavation of contaminated materials in accordance with Contractor's Health and Safety Program and Section 02200. Excavation work may include contaminated soils excavation, test pits, removal of obstructions and foundation materials, and any incidental work.

B. Excavated soil materials may be re-used on-site at the discretion of National Grid, provided the material meets the requirements outlined in Section 02200.

C. Contractor shall notify Program Manager / Construction Manager prior to sampling for waste characterization for off-Site recycling or treatment/disposal. Program Manager / Construction Manager will observe all sampling activities performed by Contractor. Any sampling performed without the knowledge of Program Manager / Construction Manager must be repeated by Contractor to the satisfaction of Program Manager / Construction Manager, at no additional expense to National Grid.

D. Contractor shall coordinate the removal, processing (if applicable), and off-Site transportation of all materials with Program Manager / Construction Manager. The Contractor shall maintain all required field controls as specified herein throughout the performance of the work.

E. All site health and safety controls shall be fully established and in operation prior to beginning any soil excavation.

3.02 PREPARATION

A. Temporary Storage Areas: Prior to storing excavated materials in stockpiles at temporary storage areas approved by National Grid, the Contractor shall install berm or other perimeter controls around the base of the stockpile area as specified in approved plan.

3.03 EXCAVATION

A. Work and decontamination procedures in areas containing contaminated materials shall be performed in accordance with standard engineering practices.

B. The Program Manager may direct the Contractor to excavate additional soils outside the defined area. The Contractor shall perform the Work in accordance with paragraph 3.08 and Bid Allowance.

3.04 STORAGE AND HANDLING OF EXCAVATED MATERIAL

A. Contractor shall dewater, bulk, blend, solidify, or stabilize materials prior to off-Site transportation and disposal so that the material meets all local, state, and federal transportation requirements and all recycling facility and/or disposal facility requirements. Unless specified otherwise, on-Site processing of these materials to meet receiving facility requirements is considered incidental to the Work and no separate payment shall be made for this Work.

B. Contractor shall perform the following tasks for the proper handling and loading of excess materials that shall be transported to the identified Owner-approved recycling or treatment/disposal facilities:

1. Contractor shall arrange and pay for all testing necessary to properly characterize wastes for disposal at the selected facility in accordance with facility requirements. Contractor shall segregate excess material types by hazardous or non-hazardous waste classification, based on results of samples collected during the Work.
2. Excess materials generated during the Work shall be transferred to Contractor's Staging areas in locations outside the 200-foot CRMC jurisdictional limit as shown on the Drawings and pre-approved by National Grid.
3. Individual stockpiles shall not exceed 1,000 cubic yards in size.
4. Stockpiled materials shall be managed by the Contractor and shall be covered at the end of each Work day and during all non-working hours.
5. Contractor shall manage all excess materials such that characterization and removal can be performed efficiently.
    a. Excess materials shall be managed in accordance with applicable laws, regulations, and disposal facility requirements governing transportation, recycling, and treatment/disposal.
    b. Contractor shall employ environmental controls during all processes involving the generation, management, handling, temporary storage, and transportation of all excess materials.
    c. No excess materials shall be stockpiled or stored outside the Limits of Work.
    d. Unsuitable Site Soils/Sediment shall either be loaded onto trucks for off-Site transportation provided that the material meet the requirements of National Grid-approved disposal/recycling facilities or transported to temporary on-Site Staging areas prior to off-Site transportation.
    e. Containerize Construction Water that is collected through dewatering in frac tanks.

C. Contractor shall be responsible for removal of solid waste and debris at the Site throughout the duration of the Work. At all times, Contractor shall ensure that the area within the Limits of Work and the adjoining areas, including roadways, access areas, and storage areas used, are free of solid waste and debris and shall clean up the Site and remove all solid waste and debris as Work progresses.

D. Pack and label materials for transportation following all USEPA, RIDEM, and Rhode Island Department of Transportation (RIDOT) regulations.

E. Contractor shall coordinate the labeling system for excavated material stockpiles, roll-off boxes, and debris stockpiles with Program Manager/Construction Manager and shall, at a

minimum, include location, identification number, date of generation, and estimated quantity.

F. Care should be taken not to overload waste containers. Debris shall be sized, as necessary, and placed in transport containers to achieve appropriate minimum densities.

G. Contractor shall be responsible for maintaining all Contractors Staging areas and covers on stockpiles or transport containers throughout the Work at no additional cost to the Owner.

H. Direct load waste materials to the maximum extent practicable.

I. Load excess materials on vehicles to optimize quantities of each shipment.

J. Inspect each vehicle before it leaves the Site and clean visible soil, sediment or debris.

K. The Contractor shall provide a suitable on-site location approved by National Grid, located on the work site for the temporary storage/stockpiling of contaminated soils for appropriate laboratory analytical testing prior to disposal. The Contractor shall temporarily stockpile excavated contaminated soil on the construction site in stockpiles pending soil characterization and analytical results. Soil shall be stockpiled in accordance with this Section. The Contractor shall prevent stormwater pollution from stockpiled material by employing perimeter controls, check dams, temporary dewatering and stilling basins as detailed by Section 02370.

L. Prior to storing uncontainerized contaminated soils in stockpiles at temporary storage areas he Contractor shall install berm or other perimeter controls around the base of the stockpile area as specified in approved plan.

M. Polyethylene sheeting shall cover the stockpiles and appropriate perimeter controls shall be constructed to prevent generation and migration of leachate and diversion of stormwater runoff.

N. Place appropriate bottom layer polyethylene sheeting beneath all stockpiles with a minimum overlap of 18-inches. The polyethylene sheeting shall extend past the limits of the berm a minimum of 12-inches.

O. The Contractor shall inspect perimeter controls at least twice per week, and provide immediate maintenance as necessary.

P. Off-site storage of excavated material is not permitted without prior written approval of National Grid.

Q. Contaminated soils shall in no case be stockpiled for more than ninety (90) days.

R. The Stockpiles shall be securely barricaded and clearly labeled.

S. Soils shall be suitably dewatered prior to their leaving the site, to prevent free water from developing during transport to the disposal facility

T. Hay bales shall be placed around the stockpile as per Section 02370.

U. The Contractor shall also maintain appropriate dust control, per Section 01500.

3.5 OFF-SITE TRANSPORTATION AND DISPOSAL PROCEDURES

A. Off-Site transportation and disposal of all excess materials generated as a result of the Work shall be in accordance with all applicable federal, state, and local regulations and the requirements of this Section.

B. Contractor shall perform the following tasks for the proper off-Site transportation and treatment/disposal of all excess materials generated as a result of the Work:

1. Engage a licensed transporter.
2. Select and contact the appropriate receiving facilities for each type of Excess Materials from the National Grid USA Service Company, Inc. approved vendors list attached to this Section. Contractor shall contract directly with each of the Owner-approved facilities selected to implement the Work.
3. Transport the materials to the Owner-approved facility in appropriate containers or trucks per the applicable laws and regulations.

C. Contractor shall coordinate the schedule and transport of materials with the Owner-approved facilities. Work delays due to scheduling or acceptance of the material at the disposal facilities for any reason will be at no additional cost to Owner.

D. Waste shall be transported in lined and covered DOT-approved containers to be provided by waste transporter(s) or drums to be provided by Contractor and staged for waste classification sampling. Containers shall meet all US DOT shipping requirements. Shipping containers shall be filled to within legal weight and height limits for shipping. Waste shall be contained to comply with all approved disposal facility requirements.

E. Contractor shall coordinate, manage, and pay for (as a part of the bid price) all waste handling activities including transportation to the approved receiving facilities. Contractor shall be responsible for all tipping fees, taxes, and facility surcharges for all waste categories. Waste handling activities shall be conducted in accordance with the approved schedule so as not to delay Work. Remove all waste as it accumulated so as not to impede Work progress.

F. Any demurrage costs associated with transportation shall be solely borne by the Contractor at no additional cost to the Owner.

G. Contractor shall prepare all waste manifests or BOLs, as appropriate, for each waste shipment. Owner will arrange for review and signature of these documents as generator.

H. All vehicles shall follow approved trucking routes to/from the Site.

I. At a minimum, all stockpiled excess materials generated as part of the Work shall be disposed from the Site within 30 days of completing Work.

3.05 EQUIPMENT AND VEHICLE DECONTAMINATION

A. The Contractor shall design and construct a decontamination pad to be used to decontaminate equipment and vehicles existing from contaminated areas. The Contractor shall be responsible for the maintenance and operation of the decontamination station (decontamination pad and wash down equipment, if necessary) throughout the duration of the work activities. The Contractor shall collect, treat and dispose of decontamination pad wash water, if necessary. At the completion of the project, the Contractor shall dismantle and properly dispose of the decontamination pad and resulting contaminated waste products. Pad shall consist of:

1. 2” Crushed Stone
2. 40 mil LLDPE Liner:
3. 8-Ounce Non-Woven Geotextile:
4. Weights used to secure the liner are to be 50-pound bags of sand (or approved equal).
5. Jersey barriers shall be a modular concrete barrier employed to retain concrete. Barriers shall comply with ASTM C825.

B. Hot Water Pressure Washers

1. Professional series, gas powered, hot water unit capable of producing 130 to 150 degree Fahrenheit temperature rise and 3,000 to 4,000 pounds per square inch (PSI) at 2.5 to 4 gallons per minute (GPM) that will result in the production of roughly 7,500 to 16,000 CU.

C. Hoses And Fittings

1. Contractor shall provide all hose and fittings necessary to connect the pressure washers to the water supply, and to connect the transfer/sump pumps to the holding tanks.

D. Contractor shall be responsible for providing all equipment necessary to remove caked or hardened material from the vehicles. Contractor shall also be responsible for providing personal protective equipment and all miscellaneous equipment such as buckets, shovels, and hoses, necessary to handle, transfer, and/or remove construction water and associated

soils, sediment, and debris from the decontamination pad and any necessary storage containers during construction activities.

3.06 DUST CONTORL

A. Dust shall be controlled during excavation of soil/fill waste material to limit potential spread of contaminants and potential exposure of contaminants to workers and the public. Materials and effort shall include:

1. Soil Equivalent Foam Concentrate. Contractor shall provide and store on Site both short-duration soil equivalent foam concentrate and long-duration soil equivalent foam concentrate to be used to control odors and/or vapor emissions from impacting the properties surrounding the Site or for localized control within the Site according to the requirements of Contractor's HASP, results of Contractor personnel monitoring, the Program Manager/Construction Manager's perimeter air monitoring, public complaints, or as otherwise required.
   a. The soil equivalent foam shall meet the requirements of RCRA Subtitle D.
   b. The short-duration soil equivalent foam shall be AC-645, vanilla scented, manufactured by Rusmar, Inc., of West Chester, PA, or approved equal.
   c. The long-duration soil equivalent foam shall be AC-900 LM 12, green and vanilla scented, manufactured by Rusmar, Inc., of West Chester, PA, or approved equal.
   d. Foam shall be free of PFOS and PFOA.
2. Contractor shall provide drums of both concentrated (not diluted or pre-mixed) odor/organic vapor suppression short-duration foam and long-duration foam and maintain adequate equipment and supplies on Site at all times to apply the foam to excavation areas, short-duration stockpiles, active areas, or other operations that are determined to be the source of odor as determined by Program Manager/Construction Manager. Contractor shall apply short-duration foam to excavation areas and other active areas. Contractor shall apply long-duration foam to long-duration stockpiles, to materials in transport vehicles prior to transport that contain odors, and other operations that are determined to be the source of odor that are not active areas, as determined by National Grid.
3. Pneumatic Foam Unit. Contractor to supply and maintain a Pneumatic Foam Unit on Site at all times. Foam shall be applied by a towable, self-contained pneumatic foam unit. The foam unit shall include an air compressor, pump, hoses, nozzles, 400-gallon solution storage tank and freeze protection system. The foam application unit shall be capable of applying foam solution at a rate of at least 25 gallons per minute.

B. During construction, real-time dust monitoring shall be conducted under windy and/or excessively dry working conditions or when directed by the Program Manager / Construction Manager. The monitoring shall consist of total dust testing using MIE, INC. MINIRAM PDM-3 DUST MONITORS, or like instruments. The total dust criteria at the site shall conform to the requirements of the HASP. Should fugitive dust quantities exceed 20 percent of the ambient level or action levels indicated within the HASP, the Contractor shall perform additional measures to reduce the total dust concentrations.

C. Nuisance dust levels shall be reduced by pre-wetting the surface soils and by establishing and maintaining clean access roads. The Contractor's Dust, Vapor, and Odor Control Plan shall describe the procedures and materials to minimize dust. At a minimum, the Contractor shall provide clean water, free from salt, oil, and other deleterious materials.

D. Areas of exposed earth to be excavated shall be lightly sprayed with water before excavation if there is potential for nuisance dust generation. Additional water spray may be utilized only when any indication of excessive dust is observed. To the extent feasible, the Contractor shall minimize the use of water within the limits of excavation.

E. Unimproved access roads shall be sprayed with water on a regular basis to minimize the generation of dust.

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SECTION 02100

MOBILIZATION, SITE PREPARATION, AND DEMOBILIZATION

PART 1 GENERAL

2.03 DESCRIPTION

A. The work specified in this section includes mobilization of all personnel and equipment, preparing construction sites for construction operations, and identifying and verifying survey control points as shown on the Drawings. Also included is protecting survey monuments from injury or defacement, utilities, traffic control, cleanup along access and haul roads, and demobilization of all personnel and equipment.

B. Related Work Described Elsewhere:
1. Section 01100 - Miscellaneous and Special Project Requirements
2. Section 01500 – Construction Facilities and Temporary Services
3. Section 01570 – Traffic Regulations
4. Section 02240 – Construction Water Handling
5. Section 02370 - Stormwater Pollution Prevention
6. Section 02773 - Construction Water Treatment and Disposal

2.04 SUBMITTALS BY CONTRACTOR TO PROGRAM MANAGER/CONSTRUCTION MANAGER

A. Construction Facilities Plan in accordance with Section 01500 – Construction Facilities and Temporary Services.

B. Vehicle wheel wash facility plan in accordance with paragraph 3.06 of this Section.

C. Traffic control plan in accordance with paragraph 3.07 of this Section.

2.05 CONSTRUCTION SITES

A. Obtaining staging areas is the responsibility of the Contractor.

PART 2 PRODUCTS

3.03 MATERIALS AND EQUIPMENT

A. Signs: Conform to requirements of Section 01500, CONSTRUCTION FACILITIES AND TEMPORARY SERVICES, and Section 01570, TRAFFIC REGULATIONS.

B. Temporary chain-link fence shall be provided, installed, and maintained at all sites. At the completion of all work at the site, the CONTRACTOR shall remove all temporary fencing and restore the site to its original or better condition.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Unpaved construction site entrance roads and parking areas shall be paved or covered with crushed stone to reduce vehicle tracking of sediments. Streets used to access the work sites shall be swept daily in accordance with Section 01500, CONSTRUCTION FACILITIES AND TEMPORARY SERVICES, to remove any excess mud, dirt, or rock originating from the site. Trucks hauling material shall be covered and equipped with refuse gates that prevent material from falling out. Catch basins shall be maintained within 100 feet of site entry and exit locations.

B. Structural strength of temporary facilities shall be sufficient to safely support all dead, live and impact loads that can reasonably be anticipated during the construction period.

C. Protect all survey monuments and adjacent contractors' work and facilities.

D. Protect all geotechnical instrumentation and groundwater observation wells. Replace at CONTRACTOR's cost if damaged by CONTRACTOR.

E. Protect existing culverts, sewers, and all other utilities including gas, telecommunications, electricity, and water. Replace at CONTRACTOR's cost if damaged by CONTRACTOR.

F. Barricade or backfill all open holes, trenches, shafts, and depressions occurring at construction sites or occurring as part of this work.

G. Groundwater Control and Treatment: Conform to Section 02240, CONSTRUCTION WATER HANDLING and Section 02773, CONSTRUCTION WATER TREATMENT AND DISPOSAL.

H. Wheel Wash Facilities: Conform to Subsection 3.06 of this specification.

I. Traffic Control: Conform to Subsection 3.07 of this specification.

3.02 TEMPORARY CONSTRUCTION FACILITIES AND UTILITIES

A. Make arrangements for storage of materials and equipment in locations at the construction sites.

B. Chain link fences fencing shall be maintained in good condition. Provide fencing around excavations and trenches as required for safety. Temporary fencing shall be removed and the area restored to a condition equal to or better than existed prior to the start of the work.

C. Limit the operations and storage of equipment and materials to the designated staging areas.

3.03 PRECONSTRUCTION INSPECTION AND SURVEY

A. In accordance with Section 01381.

3.04 FIELD OFFICES

A. CONTRACTOR's Field Office: The CONTRACTOR shall maintain a temporary field office near the Work for the CONTRACTOR's own use during the period of construction at which readily accessible copies of all Contract Documents and approved Shop Drawings shall be kept. The office shall be located in the CONTRACTOR's staging area where it will not interfere with the progress of the Work.

3.05 SITE MAINTENANCE

A. Keep all surface irregularities of construction sites and access and haul roads well graded to prevent the generation of impact noise and ground vibrations by passing vehicles.

B. Control dust from CONTRACTOR operations in accordance with dust control measures specified herein and in Section 01500, CONSTRUCTION FACILITIES AND TEMPORARY SERVICES.

C. Maintain the sites during construction in a manner that will not obstruct operations on any existing railroad tracks or street areas. Proceed with the work in an orderly manner, maintaining the construction site free of debris and unnecessary equipment or materials.

D. Dispose of all debris, rubbish, hazardous materials, oil, and grease in accordance with Section 01500, CONSTRUCTION FACILITIES AND TEMPORARY SERVICES and all regulations.

E. Maintain safety and security of the construction sites.

3.06 TRAFFIC CONTROL

A. For all of his operations, the CONTRACTOR shall provide traffic control in accordance with Section 01570, TRAFFIC REGULATIONS, of this specification. The purposes of the traffic control are to ensure that his operations in the community are done in a safe and orderly manner and that the impact of truck traffic and noise on the community are minimized. The Contractor shall be responsible for obtaining the required permits and approvals, setting up and coordinating the necessary police details in accordance with the town and state regulations, and submitting invoices to the Owner for approved traffic control detail costs.

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SECTION 02149

MAINTAINING EXISTING FLOW

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to maintain existing flow and implement and complete all flow diversions and/or bypass pumping required to complete the Work indicated on the Drawings.

1.02 PERFORMANCE REQUIREMENTS

A. It is essential to the operation of the existing combined sewerage system that there be no interruption of the wastewater and stormwater flow throughout the duration of this project. An interruption shall be considered, but may not be limited to, any condition that in the sole opinion of the Program Manager/Construction Manager adversely affects or alters operation of the existing sewage system and/or any other portion or component of the existing collection system including the associated flows; allows the level of combined flow to increase, rise, collect, surcharge and/or overflow existing facilities in any manner; or results in any operational or permit violations being issued to the Owner.

B. The Contractor shall coordinate and sequence construction to limit the need to manage existing flow. Contractor shall monitor flow in an existing line prior to execution of the work, and shall present the information to the Owner for review. To the extent practical, work on existing combined sewer pipes shall be limited to dry weather conditions.

C. The Contractor shall provide, maintain, and operate temporary facilities such as dams, bulkheads, pumping equipment (both primary and backup units as required) conduits, electrical power, and all other labor and equipment to intercept and maintain the existing sewage flow before it reaches the point where it would interfere with his work, carry it past his work, and return it to the existing facilities beyond his work.

D. The Contractor's attention is directed to the fact that the existing wastewater and stormwater flow is a result of a combined system. Increases in normal flow should be expected during periods of wet weather. The Contractor shall therefore take all precautions necessary including monitoring weather forecasts to fully accommodate, control and sufficiently handle the increases in flow during periods of wet weather and/or storms as well as periods of normal flow.

E. The Program Manager/Construction Manager may prohibit the carrying out of any work at any time when in his sole judgment, increased flow conditions are unfavorable or not suitable, or at any time, regardless of the existing flows, when proper precautions are not being taken to safeguard the existing sewerage system, previously constructed work, work in progress and/or the general public.

F. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Owner may require, at no additional expense to the Owner.

G. The Contractor shall provide a system capable of bypassing expected flow.

1.03 SUBMITTALS

A. In accordance with SECTION 01300 submit the following:

1. Detailed plans and descriptions outlining all provisions and precautions to be taken regarding the control and handling of existing sewage flows.
2. Include such items as schedules, locations, elevations, capacities of equipment, materials, traffic maintenance plans, and all other incidental items necessary and/or required by the Owner to insure proper protection of the facilities and compliance with the requirements herein specified.
3. Qualifications as described herein.
4. Detailed proposal for noise prevention measures for review.
5. Shop drawings for all pumping, piping, and appurtenances for type and size of equipment required to perform the flow diversion and/or bypass pumping work as required herein.

1.04 QUALITY ASSURANCE

A. Qualifications

1. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the Program Manager/Construction Manager that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five (5) references of projects of similar size and complexity in wastewater applications performed by his firm within the past three years within New England. The bypass system shall meet the requirements of codes and regulatory agencies having jurisdiction.
2. The vendor shall demonstrate the bypass pumping equipment is automated and is capable of functioning without the assistance of an operator.
3. The vendor shall demonstrate the pumping equipment can operate for an extended period of time running dry. After this period of time, the pump shall have the capability of pulling a 25" Hg vacuum without adjustment or repair.
4. The vendor shall demonstrate sufficient service resources and repair parts in stock to fulfill service or repair of rental equipment within one hour of a service call, twenty-four hours per day, seven days per week.
5. Temporary components of the bypass system including pumps, pipe, hose, valves, and fittings shall be provided by one bypass vendor. Hydraulic calculations and drawings

required by the submittals shall be provided by the bypass vendor and stamped and certified by a Professional Engineer licensed in the State of the installation.

B. Pre-Installation Meeting

1. Contractor to schedule and attend a pre-installation meeting with the vendor, Owner and Program Manager/Construction Manager prior to installation of by-pass system.

PART 2 PRODUCTS

2.01 GENERAL

A. At a minimum, all equipment shall be supplied in duplicate for emergency situations. Provide adequate on-line backup facilities so that no interruption in service is encountered. Equipment and installation are subject to the approval of the Program Manager/Construction Manager.

2.02 PUMPING SYSTEM(S)

A. All pumping units (primary and secondary) and appurtenances shall be sized properly to handle the flows encountered including increased flows due to wet weather.

B. Pumps shall be centrifugal, end suction, fully automatic self-priming pumps that do not require the use of foot-valves, vacuum pumps, diaphragm pumps, or isolation valves in the priming system. The pumps may be electric or diesel powered. Pumps must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows and shall immediately develop 25" Hg vacuum without adjustment or repair or employ level control devices to regulate on/off or variable speed of the pump. Pumps shall be CD low noise units as manufactured by Godwin Pump of America, Inc, or approved equal. All pumping units and appurtenances shall be sized in accordance with the design parameters provided. Pumps shall not be connected by a common suction manifold.

C. Seals shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding suction pressures to 100 psi running. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. Pump shall be capable of running dry, with no damage, for extended periods of time. All metal parts shall be of stainless steel. Elastomers shall be Viton.

D. The Contractor shall provide the necessary start/stop controls for each pump.

E. The Contractor shall be responsible to meet noise requirements in specified elsewhere in this section. All diesel driven primary and standby pumps shall be sound attenuated. The use of Critical Silenced Canopy pumps or acoustical Whisper Pac enclosures for sound attenuation are required.

2.03 PIPING SYSTEM(S)

A. All piping systems (primary and secondary) and appurtenance shall be sized properly to handle the flows encountered including increased flows due to wet weather.

B. Provide temporary bypass suction piping from the upstream manhole(s) to the bypass pumps, and temporary discharge piping from the bypass pumps to the downstream discharge manhole(s).

2.04 POWER GENERATING FACILITIES

A. Include power generating facilities capable of providing all power necessary to operate any primary and secondary pumping systems.

B. Maintain facility to be ready for use if required.

2.05 NOISE PREVENTION

A. Noise prevention measures for all equipment shall be used to insure minimum noise impact or surrounding areas.

B. Measures may include but shall not be limited to enclosures, insulation, electric pumping units, and hospital grade silencers or mufflers.

C. Noise levels shall be maintained such that increase shall not exceed 10 dBA over background at the nearest property line.

D. Should at any time prior to or during the performance of above mentioned work, the Program Manager/Construction Manager determines the noise prevention measures being used are not adequate, the Contractor shall at no additional cost to the Owner suspend all work until acceptable measures are incorporated.

PART 3 EXECUTION

3.01 PUBLIC SAFETY AND CONVENIENCE

A. General

1. The Contractor shall at all times keep the streets, highways, roads, driveways, parking lots, private walks, and public sidewalks open for pedestrian and vehicular traffic unless otherwise authorized by the Program Manager/Construction Manager.

B. Public Travel Ways

1. Any authorized temporary closure of any streets, highways or roads shall be coordinated with the local Fire, Police and/or Department of Public Works as required by the municipality.

C. Municipal, Commercial and Private Property

1. Any authorized, temporary closure of any municipal, commercial or private driveway or access route will require the Contractor provide 48 hour notice to abutters of the temporary restriction of access to their property. The Contractor will make every attempt to schedule his work with as little inconvenience to the property owner as possible

3.02 INSTALLATION

A. Keep the Program Manager/Construction Manager advised at all times of any changes made to the overall operation(s) to accommodate field conditions.

B. Flow diversions and/or bypass pumping shall be maintained at all times as long as it is necessary to maintain the flow through the limits of the project during construction.

C. Maintain auxiliary and/or emergency equipment at the site to continue flow division and/or by-pass pumping operations in the event of a breakdown and/or loss of normal power.

D. The Contractor shall be responsible for the proper functioning and operation of the backup pumping units. Back-up pump(s) shall be on-line, isolated from the primary system by a valve.

E. No work shall begin until all provisions and requirements of this Section have been reviewed and approved by the Program Manager/Construction Manager.

F. The Program Manager/Construction Manager reserves the right to limit and/or otherwise restrict the Contractor's overall activities and/or operations at any time without claim should the Program Manager/Construction Manager deem it to be in the Owner's or public's best interest to do so.

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SECTION 02200

EARTH EXCAVATION, BACKFILL, FILL AND GRADING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for; excavating in earth for trenches and structures; backfilling excavations; furnishing necessary material; compaction; constructing embankments and fills; miscellaneous earth excavations and miscellaneous grading.

B. Related Sections

1. Section 01025 – Measurement and Payment
2. Section 01410 – Testing Laboratory Services
3. Section 02149 – Maintaining Existing Flow
4. Section 02215 – Aggregate Materials
5. Section 02218 – Impermeable Earth Fill
6. Section 02240 – Construction Water Handling
7. Section 02260 – Support of Excavation
8. Section 03300 – Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.03 QUALITY ASSURANCE

A. Field Samples

1. Provide samples of materials as requested by the Engineer, to the Quality Control Engineer hired by the Program Manager, prior to delivery of materials on site, in order to facilitate field testing of compaction operations and material properties.

1.04 PROJECT/SITE CONDITIONS

A. Existing Conditions

1. There are pipes, drains, and other utilities in locations not indicated on drawings, no attempt has been made to show all services, and completeness or accuracy of information given is not guaranteed.

1.05 MAINTENANCE

A. Maintain all work in accordance with SECTION 01800.

PART 2 PRODUCTS

2.01 MATERIALS

A. Suitable Aggregate

1. The nature of materials will govern both acceptability for backfill and methods best suited for placement and compaction.
2. All material whether from excavations or from borrow pits, after being placed and properly compact, will make a dense stable fill and containing no vegetation, masses of roots, individual roots more than 18 inches long, or more than 1/2 inch in diameter, stones over 6 inches in diameter, or porous matter.
3. Organic matter to be well distributed and not to exceed minor quantities.

B. Trench and Excavation Backfill

1. In general, and unless other material is indicated on drawings or specified, material used for backfilling trenches and excavations shall be suitable material which was removed in the course of making the construction excavations. If sufficient suitable material is not available from the excavations, the backfill material shall be crushed stone, gravel borrow or select borrow as directed by the Program Manager, in according to respective Specification Sections.

C. Structure Backfill

1. Unless otherwise indicated or specified, all fill and backfill under structures and pavement adjacent to structures shall be compacted gravel borrow containing not more than 10 percent material passing a 200 sieve. When coarse aggregate and fine aggregate are indicated or specified for use under structures, they shall conform to the requirements for coarse and fine aggregate specified in SECTION 03300.

D. Filling and Embankment Backfill

1. Suitable selected materials available from the excavations and not required for backfill around pipes or against structures may be used for filling and building embankments, except as otherwise specified. Material needed in addition to that available from construction operations shall be obtained from suitable gravel banks or other suitable deposits. The Contractor shall furnish, at his own expense, all borrow material needed on the work.

E. Additional materials

1. Concrete: In accordance with SECTION 03300.
2. Crushed stone: In accordance with SECTION 02215.
3. Gravel borrow: In accordance with SECTION 02215.
4. Select borrow: In accordance with SECTION 02215.

2.02 EQUIPMENT

A. Well Points

1. Designed to drain soil and prevent saturated soil from flowing into excavation.

B. Pumping Units

1. Designed for use with the wellpoints, capable of maintaining a high vacuum and, handling large volumes of air and water at the same time.

C. Underdrain Pipe

1. HDPE pipe enclosed in crushed stone encased in filter fabric.
2. Sewer pipe of quality know as "seconds".

2.03 SOURCE QUALITY CONTROL

A. Provide Program Manager with access to location of off-site sources of materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all existing utilities and facilities prior to excavation.

3.02 PROTECTION

A. Utilities

1. Support and protect from damage existing pipes, poles, wires, fences, curbing, property line markers, and other structures, which the Program Manager decides must be preserved in place without being temporarily or permanently relocated.
2. Restore items damaged during construction without compensation, to a condition at least equal prior to construction.

B. Trees

1. Enclose the trunks of trees adjacent to work with substantial wooden boxes of height necessary to protect trees from injury from piled material, equipment, operations or otherwise.
2. Employ excavating machinery and cranes of suitable type and size and operate with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
3. When trimming is required, make all cuts smooth and neat without splitting or crushing.
4. Cover cut areas with an application of grafting wax or tree healing paint.
5. Branches, limbs, and roots shall not be cut except by permission of the Program Manager.

C. Plantings

1. Protect by suitable means or temporarily replant and maintain cultivated hedges, shrubs, and plants which may be injured by the Contractor's operations
2. Replant in their original positions and care for until growth is re-established, once the construction operations have been substantially completed.
3. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of kind and quality at least equal to which existed prior to the start of the Work.

D. Paved surfaces

1. Do not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels shaped as to cut or injure paved surfaces.
2. All surfaces which have been injured by the Contractor's operations shall be restored to a condition at least equal to which existed prior to start of the Work.
3. Suitable materials and methods shall be used for such restoration.

3.03 PREPARATION

A. Pavement Removal

1. Remove only existing pavement as necessary for the prosecution of the work.
2. Program Manager may require that pavement be cut with pneumatic tools or saws without extra compensation to Contractor, where in the opinion of the Program Manager it is necessary to prevent damage to the remaining road surface.
3. Dispose large of pieces of broken pavement before proceeding with excavation.

B. Top Soil Removal

1. From areas 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.

C. Subgrade

1. Remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas where embankments will be built or material will be placed for grading.
2. Shape as indicated on the drawings and prepare by forking, furrowing, or plowing to bond first layer of the new material placed.

3.04 RELOCATION AND REPLACEMENT OF EXISTING STRUCTURES

A. The structures to which the provisions of this article apply include pipes, wires, and other structures which meet all of the following:

1. Are not indicated on the drawings or otherwise provided for.
2. Encroach upon or are encountered near and substantially parallel to the edge of the excavation.
3. In the opinion of the Program Manager will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

B. In removing existing pipes or other structures, the Contractor should use care to avoid damage to materials, and the Program Manager shall include for payment only those new materials which, in his judgment, are necessary to replace those unavoidably damaged.

C. Whenever the Contractor encounters certain existing structures as described above and is so ordered in writing, he shall do the whole or such portions of the work as he may be directed to change the location of, remove and later restore, or replace such structures, or to assist the Program Manager thereof in so doing. For all such work, the Contractor shall be paid under such items of work as may be applicable, otherwise as Extra Work.

D. When fences interfere with the Contractor's operations, he shall remove and (unless otherwise specified) later restore them to a condition which existed prior to the start of the Work, all

without additional compensation. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.05 SUPPORT OF EXCAVATION

A. Provide in accordance with specification SECTION 02260.

3.06 DEWATERING

A. Provide in accordance with specification SECTION 02240.

3.07 EXCAVATION

A. Execute operation of dewatering, support of excavation without undermining or disturbing foundations of existing structures or of work previously completed under this contract.

B. Excavate to widths that provide suitable room for:

1. Building structures or laying and jointing piping.
2. Placing all support of excavation.
3. Cofferdamming, pumping and draining.

C. Render bottom of excavations firm, dry and acceptable in all respects.

D. Do not plow, scrap or dig by machinery, earth at finished subgrade which results in disturbance of material below subgrade, unless indicated or specified, and remove with pick and shovel, last of material to be excavated, just before placing pipe, masonry or other structure.

E. Make all excavations in open, except as otherwise specified or permitted.

F. Excavation Near Existing Facilities

1. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools. Such manual excavation when incidental to normal excavation shall be included in the work to be done under items involving normal excavation.

G. Unauthorized Excavation

1. If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled at the Contractor's expense with thoroughly compacted gravel borrow, if the excavation was for a pipeline, or with Class B concrete, if the excavation was for a masonry structure.

H. Unsuitable Material

1. If material unsuitable for foundation (in the opinion of the Program Manager) 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, crushed stone, gravel borrow, fine aggregate or concrete as directed.

3.08 TRENCHING

A. Trench Excavation

1. Where pipe is to be laid in specified bedding material or concrete cradle, the trench may be excavated by machinery to, or to just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed.
2. Where pipe is to be laid directly on the trench bottom, the lower part of trenches in earth shall not be excavated to subgrade by machinery, but, just before the pipe is to be placed, the last of the material to be excavated shall be removed by means of hand tools to form a flat or shaped bottom, true to grade, so that the pipe will have a uniform and continuous bearing and support on firm and undisturbed material between joints except for limited areas where the use of pipe slings may have disturbed the bottom.

B. Depth of Trench

1. Excavate trench to depths permitting the pipe to be laid at the elevations, slopes, or depths of cover indicated on the drawings, and at uniform slopes between indicated elevations.

C. Width of Trench

1. Excavate trench as narrow as practicable and do not widen by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.
2. Excavate trenches with approximately vertical sides between the elevation of the center of the pipe and an elevation 1 ft. above the top of the pipe.

D. Trench Excavation in Fill

1. 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 1 ft. 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 then be excavated as though in undisturbed material.

E. Length of trench open at any one time will be controlled by conditions, subject to any limits that may be prescribed by Program Manager.

3.09 BACKFILLING

A. General

1. Frozen material shall not be placed in the backfill nor shall backfill be placed upon frozen material. Previously frozen material shall be removed or shall be otherwise treated as required, before new backfill is placed.

B. Fill and Backfill Under Structures

1. The fill and backfill materials shall be placed in layers not exceeding 6 in. in thickness. Unless otherwise indicated or specified, each layer shall be compacted to 95 percent in accordance with ASTM D1557.

C. Backfilling Around Structures

1. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been done, special leakage tests, if required, shall be made. Promptly after the completion of such tests, the backfilling shall be started and then shall proceed until its completion. The best of the excavated materials shall be used in backfilling within 2 ft. of the structure. Unequal soil pressures shall be avoided by depositing the material evenly around the structure.
2. The material shall be placed and compacted to 90 percent in accordance with ASTM D1557 unless otherwise indicated or specified.

D. Backfilling Pipe Trenches

1. As soon as practicable after the pipes have been laid and the joints have acquired a suitable degree of hardness, if applicable, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, the backfilling shall be started and thereafter it shall proceed until its completion.
2. With the exception mentioned below in this paragraph, trenches shall not be backfilled at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights and barricades and the obstruction of traffic, he may, at his own risk backfill the entire trench, omitting or including backfill at joints as soon as practicable after the joints have acquired a suitable degree of hardness, if applicable, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.
3. No stone or rock fragment larger than 12 in. in greatest dimension shall be placed in the backfill nor shall large masses of backfill material be dropped into the trench in such a manner as to endanger the pipeline. If necessary, a timber grillage shall be used to break the fall of material dropped from a height of more than 5 ft. Pieces of bituminous pavement shall be excluded from the backfill unless their use is expressly permitted, in which case they shall be broken up as directed.
4. Zone Around Pipe
   a. Backfilled with the materials and to the limits indicated on the drawings.
   b. Material shall be compacted to 90 percent by tamping.
5. Remainder of Trench
   a. Compact by water-jetting, or tamping, in accordance with the nature of the material to 95 percent in accordance with ASTM D1557. Water-jetting may be used wherever the material does not contain so much clay or loam as to delay or prevent satisfactory drainage. However, tamping shall be used if water-jetting does not compact the material to the density required.
6. Excavated material which is acceptable to the Program Manager for surfacing or pavement subbase shall be placed at the top of the backfill to such depths as may be specified elsewhere or as directed. The surface shall be brought to the required grade and stones raked out and removed.

E. Placing And Compacting Embankment Material

1. After the subgrade has been prepared as hereinbefore specified, the material shall be placed thereon and built up in successive layers until it has reached the required elevation.

2. Layers shall not exceed 12 in. in thickness before compaction. In embankments at structures, the layers shall have a slight downward slope away from the structure; in other embankments the layers shall have a slight downward slope away from the center. In general, the finer and less pervious materials shall be placed against the structures or in the center, and the coarser and more pervious materials, upon the outer parts of embankments.
3. Each layer of material shall be compacted by the use of approved rollers or other approved means so as to secure a dense, stable, and thoroughly compacted mass. At such points as cannot be reached by mobile mechanical equipment, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.
4. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.
5. The portion of embankments constructed below proposed structures shall be compacted to 95 percent in accordance with ASTM D1557. The top 2 ft. of an embankment below a pavement base shall be compacted to 95 percent. All other embankments shall be compacted to 90 percent in accordance with ASTM D1557.

3.10 METHODS OF COMPACTION

A. Water-Jetting

1. Saturate backfill material throughout its full depth and at frequent intervals across and along the trench until all slumping ceases.
2. Furnish one or more jet pipes, each of sufficient length to reach the specified depth and of sufficient diameter (not less than 1-1/4 in.) to supply an adequate flow of water to compact the material.
3. Equip jet pipe with a quick-acting valve, supply water through a fire hose from a hydrant or a pump having adequate pressure and capacity to achieve the required results.

B. Tamping and Rolling

1. Deposit backfill material and spread in uniform, parallel layers not exceeding 8 in. thick before compaction. Before the next layer is placed, each layer shall be tamped to obtain a thoroughly compacted mass. Care shall be taken that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench 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, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar power equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling, and compacting.
2. If necessary to ensure proper compaction by tamping (or rolling), the backfill material shall first be wet by sprinkling. However, no compaction by tamping (or rolling) shall be done when the material is too wet either from rain or too great an application of water to be compacted properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compaction.

C. Miscellaneous Requirements.

1. 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. Only suitable quantities of stones and rock fragments shall be used in the backfill; the Contractor shall, as part of the work done under the items involving earth excavation and rock excavation as appropriate, furnish and place all other necessary backfill material.
2. All voids left by the removal of support of excavation shall be completely backfilled with suitable materials, and thoroughly compacted.

3.11 DISPOSAL OF SURPLUS EXCAVATED MATERIALS

A. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as directed or permitted by the Program Manager.

B. Surplus excavated materials suitable for backfill shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill; shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes within a haul of 1 mile from the point of excavation; all as directed or permitted and without additional compensation.

C. Surplus excavated materials not needed as specified above shall be hauled away and dumped by the Contractor, at his expense, at appropriate locations, and in accordance with arrangements made by him.

D. Surplus excavated materials generated from excavations on the Tidewater property shall be managed as outlined in Specification Section 02075.

3.12 DISPOSAL OF SPECIAL WASTES (IN RHODE ISLAND)

A. The Contractor's attention is directed to the requirements set forth by the State of Rhode Island, Department of Environmental Management, (RIDEM) regarding "Special Hazardous Wastes" and the proper disposal thereof. All waste materials and debris, as designated by the Program Manager, including but not limited to any sewers, storm drains, catch basins, and combined system pipelines and associated structures, or any portions thereof, including but not limited to sludge, grit, sediment, dirt, sand, rock, grease, roots and other liquid, solid or semi-solid materials contained therein, shall be considered "Type 5 - Rhode Island Special Hazardous Waste (005)" In addition, any excavated soils contaminated in any manner, as designated by the Program Manager, shall also fall under this category and shall be handled the same. When so encountered, all such materials and debris shall be removed to the extent so ordered by the Program Manager and properly disposed of in strict compliance with the requirements of the RIDEM, Division of Waste Management, Rules and Regulations for Hazardous Waste Management, amended 4/19/92. and other regulating authorities to an approved and certified waste disposal site. It shall remain the sole responsibility of the Contractor to apply for and obtain all required permits, bonds and/or insurance relative to such disposal. The Contractor shall also pay all costs associated with the disposal, required permits, bonds and insurance with no additional expense to the Owner. All handling of such "Special Hazardous Waste" shall be done in strict compliance with the RIDEM requirements

and/or any other federal, state or local agency having jurisdiction or authority over the same. Under no circumstances shall sewage, solids or other "Special Hazardous Wastes" removed from the sewer lines be dumped or spilled onto the streets or into ditches, catch basins or storm drains. The Contractor must use watertight and State approved vehicles in transporting any wastes as hereinbefore designated.

B. The Contractor shall indemnify and save harmless the Owner and Program Manager and all persons acting for or on behalf of the Owner and Program Manager from all claims and liability of any nature or kind, and all damages, costs and expenses, including attorney's fees and penalties, arising from the improper handling, transportation or disposal of "Special Hazardous Wastes" as determined by the RIDEM and/or any other federal, state or local agency having jurisdiction or authority over the same.

3.13 DUST CONTROL

A. During the progress of the Work, maintain the area of activities, by sweeping and sprinkling of streets to minimize the creation and dispersion of dust. If the Program Manager decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.

3.14 BRIDGING TRENCHES

A. Provide suitable and safe bridges and other crossings where required for the accommodation of travel, and to provide access to private property during construction. Remove once bridges and crossings are no longer needed.

3.15 FIELD QUALITY CONTROL

A. Site Tests

1. In accordance with SECTION 01410

3.16 CARE AND RESTORATION OF PROPERTY

A. Restoration of existing property or structures done as promptly as practicable and not left until the end of the construction period.

END OF SECTION

SECTION 02210

ROCK EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for removal and disposal of rock.

B. Related Sections

1. Section CA – Contract Agreement
2. Section 01000 – General Specifications
3. Section 02200 – Earth Excavation, Backfill, Fill and Grading

1.02 DEFINITIONS

A. Rock-as defined in SECTION CA.

1.03 REQUIREMENTS

A. Excavate rock if encountered, to the lines and grades indicated on the drawings or as directed, dispose of the excavated material, and furnish acceptable material for backfill in place of the excavated rock.

B. Excavate rock in pipe trenches to a limit which provides 6-inches clearance minimum from the pipe after it has been laid. Before the pipe is laid, the trench shall be backfilled to the correct subgrade with thoroughly compacted, suitable material or, when so specified or indicated on the drawings, with the same material as that required for bedding the pipe, furnished and placed at the expense of the Contractor.

C. The use of explosives will not be allowed.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXCESS ROCK EXCAVATION

A. If rock is excavated beyond the limits of payment indicated on the drawings, specified, or authorized in writing by the Program Manager, the excess excavation, whether resulting from overbreakage or other causes, shall be backfilled, by and at the expense of the Contractor, as specified below in this section.

B. In pipe trenches, excess excavation below the elevation of the top of the bedding, cradle, or envelope shall be filled with material of the same type, placed and compacted in the same manner, as specified for the bedding, cradle, or envelope. Excess excavation above said elevation shall be filled with earth as specified in the article titled "Backfilling Pipe Trenches" in SECTION 02200.

C. In excavations for structures, excess excavation in the rock beneath foundations shall be filled with 3000 psi concrete. Other excess excavation shall be filled with earth as specified in the article titled "Backfilling Around Structures" in SECTION 02200.

3.02 SHATTERING ROCK

A. In the event use of explosives are not allowed, shattering rock at ends of pipe and elsewhere as indicated on the drawings, shall be done by mechanical methods. Shattering shall be completed before any pipe or fitting is placed within 50 ft. of rock to be shattered.

3.03 SHATTERED ROCK

A. If the rock below normal depth is shattered due to rock removal operations of the Contractor, and the Program Manager considers such shattered rock to be unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled with concrete as required, except that in pipe trenches screened gravel shall be used for backfill. All such removal and backfilling shall be done by and at the expense of the Contractor.

3.04 PREPARATION OF ROCK SURFACES

A. Whenever so directed during the progress of the work, remove all dirt and loose rock from designated areas and shall clean the surface of the rock thoroughly, using steam to melt snow and ice, if necessary. Water in depressions shall then be removed as required so that the whole surface of the designated area can be inspected to determine whether seams or other defects exist.

B. The surfaces of rock foundations shall be left sufficiently rough to bond well with the masonry and embankments to be built thereon, and if required, shall be cut to rough benches or steps.

C. Before any masonry or embankment is built on or against the rock, the rock shall be scrupulously freed from all vegetation, dirt, sand, clay, boulders, scale, excessively cracked rock, loose fragments, ice, snow, and other objectionable substances. Picking, barring, wedging, streams of water under sufficient pressure, stiff brushes, hammers, steam jets, and other effective means shall be used to accomplish this cleaning. Remove free water left on the surface of the rock.

3.05 REMOVAL OF BOULDERS

A. Remove piles of boulders and loose rock encountered within the limits of excavations and earth embankments and dispose in a suitable place.

3.06 DISPOSAL OF EXCAVATED ROCK

A. Excavated rock may be used in backfilling trenches subject to the following limitations:

1. Pieces of rock larger than permitted under the article titled "Backfilling Pipe Trenches" in SECTION 02200 shall not be used for this purpose.
2. The quantity of rock used as backfill in any location shall not be so great as to result in the formation of voids.
3. Rock backfill shall not be placed within 36 in. of the surface of the finish grade.

B. Surplus excavated rock shall be disposed of as specified for surplus excavated material as specified in SECTION 02200.

3.07 BACKFILLING ROCK EXCAVATIONS

A. Where rock has been excavated and the excavation is to be backfilled, the backfilling above normal depth shall be done as specified in SECTION 02200. If material suitable for backfilling is not available in sufficient quantity from other excavations, the Contractor shall, at his own expense, furnish suitable material from outside sources.

END OF SECTION

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SECTION 02215

AGGREGATE MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing and placing materials, which include Crushed Stone, Gravel Borrow and Select Borrow.
2. Location of specified materials as detailed on the Drawings or as directed by the Program Manager for excavation below normal depth, utility support, replacement of unsuitable material or elsewhere, as ordered.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading.
2. Section 02500 - Paving

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO).

1. T11, Amount of Material Finer than 0.075 mm Sieve in Aggregate
2. T27, Sieve Analysis of Fine and Coarse Aggregates.

B. American Society for Testing and Materials (ASTM).

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.03 DEFINITIONS

A. The term Screened Gravel as used in the Contract Documents shall mean Crushed Stone.

1.04 SUBMITTALS

A. Shop Drawings

1. Provide sieve analysis when gradation requirements are given in the Specification.

B. Samples

1. Furnish representative sample including location of source with Shop Drawing transmittal sheet.

1.05 QUALITY ASSURANCE

A. Field Samples

1. The attention of the Contractor is directed to the fact that under Specification Section 01000, 1.03 Materials – Samples - Inspection, all materials furnished by the Contractor to

be incorporated into the Work shall be subject to the inspection of the Program Manager. The Program Manager shall be the sole judge as to the acceptability of proposed materials and said judgement shall be final, conclusive, and binding.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. In accordance with Specification Section 01000, 1.05 Storage of Materials and Equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed Stone

1. For bedding and pipe zone material for pipe larger than 3 inches diameter. Well graded in size from 3/8 inches to 3/4 inches or such other sizes as may be approved.
2. For bedding and pipe zone material for plastic pipe 3 inches diameter and less, maximum particle size shall be 3/8 inches.
3. Clean, hard, and durable particles or fragments, free from dirt, vegetation, or other objectionable matter, and free from an excess of soft, thin elongated, laminated or disintegrated pieces.
4. Screened Stone of similar size and grading to this specification may be used instead of Crushed Stone.

B. Gravel Borrow

1. Granular material well graded from fine to coarse with a maximum size of 3 inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
2. Gravel shall not contain vegetation, masses of roots, or individual roots more than 18 inches long or more than 1/2 inches in diameter.
3. Gravel shall be substantially free from loam and other organic matter, clay and other fine or harmful substances.
4. Gradation requirements for gravel shall be determined by AASHTO-T11 and T27 and conform to the following:

Sieve	Percent Passing
1/2 inch	60-95
No. 4	50-85
No. 50	8-28
No. 200	0-8

C. Select Borrow

1. Use inorganic natural soils and/or rock, having not more than 8 percent by weight passing the No. 200 sieve and having a maximum stone size no greater than 6-inches.
2. Use only material well-graded throughout entire size range, free of roots, leaves and other organic material, ice or frost and aggregations of frozen soil particles.

3. Moisture content to be within plus minus 3 percent optimum at the borrow source.
4. Material must meet compaction requirements indicated or as specified.

D. Gravel Base Course

1. In accordance with SECTION 02500.

2.02 SOURCE QUALITY CONTROL

A. Test, Inspection

1. Program Manager may elect to sample material supplied at the source.
2. Assist the Program Manager and/or personnel from the designated testing laboratory in obtaining samples.

PART 3 EXECUTION

3.01 INSTALLATION

A. Crushed Stone

1. Spread in layers of uniform thickness not greater than 6 inches.
2. Compact thoroughly by means of a suitable vibrator or mechanical tamper.

B. Gravel Borrow

1. Spread in layers of uniform thickness not exceeding 12 inches before compaction and moistened or allowed to dry as directed.
2. Compact thoroughly by means of suitable power-driven tampers or other power-driven equipment.
3. Compaction shall conform to 95% of minimum dry density per ASTM D1557.
4. The percolation rate for the compacted bank-run gravel shall not exceed 5 minutes per inch.

C. Select Borrow

1. Spread in layers of uniform thickness not exceeding 12 in. (loose lift) before compaction and moistened or allowed to dry.
2. Compact thoroughly by means of suitable power-driven tampers or other power-driven equipment unless otherwise directed by the Program Manager.

3.02 FIELD QUALITY CONTROL

A. Material and compaction testing

1. In accordance with SECTION 01410.

END OF SECTION

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SECTION 02218

IMPERMEABLE EARTH FILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for impervious material to be used for earth water stops and check dams.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
2. D2487, Test Method for Classification of Soils for Engineering Purposes.

1.03 SUBMITTALS

A. Samples

1. Submit twenty (20) pounds of representative sample.
2. Submit three (3) weeks prior to scheduled use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source of Supply

1. The material source shall be at the option of the Contractor, with the acceptance of the Program Manager.

2.02 MATERIALS

A. Impermeable Earth Fill

1. The material shall be an impervious material principally of clay.
2. Containing select, natural, inorganic fine material.
3. Soil classification in accordance with ASTM D2487, designation CL.
   a. 100 percent finer than a No. 4 sieve.
   b. 50 percent finer than a No. 200 sieve.

PART 3 EXECUTION

3.01 PREPARATION

A. Protection

1. No frozen material to be used in the construction of the impermeable fill.
2. Cover and maintain in a granular and loose condition at all times.
3. No material to be placed on portions of the Work which are frozen.
4. Protect trenches and excavations from freezing which will receive impermeable earth fill.

B. Surface Preparation

1. Prior to placing a new layer of impermeable material, the surface of the preceding layer is to be scarified to a depth of 2 inches to enable a bond between layers.

3.02 INSTALLATION

A. Placing and Spreading

1. Spread material evenly and in uniform layers not to exceed eight (8) inches in uncompacted depth.
2. Joints and laps in or between layers shall be carefully made to insure the continuity of each layer in all directions.
3. Compact each layer prior to placement of the next layer.

B. Compaction

1. Compact all layers to at least 90 percent in accordance with ASTM D1557.
2. Moisture content to be plus or minus 2 percent of optimum.
3. Compact in according to Tamping as specified in SECTION 02200.
4. Contractor may propose an alternate method of compaction, which proves adequate and is acceptable to the Program Manager.
5. Compaction by use of a hand operated power driven tamper weighting not less than 100 pounds will be required where compaction by other means is impracticable.
6. Materials shall be compacted having the best practicable moisture content required for the desired results.

END OF SECTION

SECTION 02220

RIPRAP

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for the installation of riprap, including: loading, hauling, placing, spreading, grading and other related and incidental work.

B. Related Sections

1. Section 02215 - Aggregate Materials
2. Section 02200 - Earth Excavation, Backfill and Grading
3. Section 02272 - Geotextile Materials

PART 2 PRODUCTS

2.01 MATERIAL

A. All riprap used shall be sound, tough and durable stone, not lumpy or frozen, and free from slag, cinders, ashes, rubbish or other deleterious materials. All riprap will be of the size required for each specific application, as shown on the Drawings.

B. The material for riprap shall consist of broken stone produced from sound ledge or large boulders with at least three fractured faces on each particle and shall be free from overburden, spoil, shale or organic material. The stone shall have a minimum density of 160 pounds per cubic foot. It shall be angular in shape with its minimum dimension not less than one third of the maximum dimension.

C. Stone for placed riprap shall have one flat face and shall be roughly square or rectangular to facilitate laying up.

D. Riprap shall conform to the following gradation and shall be well graded within the size required:

National Stone Association Modified NSA No.	Size Inches (square opening) Maximum	Average	Minimum
R-1	2	1	No. 4
R-2	4	2	1
R-3	8	4	2
R-4	14	7	4
R-5	20	10	6
R-6	26	13	8
R-7	34	18	14
R-8	50	24	18

E. "Average size" is that size exceeded by at least 50 percent of the total weight of the tonnage shipped; i.e., 50 percent of the tonnage shall consist of pieces larger than the "average" size (normally half the specified nominal top size).

F. Pieces smaller than the minimum size shown shall not exceed 15 percent of the tonnage shipped.

G. Geotextile material in accordance with SECTION 02272.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation

1. Areas to receive 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 plans or as authorized and replaced with gravel borrow conforming to SECTION 02215. Filled areas will be compacted as specified in SECTION 02200.
2. Install Geotextile material at locations indicated on the Contract Drawings in accordance with SECTION 02272.

B. Dumped Riprap

1. Stone for riprap shall be paced on the prepared area in a manner, which will produce, and evenly graded mass of stone with the minimum practical percentage of voids. The entire mass of stone shall be placed so as to conform with the lines, grades, and thicknesses shown on the plans. Riprap shall be placed to its full course thickness at 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 degradation will not be permitted.
2. All riprap shall be placed and distributed with no large accumulations of either the larger or smaller size of stone.
3. It is the intent of these specifications to produce a compact riprap installation 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.
4. When riprap and bedding material are dumped under water, thickness of the layers shall be increased as shown on the Drawings.

C. Placed Riprap

1. Stone for placed riprap shall be placed on a prepared surface in a pattern that contains minimum voids. Top surface of riprap shall conform to a true and even plane with a tolerance of plus or minus 4-inches.
2. Joints shall be broken as much as practicable, chocking openings with smaller stones.
3. Larger stones placed near base of slopes, stones laid to rest on the prepared surface and not on other stones, Stones placed on slopes shall be done from the top down.

D. Riprap placed outside the specified limits will not be measured or paid for, and the Contractor may be required to remove and dispose of the excess riprap without cost to the Owner.

END OF SECTION

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SECTION 02224

CONTROLLED DENSITY FILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for controlled low strength material (CLSM) to be used in place of compacted soil for general backfill of trenches.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading
2. Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C33, Standard Specification for Concrete Aggregates.
2. C150, Standard Specification for Portland Cement.
3. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
4. C494, Standard Specification for Chemical Admixtures for Concrete
5. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
6. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

B. American Concrete Institute (ACI)

1. ACI Committee 229, Standard Specification for Controlled Low Strength Materials (CLSM).

C. This specification makes reference to the requirements of additional specifications as listed. The Contractor shall obtain and familiarize himself with all requirements referenced by this specification prior to preparation and installation of any materials.

1. Rhode Island Department of Transportation, Standard Specifications for Road and Bridge Construction, 2004 Edition, including all addenda, issued by the State of Rhode Island Department of Public Works, (referred to as the Standard Specification).

1.03 DEFINITIONS

A. Controlled Low Strength Material, also known as “Flowable Fill”, “Controlled Density Fill” and “Ready-mix Fill.” Self-compacting, self-leveling, cementitious material used for backfills, fills and structural fills.

B. Very Flowable, Exhibits characteristics needed for small or confined areas and required to flow over long distances.

C. Flowable, Where the above flowability characteristics are not required.

D. Excavatable, may be removed in the future if required.

E. Non excavatable, not expected to be removed in the future.

1.04 DESIGN REQUIREMENTS

A. Provide a mixture of Portland cement, aggregates, water and mineral admixtures with a low cement content and high slump to reduce strength development for possible removal and minimize settlement after placement.

B. The proposed mix should maximize the flow characteristics of the material while producing the necessary strength.

C. The design mixes shall have the following strengths at 28 days:

1. Excavatable fill,
   a. Class I (flowable) and II (very flowable), Range: 30 to 100 psi.
   b. Maximum: 100 psi maximum at 28 days, 200 psi at 6 months.
2. Non excavatable fill,
   a. Class III (flowable) and IV (very flowable), Range: 100 to 1200* psi.
   b. Maximum: 1200 at 28 days
      * Specific compressive strength(s) for structural applications are noted on the Contract Drawings

D. Air Content to be minimum 15%

E. Slump, using the modified method consisting of a six-inch long by three-inch inside diameter straight tube of non-porous material.

1. Class I and III: 6” to 8” diameter
2. Class II and IV: 9” to 14” diameter

1.05 PERFORMANCE REQUIREMENTS

A. Provide fill of homogeneous structure which when cured, will have the required strength, water tightness, and durability. To this end, it is essential that careful attention be given to the selection of materials, mixtures, placing and curing of the fill.

1.06 SUBMITTALS

A. In accordance with Section 01300, submit the following,

1. Mix design data not limited to, but including maximum and minimum strengths, air content, setting times, flowability and yield.
2. Certification by the supplier stating compatibility with the project requirements and the Contractor's installation methods.

1.07 QUALITY ASSURANCE

A. Furnish the supplier with information as to the intended use of the CLSM.

PART 2 PRODUCTS

2.01 MATERIALS

A. In general conformance with the Standard Specification and the following:

1. Portland Cement: ASTM C150, Type II American-made. (AASHTO M85)
2. Water: Clean, potable and complying with ASTM C94. (AASHTO M157)
3. Aggregates: ASTM C33 or a non-reactive aggregate source free of contaminants which exhibits high flow properties for controlled density fill. (AASHTO M6, M80)
4. Air entraining admixture conforming to ASTM C260, (AASHTO M154)
5. Chemical Admixtures: In accordance with ASTM C494. (AASHTO M194)
6. Fly Ash: Meet requirements of ASTM C618 Class C or Class F. (AASHTO M295)
7. Granulated Blast Furnace Slag: In accordance with ASTM C989.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall follow the guideline set forth in ACI 229, except non-standard materials shall not be used.

3.02 PREPARATION

A. Pipes and all other members to be encased in CLSM shall be temporarily secured in place to prevent displacement during fill placement.

B. To reduce hydrostatic pressure and limit displacement potential, Contractor may use a high air generator in the fill mixture to lower unit weights.

C. Pre-job test all pump applications prior to day of placement with actual equipment.

D. Secure site during the placement for the CLSM. Cautions include but are not limited to barricades, fences, lights and steel plates.

E. Work shall be sequenced so as to keep traffic flowing within the project area.

3.03 INSTALLATION

A. CLSM shall be batched at concrete plants and hauled to job sites in ready-mix trucks with continuous agitating drums.

B. During waiting period prior to discharge, truck drums shall agitate mixture.

C. CLSM shall be installed in accordance with suppliers recommendations.

3.04 FIELD QUALITY CONTROL

A. All CLSM to be used in the work shall be subject to testing to determine whether it conforms to the requirements of the specifications. The methods of testing shall be in accordance with the Standard Specification.

B. The place, time, frequency, and method of sampling will be determined by the Program Manager/Construction Manager in accordance with the particular conditions of this project.

3.05 PROTECTION

A. Open trenches shall not be left uncovered overnight.

END OF SECTION

SECTION 02240

CONSTRUCTION WATER HANDLING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for providing all personnel, power, and equipment for designing, furnishing, installing, operating, monitoring, maintaining and removing temporary dewatering systems and water handling systems necessary to collect, treat, and dispose of all Construction Water.

B. Construction Water refers to all water, whatever the source, including, but not limited to, the following:

1. Groundwater and storm water inflows into any excavation.
2. Groundwater from any dewatering wells or other dewatering or depressurization activity.
3. Water collected from material stockpiles.
4. Wet weather surface flows entering the construction site.
5. Water utilized by the Contractor during the course of construction, including water from microtunneling, grouting, and other activities.
6. Water from concrete washout and waste concrete containment structures.
7. Water collected from sumps or other areas in excavations.

C. The Contractor shall design and operate the dewatering systems and water handling systems to allow for release to an NBC discharge point (*TBD*).

D. The Contractor shall obtain and comply with all required permits, discharge authorizations, and regulatory approvals to discharge, treat and discharge, or collect, transport, and dispose of any Construction Water.

E. The Contractor shall coordinate the design of the groundwater control systems with the design of temporary excavation support system. Refer to Section 02260, Support of Excavation, Section 02465, Secant Pile Wall, Section 02466, Slurry Diaphragm Wall, and Section 02467, Cutter Soil Mix Wall for requirements of temporary excavation support.

F. The Contractor shall also coordinate the work of this section with the requirements in Section 02314, Microtunneling.

G. Special Considerations

1. The Contractor shall be prepared to handle contaminated and uncontaminated water. Areas of contaminated water are identified on the Contract Drawings.
2. The Contractor shall collect samples of the dewatering effluent as required by the permits and provide the services of a laboratory certified for the analyses of the samples collected to determine the quality of dewatering effluent prior to disposal.

3. The Contractor shall provide standby equipment and power supply for maintaining uninterrupted construction dewatering.
4. The Contractor shall install groundwater monitoring wells/piezometers and measure, record, and report the groundwater levels during the project.
5. The Contractor shall closely coordinate the support of excavation and construction water handling submittals. These two submittals shall be provided together to the PM/CM.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01060 – Permits and Regulatory Requirements

C. Section 01300 – Submittals

D. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

E. Section 02260 – Support of Excavation

F. Section 02295 – Geotechnical Instrumentation and Monitoring

G. Section 02314 – Microtunneling

H.

I. Section 02465 – Secant Pile Wall

J. Section 02466 – Slurry Diaphragm Wall

K. Section 02467 – Cutter Soil Mix Wall

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern.

B. American Water Works Association (AWWA)

1. A100 Standard for Water Wells

C. Narragansett Bay Commission (NBC)

1. Rules and Regulations for the Use of Wastewater Facilities within the Narragansett Bay Water Quality Management District Commission, effective February 1, 1995.

D. State of Rhode Island, Department of Environmental Management (RIDEM)

1. Rules and Regulations for Hazardous Waste Management, as amended.

E. U. S. Environmental Protection Agency (EPA).

1. The Federal Clean Water Act (33 U.S.C. 1251 et seq., as amended),

1.04 DEFINITIONS (NOT USED)

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. The quality of water discharged under this Contract to the NBC treatment facilities shall, at a minimum, meet the NBC pre-treatment requirements noted in the referenced NBC Rules and Regulations.

C. Qualifications

1. Dewatering design shall be performed by a Professional Engineer licensed in the State of Rhode Island having designed not less than five (5) successful projects of similar type, size, and complexity.

2. Dewatering wells shall be installed by a Specialty Subcontractor licensed in the State of Rhode Island with a minimum of five (5) completed dewatering projects including at least two (2) successful projects using pumped dewatering wells.

3. The dewatering work shall be under the supervision of a Superintendent(s) having not less than three (3) years of recent experience and have successful projects of similar type, size, and complexity.

4. Well drillers shall be licensed in the State of Rhode Island.

D. The Contractor shall employ a Testing Agency using trained and experienced personnel to perform the required water quality testing to verify that the biological, chemical, and physical condition of the water to be discharged from the site complies with the permit conditions.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submittals for design, shop drawings, and work plans required herein shall be submitted at the same time and in full coordination with the required submittals of Section 02260, Section 02465, Section 02466, and Section 02467.

C. Submit shop drawings and engineering calculations signed and sealed by a Licensed Professional Engineer registered in the State of Rhode Island at least thirty (30) days prior to the start of the work. Include, at a minimum, the following:

1. Plans, sections, and details that clearly describe the system to be installed. Include location, layout, and depth of system components as well as monitoring and discharge locations.

2. Details of construction and installation of fabricated items including materials, sizes, dimensions, and connections.

3. Anticipated flows and volume at each location of discharge.

4. Design computations including a dewatering drawdown analysis demonstrating that the required design criteria have been met.

5. Calculations demonstrating that the system designer has evaluated the potential impacts of the dewatering and incorporated adequate precautions in the design to protect existing structures and avoid damage.
6. A schedule that includes the time required for installation and development of dewatering wells in order to meet the design criteria specified herein and any discharge criteria required in accordance with the regulations.
7. A narrative comparing the site groundwater quality data with the water quality standards to be followed per the required permits for the project.

D. Submit a Construction Water Handling Work Plan at least thirty (30) days prior to the start of construction. Include, at a minimum, the following:

1. Construction schedule, methods and procedures of installation, proposed construction sequence, and maintenance schedule.
2. Provisions and protocols for measuring pumped water, monitoring water, and testing water.
3. Interface details and protection measures for existing structures and utilities as necessary.
4. Contingency plans complete to address potential emergencies including, but not limited to, power failures, overflows and effluent parameters exceeding the discharge limits specified in the required permits.
5. List of equipment including standby equipment and power supply.
6. A list of proposed hazardous waste transporters and hazardous waste disposal facilities acceptance to transporting any hazardous waste for off-site disposal. The submittal shall include a copy of the proposed hazardous waste transporter's permit and the proposed hazardous waste disposal facility's license and operating permit.
7. A well decommissioning plan to include, at a minimum, the following for each dewatering system:
    a. A schedule of activities.
    b. The method and procedures of decommissioning in accordance with the regulations.
    c. A list of materials and equipment to be used.
    d. Waste management procedures.

E. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.
2. Submit manufacturers' product data, calibration records, certificates, and manufacturers' test data for any manufactured materials incorporated.
3. Submit copies of all permits applications and permits obtained.
4. Submit installation documentation within seven (7) days of completion of well development to include the following:

a. Drillers logs including drilling method, surveyed location, subsurface ground and groundwater conditions, and depth.

b. Drillers notices and dewatering well tag identification numbers.

c. For each dewatering well, casing material and diameter; total depth; well screen material, slot size, length and interval depth; filter material, sealing material, and interval depths.

d. Well development record including date, method, rate and length of development, drawdown, discharge and solids concentrations at the beginning and end.

5. Submit a Weekly Construction Water Handling Report to include rate of flow measured daily, total flow indicated on flowmeter, sand content measured weekly in accordance with AWWA A100, groundwater level, results of any laboratory testing, and manifest or bills of laden for any offsite disposal.

6. Submit a Verification Form for dewatering system operations and performance completed by the Contractor's Engineer following each site visit.

7. Submit copies of all disposal documents for treatment system components that require disposal as hazardous or special wastes.

1.07 PERFORMANCE AND DESIGN REQUIREMENTS

A. The Contractor shall select the method of dewatering and control of water inside and outside the excavations and shall be solely responsible for the location, arrangement, and depth of any system(s) selected to accomplish the work.

B. The Contractor shall maintain groundwater levels to a point no higher than 2 feet below the prevailing excavation level so as to preserve the undisturbed characteristics of the subgrade soils and to preserve the bearing capacity. Groundwater levels shall be lowered for a time period as deemed necessary to ensure adequate factor of safety to construct the permanent structures.

C. The Contractor shall design and implement the dewatering system so as to maintain a minimum factor of safety against the uplift groundwater pressures in any soil strata. The factor of safety shall be calculated by considering the stabilizing pressure consisting of overburden soil weight alone. The dewatering system shall be maintained operational until the dead weight of the overburden soil plus any completed portion of the structure is able to provide the required factor of safety at static (normal) groundwater level/pressure.

D. The Contractor shall coordinate with all utility companies to verify all utility locations prior to commencing work.

E. The Contractor shall install a sufficient number of observation wells and shall monitored the water levels weekly, at a minimum, to demonstrate that the performance criteria is being met.

F. If the Contractor is excavating and encounters large amounts of water draining into the excavation, the Contractor shall take immediate steps to control the water source. Large amounts of water requiring control shall be defined as those that adversely affect the performance of work under the Contract and/or amounts that have the potential of resulting in improper operation of sedimentation basins or other

treatment components, or cause a loss or damage to adjacent properties. The Contractor shall have equipment, materials, manpower and all accessories necessary to deal with such an occurrence.

G. The Contractor shall design containment and treatment systems capable of handling 125 percent of anticipated flows and treating discharged water to the levels specified herein. The water treatment system shall include provisions for a minimum of 100 percent stand-by equipment for essential components and systems to include mobile electric generating equipment and spare pumps.

H. The water treatment system shall include the consideration of the following deleterious effects on Construction Water:

1. Constituents derived from cementitious products.
2. Constituents generated by the excavation process, microtunneling and muck handling.
3. Constituents derived from dewatering, groundwater depressurization, and groundwater inflows to excavations.
4. Oil and grease derived from the proper use and maintenance of equipment in accordance with legal requirements.

I. Acceptance of the Construction Water Handling Work Plan shall not in any way relieve the Contractor from full responsibility for the complete and adequate design and performance for the dewatering system and water handling system.

1.08 PROJECT CONDITIONS

A. Pre-Construction Meeting: The Contractor shall coordinate and schedule a pre-dewatering system construction meeting with the PM/CM and Contractor's Engineer to discuss the design, construction means, methods, procedures, sequence, schedule and anticipated performance for dewatering systems installation, operation, monitoring and removal.

B. Project Site Information: A Geotechnical Data Report (GDR) and an Environmental Data Report (EDR) have been prepared for the Project. The GDR and EDR have been included as part of the Contract Documents.

C. The Contractor shall review the GDR and make a determination as to the need to perform additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements. The Contractor will be responsible for conducting these additional investigations including associated costs.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide materials that are either new or in serviceable condition and free from defects that impair their strength or performance.

B. Materials and equipment used shall adhere to accepted industry standards and be in good operating condition and able to perform satisfactorily over the required duration of the dewatering work.

2.02 MATERIALS

A. Filter material shall consist of clean, rounded, washed select silica gravel and sand, free from silt, clay and other deleterious material. Use filters and filter packs such that soils are not subject to removal of fines upon pumping.

B. Well screens shall consist of factory-slotted pipe and sized appropriately for the filter pack and formation to prevent the removal of fines from the filter pack or formation. Groundwater entrance velocities through the well screen shall equal 0.01 feet per second or less.

2.03 EQUIPMENT

A. Provide all necessary tanks, sumps, pumps, motors, electrical and mechanical equipment, power lines, poles, piping discharge lines, valves, controls, oil skimmers, water meters, and other appurtenances required for functional dewatering systems and water handling systems.

B. Sumps shall include a slotted or perforated casing surrounded by filter pack to prevent movement of fines.

C. Flow Meters

1. Shall be capable of measuring the flow from the well within ten percent of the actual flow.

2. Shall be capable of reporting current flow in gallons per minute and total flow volumes in gallons per cubic feet.

3. Shall be factory calibrated within one year of data acquisition.

D. Provide stand-by equipment and replacement components to ensure the dewatering systems and water handling systems function at all times.

2.04 SOURCE QUALITY CONTROL

A. Only materials meeting the requirements of these specifications shall be used.

PART 3 EXECUTION

3.01 GENERAL

A. Commence installation of systems only after design calculations and shop drawings, and the work plan has been reviewed and accepted by the PM/CM and applicable permits have been obtained.

B. Conduct all work within the construction limits established for the project.

C. At a minimum, place fencing, gates, lights, and signs as necessary around the work areas to provide for public safety.

D. Operate all systems in accordance with permits, design requirements, and manufacturer's instructions.

E. Provide all necessary settling tanks or other acceptable means, as necessary, to prevent undesirable constituents from being discharged in accordance with the applicable permits.

F. Collected water shall be pumped to the discharge location or to the water treatment system as required before discharge.

G. Water from system operations shall not enter flowing or dry watercourses without compliance with the required permit. The Contractor shall provide and construct all necessary intercepting ditches, barriers, sedimentation basins, holding ponds, or other accepted means to eliminate the undesirable constituents.

H. Monitor system operation and performance as required by the permit and operational requirements.

I. During construction, the Contractor's Engineer shall make regular site visits and complete a Verification Form to verify that installation of dewatering systems are installed and operating in accordance with the performance criteria included herein.

J. Maintain adequate supplies of spare parts and treatment supplies to keep treatment system in continuous operation.

K. The dewatering systems and water handling systems shall be installed and operated in such a manner as to avoid the movement of fines or loss of ground below the bearing level and shall not influence the stability of surrounding areas. Wells or well points shall be properly sanded in and sumps shall be sheeted and provided with proper filter material.

L. Open pumping with sumps and ditches resulting in boils, loss of fines, softening of the ground or instability of slopes will not be permitted.

M. Dewatering effluent may be affected by rainfall. The Contractor shall provide adequate equalization and holding tanks to allow work to proceed in the case of restricted discharge capability during rain events.

N. The Contractor shall provide sufficient clean water to flush all sewers and drains when necessary. If any sewer, drain, catch basin, or inlet becomes filled or partially filled with sediment or debris, the Contractor shall promptly and satisfactorily remove such deposits.

O. The Contractor shall be responsible for periodically monitoring groundwater inflows into excavations, and water accumulating in excavations for visual and olfactory indications of contamination.

P. The dewatering system and water handling system shall keep the water in the excavation sufficiently controlled to develop a workable subgrade and maintain the groundwater levels as specified.

3.02 DEWATERING WELLS

A. Prepare a Well Construction Record after installation is completed, including appropriate items from the following list:

1. Project name, contract name, and number.
2. Drillers logs including drilling method, location, subsurface ground and groundwater conditions, and depth. Strata soil nomenclature shall be based on boring logs contained in the Geotechnical Data Report.
3. Drillers notices and dewatering well tag identification numbers.
4. For each dewatering well, casing material and diameter; total depth; well screen material, slot size, length and interval depth; filter material, sealing material, and interval depths.
5. Well development record including date, method, rate and length of development, drawdown, discharge and solids concentrations at the beginning and end.
6. Notes, including problems encountered, delays, unusual features of the installation, and details of any events that may have a bearing on well behavior.

B. Develop each well after installation is complete to remove fines from drilling and installation.

1. Develop wells until fines content of the discharge water during surging is less than 20 parts per million (ppm) as determined by a centrifugal, separating meter such as Rossum Sand Tester or acceptable equivalent in accordance with AWWA A100.
2. Monitoring System and Reporting
3. Install flow meters in accordance with the manufactures recommendations.
4. Maintain accurate and continuous records of water level, quality, sand content, and flow information in accordance with the project permits and regulations.

C. Decommission wells and dewatering system and instrumentation used to monitor the system in accordance with the submitted well decommissioning plan.

3.03 CONCRETE WASHOUT

A. All concrete, grout, and any other cementitious product washout shall be directed to a leakproof container or containment pit in accordance with the applicable permits, codes, and standards.

B. Washout discharge onto pavement or the ground is prohibited.

C. Decant water must be checked for TSS concentration and pH prior to discharge. Only decant water meeting design criteria for TSS and pH is allowed to be discharged through any onsite treatment and discharge system.

D. Water and liquids from grouting operations is prohibited from discharge and must be removed and disposed offsite.

E. Waste, excess, or spilled concrete, grout, and grout (and any other cementitious material) on the ground or pavement must be promptly cleaned-up and placed in an appropriate waste container.

3.04 RESPONSIBILITY FOR DAMAGE

A. Structures including, but not limited to, footings, foundations, above and below grade walls, driveways, utilities, streets, curbs, and sidewalks that become unstable and vulnerable to collapse, or settlement due to removal or disturbance of groundwater shall be corrected immediately by the Contractor. Provide all means necessary to rectify the particular problem identified.

B. The Contractor shall be responsible for any and all loss or damage arising from removal or disturbances of groundwater, including, but not limited to, any such claims for subsidence of soil, utilities, cracked slabs or walls, foundations, concrete driveways and any such claims for slumping and the loss of lateral support rendering walls unstable and vulnerable to collapse, that may occur in the prosecution of the work shall be sustained and borne by the Contractor at his expense.

C. If the Contractor fails to correct the damage or destruction resulting from his operations, the PM/CM may proceed to repair, rebuild or otherwise restore such damaged property as may be deemed necessary. The cost of this work shall be deducted from any compensation that may be (or become) due the Contractor under this Contract.

D. In any event, the Contractor shall indemnify and save the NBC and the PM/CM harmless from claims by property owners for damages to their property as a result of his dewatering operations regardless of whether or not such claims for damages are covered by his insurance and regardless of whether or not such dewatering operations were reviewed or accepted by the PM/CM.

3.05 HAZARDOUS WASTE DISPOSAL

A. Contaminated construction water treatment system components that require disposal as a hazardous waste shall be disposed in accordance with applicable federal, state, and local rules and regulations.

B. The Contractor shall use a licensed hazardous waste transporter to transport all hazardous waste to an off-site hazardous waste disposal facility.

C. The Contractor shall only dispose of hazardous waste at a hazardous waste disposal facility accepted by the PM/CM.

3.06 SITE CLEAN UP AND RESTORATION

A. After construction has been completed, the Contractor shall dismantle and remove all temporary facilities associated with the collection, handling, and treatment of

construction water. The area shall be returned to original condition unless otherwise specified on the Contract Drawings.

3.07 FIELD QUALITY CONTROL

A. Notifications

1. Notify the PM/CM immediately of any permit compliance limit or standard exceedance.
2. Notify the PM/CM immediately of any improper or unanticipated discharge.
3. Notify the PM/CM immediately of any sign of subgrade disturbance due to seepage or unaccountable reduction in effluent flow rate and take immediate steps immediately to correct the condition at no additional cost to the NBC.
4. Notify the PM/CM of any indication that suspected contaminated groundwater has been encountered.

END OF SECTION 02240

SECTION 02260

SUPPORT OF EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for providing all personnel, power, and equipment for designing, furnishing, installing, and maintaining support of excavation systems for all surface excavations.

B. The support of excavation systems may be either single or multi-staged, comprised of soldier pile and lagging, secant pile walls, slurry diaphragm walls, cutter soil mix walls, internal bracing supports (ring beams, walers, and/or struts), traffic/sidewalk decking or other system designed by the Contractor and submitted to the PM/CM for review and acceptance. Trench boxes or slide rail shoring systems shall not be used as support of excavation systems for launching and receiving shafts for trenchless operations. Trench boxes or slide rail shoring systems may be used at the Contractor's risk in areas where excavations are 10 feet or less in depth and known to be free of obstructions.

C. The excavation support system for the microtunnel boring machine (MTBM) launching and receiving shafts (MH-217-6 and MH-217-7) for trenchless operations shall consist of water tight systems socketed in bedrock, such as secant pile walls, slurry diaphragm walls, or cutter soil mix wall. The Contractor shall select and design the system appropriately to achieve this criterion.

D. Refer to Section 02465 for additional requirements for secant pile walls in addition to those stated herein.

E. Refer to Section 02466 for additional requirements for slurry diaphragm wall in addition to those stated herein.

F. Refer to Section 02467 for additional requirements for cutter soil mix wall in addition to those stated herein.

G. The Contractor shall coordinate the design and submittals of the excavation support systems with the dewatering systems and the water handling systems specified in Section 02240.

H. The Contractor shall be responsible for sizing the support of excavation systems.

1. The support of excavation systems shall be adequately sized for construction of the permanent structures and pipelines indicated on the Contract Drawings and to provide adequate space to meet the requirements of the Contractor's selected means and methods of construction.

2. Pit excavation sizes larger than those indicated on the Contract Drawings shall be subject to review and acceptance of the PM/CM.

3. Modifications to approved traffic control measures and utility relocations shall be subject to review and acceptance of the PM/CM and completed at no additional cost.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 03300 – Cast-in-Place Concrete

D. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

E. Section 02400 – Construction Water Handling

F. Section 02295 – Geotechnical Instrumentation and Monitoring

G. Section 02314 – Microtunneling

H. Section 02465 – Secant Pile Wall

I. Section 02466 – Slurry Diaphragm Wall

J. Section 02467 – Cutter Soil Mix Wall

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern.

B. American Association of State Highway and Transportation Officials (AASHTO)

1. LRFD Bridge Design Specifications, 9th Ed., 2020

C. American Concrete Institute (ACI)

1. 301 Specifications for Structural Concrete
2. 318-14 Building Code Requirements for Structural Concrete

D. American Institute of Steel Construction (AISC)

1. 2016 Specification for Structural Steel Buildings

E. ASTM International Standards (ASTM)

1. A36 Specification for Carbon Structural Steel
2. A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
3. A490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
4. A572 Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
5. A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

6. A690 Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
7. A722 Specification for High Strength Steel Bars for Prestressed Concrete
8. A992 Specification for Structural Steel Shapes
9. C150 Specification for Portland Cement

F. American Welding Society (AWS)

1. D1.1 Structural Welding Code-Steel

G. American Wood-Preservers Association (AWPA)

1. U1-19 Use Category System: User Specification for Treated Wood

H. U.S. Department of Labor, Occupation Safety and Health Administration (OSHA)

1. Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S. Section 1926.800, “Underground Construction.

1.04 DEFINITIONS

A. Launching Shaft: A shaft from which the trenchless operations are conducted including launch of the MTBM, pipe placement, and spoils removal.

B. Receiving Shaft: A shaft used for which the retrieval operations for the MTBM is conducted.

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. The design of the excavation supports systems shall be performed by a Professional Engineer licensed in the State of Rhode Island having not less than five successful projects of similar type, size, and complexity. Experience shall include designing excavation support systems in similar site and ground conditions.
2. Any welding required shall be performed by certified welders in accordance with AWS D1.1.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submittals for design, shop drawings, and work plans required herein shall be submitted at the same time and in full coordination with the required submittals of Section 02240.

C. Submit 30 days prior to the work, signed and sealed design calculations and shop drawings by a Professional Engineer licensed in the State of Rhode Island to include, at a minimum, the following:

1. A written summary, applicable code and design standard references, and design loading criteria for all stages of installation and excavation.
2. Plans, elevations, sections, and details that clearly describe the excavation support systems to be installed.
3. Show location, arrangement, bracing levels, and interface details at existing structures.
4. Include materials, sizes, dimensions, reinforcement, and connections of fabricated items.
5. Design for any utilities required to be supported in place. Include a description of the method and procedures to be implemented during construction.

D. Submit a Support of Excavation Work Plan at least thirty (30) days prior to the start of construction. Include, at a minimum, the following:

1. Construction schedule, list of equipment, methods and procedures of installation, and proposed construction sequence.
2. The method of groundwater control and estimated discharge rates.
3. Interface details and protection measures for existing structures and utilities as necessary
4. Include contingency plans for excessive movement of ground, support wall system, or existing structures or utilities in excess of allowable movement indicated on the Contract Drawings. Contingency plans shall include positive measures by the Contractor to limit further movement of ground, support wall system, or existing structures or utilities. Coordinate the contingency plans with Section 02295.

E. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.
2. Manufacturers' product data, certificates, and manufacturers’ test data for any manufactured materials incorporated.
3. Submit as-built record data within one week of each installation completion that includes plans, elevations, dimensions, and installed excavation support system.
4. Submit a Verification Form for excavation support system installation and performance and base subgrade stability completed by the Contractor’s Engineer following each site visit.

1.07 DESIGN CRITERIA

A. The Contractor shall design of the excavation support systems to include, at a minimum, the minimum loading criteria indicated on the Contract Drawings and any other loads that may be imposed.

B. The Contractors design shall include all phases of construction with appropriate factors of safety.

C. The Contractors design shall consider conditions that may occur during the various stages of construction including, but not limited to following:

1. Temporary or permanent alteration of the soils' in-situ properties caused by the selected methods of construction.
2. Installation, relocation, and removal of temporary bracing.
3. Excavation below bracing.
4. Dewatering of excavation.
5. Time related effects.
6. Load transfer to permanent structures.

D. At trenchless operation launching shafts, the Contractor shall consider MTBM and pipe jacking thrust loads developed based on the jacking procedures selected by the Contractor. Coordinate the design of the excavation supports systems with the thrust block and pipe design.

E. The Contractor is solely responsible for design of each pit bottom to provide a stable support for guide rails, thrust block, and other construction operations. Include, at a minimum, a working slab (mudmat), a drainage layer, and geotextile fabric.

F. The Contractor shall design the excavation support system to limit movements in accordance with Section 02295.

G. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation system includes an analysis of the stability of the adjacent structure and includes, as necessary, any required bracing/underpinning of the adjacent structure.

H. Traffic/sidewalk decking shall be designed in accordance with AASHTO LRFD Bridge Design Specifications.

I. Elements supporting vertical loads as well as lateral pressures shall be analyzed as members subjected to combined axial loads and bending.

J. The maximum lateral deflection along the full depth of the excavation shall be limited by response level criteria provided on the drawings.

1.08 PROJECT CONDITIONS

A. Pre-Construction Meeting: The Contractor shall coordinate and schedule a pre-construction meeting with the PM/CM and Contractor's Engineer to discuss the design, construction means, methods, procedures, sequence, schedule and anticipated performance for the support of excavation system installation, operation, monitoring, and removal.

B. Project Site Information: A Geotechnical Data Report (GDR) and an Environmental Data Report EDR) have been prepared for the Project. The GDR and EDR have been included as part of the Contract Documents.

C. The Contractor shall review the GDR and make a determination as to the need to perform additional test borings and conduct other exploratory operations necessary for installation of support of excavation systems according to the performance requirements. The Contractor will be responsible for conducting these additional investigations including associated costs

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall either new or in serviceable condition.

B. The Contractor shall furnish all installation tools, materials, and miscellaneous components.

2.02 MATERIALS

A. Structural Steel shall conform to ASTM A 36/A 36M, ASTM A 572/A 572M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

B. Bolts and Nuts for Structural Steel shall conform to ASTM A325 or ASTM A490 as appropriate.

C. Reinforcing Bars shall conform to ASTM A 615/A 615M, Grade 60.

D. Timber for lagging shall be any species, rough-cut, mixed hardwood, nominal 3 inches thick and shall conform to the requirements of AWPA. Lagging need not be new, but shall be in serviceable condition, free of cracks splits, decay or other types of damage and deterioration.

E. Grout shall be suitable for service when used for excavation support systems. Conform to ASTM C150, Type I, II, or III Portland Cement.

F. Concrete shall conform to Section 03300 when used for excavation support systems. Conform ACI 318 for compressive strength required for application.

PART 3 EXECUTION

3.01 GENERAL

A. Commence installation of support of excavations systems only after design calculations and shop drawings have been reviewed and accepted by the PM/CM and applicable permits have been obtained.

B. Conduct all work within the construction limits established for the project.

C. At a minimum, place fencing, gates, lights, and signs as necessary around the support of excavation work areas to provide for public safety.

D. Methods of construction for support of excavations systems shall be such as to ensure the safety of the Contractor's employees, the Owner's employees and inspectors, the public, and adjacent property owners.

E. During construction, the Contractor's Engineer shall make regular site visits and complete a Verification Form to verify that installation of excavation support systems are installed in accordance with their design and the stability of the subgrade at the base of excavations is stable in accordance with the performance criteria included herein.

F. Perform the work to achieve the minimum required clearances and tolerances necessary for the permanent structures.

G. If the PM/CM is of the opinion that at any point sufficient or proper supports have not been provided, additional supports may be ordered to be placed at no additional cost. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports.

H. If unstable material is encountered during excavation, all necessary measures shall be taken immediately to prevent ground movement.

I. Maintain a sufficient quantity of materials throughout the conduct of the work for installation of temporary excavation support systems, protection of the work, or in cases of accident or emergency.

J. Excavations shall be kept free of water at all times and a stable subgrade shall be maintained. Refer to Section 02240 for requirements.

K. Care shall be taken to prevent voids outside of the excavation support system. If voids are formed, they shall be immediately filled with sand or stone. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete or other material as accepted by the PM/CM.

L. Maintain temporary excavation support systems in place and functioning properly until no longer necessary.

3.02 UTILITIES

A. All underground utility lines shall be identified, located, and protected from damage or displacement.

B. Utility companies and other responsible authorities shall be contacted to locate and mark the locations and, if they so desire, direct or assist the Contractor with protecting existing utilities.

C. When required, the Contractor shall obtain an excavation permit from the local authority having jurisdiction prior to the initiation of any excavation support system work.

D. Perform the work to limit movements in accordance with Section 02295.

3.03 SOLDIER PILE AND LAGGING

A. Install soldier piles to the minimum embedment depths as shown on the reviewed shop drawings.

B. Soldier piles shall be installed in predrilled holes. Provide casing or other methods of support to prevent caving of holes and loss of ground.

C. Predrilled holes for soldier piles shall be backfilled with concrete from the pile tip elevation to the elevation of the bottom of the excavation. The remainder of the

predrilled hole shall be backfilled with lean concrete or sand. Concrete strength shall be in accordance with the reviewed shop drawings.

D. Install lagging to mitigate gap spacing between adjacent boards so that excessive ground loss does not result in exceeding ground movement levels. The Contractor shall anticipate having to make adjustments in height of unlagged face support based on ground and groundwater conditions at each pit excavation.

E. As the installation progresses, backfill the voids between the excavation face and the lagging. Pack with materials such as hay, burlap, or geotextile filter fabric as necessary to allow drainage of ground water without loss of ground.

3.04 BRACED SUPPORT SYSTEMS

A. The internal bracing support system shall include wales, struts, rakers, or tiebacks. Arrange in a manner that will minimize interference with construction of the permanent structures.

B. Include web stiffeners, plates, or angles as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

C. Install and maintain all bracing support members in tight contact with each other and with the surface being supported.

D. Where passive soil pressure limits permit, internal bracing shall be prestressed to at least 50 percent of maximum design loads.

E. Coordinate excavation work with installation of bracing. Excavation shall extend no more than two feet below centerline of any brace level prior to installation of the next bracing.

F. Use procedures that produce uniform loading of bracing member without eccentricities or overstressing and distortion of members of system.

3.05 REMOVAL OF EXCAVATION SUPPORT SYSTEMS

A. Unless approved by the PM/CM, all soldier piles, shall be left in place. Refer to Section 02465, Section 02466, and Section 02467 for removal requirements for other types of excavation support systems.

B. Soldier piles that are not completely removed shall be cut off at least 5 feet below finished grade and removed or as noted on the Contract Drawings. No wood shall remain as part of the abandoned portion of the work.

C. Except where specified elsewhere in the Contract Documents, other support system elements, including wales, struts, lagging, thrust blocks, and working slabs, shall be carefully removed from the bottom of the excavation prior to restoration. Remove the support system in a manner that will not disturb or damage adjacent buildings, structures, waterproofing material, or utilities.

D. Do not remove vertical support members installed within the zone of influence of new or existing structure or below the mid-diameter of any pipe. The zone of influence is defined as a zone extending down and away from the lowest outer edge of the structure at 1 horizontal to 1 vertical.

END OF SECTION 02260

SECTION 02261

SUPPORT OF UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for providing all personnel, power, and equipment for designing, furnishing, installing, and maintaining systems for support of existing utilities.

B. The Contractor means and methods shall not cause damage to any underground existing utility. Existing underground utilities that are to remain shall be temporarily supported and protected throughout the work.

C. The PM/CM acceptance of Contractor construction methods and procedures does not relieve the Contractor of his responsibilities to protect and preserve utilities.

D. The Owner accepts no responsibility and makes no representation or warranty as to the accuracy of completeness of the utility information provided on the Contract Drawings.

E. The Contractor shall establish direct and continuous contact with the respective utility companies and cooperate with them in all phases of construction. The Contractor shall contact the utility companies in sufficient time so that the construction is not delayed.

F. The Contractor shall verify by field investigation the locations of existing utilities within and adjacent to the project limits that may be affected by construction operations.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

D. Section 02260 – Support of Excavation

E. Section 02295 – Geotechnical Instrumentation and Monitoring

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern.

B. U.S. Department of Labor, Occupation Safety and Health Administration (OSHA)

1. Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S. Section 1926.800, “Underground Construction.

1.04 DEFINITIONS (NOT USED)

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. The design of the utility support systems shall be performed by a Professional Engineer licensed in the State of Rhode Island having not less than five successful projects of similar type, size, and complexity. Experience shall include designing utility support systems in similar site and ground conditions.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit 30 days prior to the work, signed and sealed design calculations and shop drawings by a Professional Engineer licensed in the State of Rhode Island to include, at a minimum, the following:

1. A written summary, applicable code and design standard references, and design criteria used.

2. Plans, elevations, sections, and details that clearly describe the utility support systems to be installed.

3. Show location, arrangement, bracing, and interface details.

4. Include materials, sizes, dimensions, reinforcement, and connections of fabricated items used.

5. Include a description of the method and procedures to be implemented during construction.

C. Submit a Work Plan for temporary utility support in coordination with the requirements of Section 02260 at least thirty (30) days prior to the start of construction. Include, at a minimum, the following:

1. Construction schedule, list of equipment, methods and procedures to be used, and proposed construction sequence.

2. Include contingency plans for excessive movement of utilities in excess of allowable movement indicated on the Contract Drawings. Contingency plans shall include positive measures by the Contractor to limit further movement of utilities. Coordinate the contingency plans with Section 02295.

D. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.

2. Manufacturers' product data, certificates, and manufacturers’ test data for any manufactured materials incorporated.

1.07 DESIGN CRITERIA

A. The utility support systems shall be designed by the Contractor and submitted to the PM/CM for review and acceptance.

B. The utility support systems shall be designed by the Contractor and submitted to the utility owner as required for review and acceptance.

C. The utility support systems shall be designed by the Contractor to provide adequate space to meet the requirements of the Contractor's selected means and methods of construction.

D. The Contractor means and methods shall not result in applied surcharge loadings to existing utilities in excess of H-20 loading. The Contractor shall design of the utility support systems to include any additional loads that may be imposed.

E. The Contractors design shall include all phases of construction with appropriate factors of safety.

F. The Contractor shall design the utility support system to limit movements in accordance with the criteria specified on the Contract Drawings and Section 02295.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall be either new or in serviceable condition.

B. The Contractor shall furnish all installation tools, materials, and miscellaneous components.

2.02 MATERIALS

A. As determined by the Contractor's designer of the utility support system.

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate the work of this section with Section 02260.

B. Commence installation of utility support systems only after design calculations and shop drawings have been reviewed and accepted by the PM/CM and the utility owner as required and applicable permits have been obtained.

C. Conduct all work within the construction limits established for the project.

D. At a minimum, place fencing, gates, lights, and signs as necessary around the support of excavation work areas to provide for public safety.

E. Methods of construction for utility support systems shall be such as to ensure the safety of the Contractor's employees, the Owner's employees and inspectors, the public, and adjacent property owners.

F. Perform the work to achieve the minimum required clearances and tolerances necessary for the permanent structures.

G. If the PM/CM is of the opinion that at any point sufficient or proper supports have not been provided, additional supports may be ordered to be placed at no additional cost. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports.

H. Maintain a sufficient quantity of materials throughout the conduct of the work for installation of utility support systems.

I. Maintain temporary excavation support systems in place and functioning properly until no longer necessary.

3.02 INSTALLATION

A. All underground utility lines shall be identified, located, and protected from damage or displacement.

B. Utility companies and other responsible authorities shall be contacted to locate and mark the locations and, if they so desire, direct or assist the Contractor with protecting existing utilities.

C. The Contractor shall permit the utility owner and their representatives to have access to inspect the work during construction.

D. Proceed with caution in the areas of existing utilities and expose them by hand or by other excavation methods acceptable to the utility owner.

E. Existing utilities shall remain in operation as required until the relocated utilities are completed and made operational.

F. When required, the Contractor shall obtain an excavation permit from the local authority having jurisdiction prior to the initiation of any utility support system work.

G. Remove utility support systems in a manner that will not disturb or cause damage to the utilities.

END OF SECTION 02261

SECTION 02272

GEOTEXTILE MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for installation of geotextile filter fabric in trenches and under riprap.

B. Related Sections

1. Section 02100 – Mobilization, Site Preparation, and Demobilization
2. Section 02200 – Earth Excavation, Backfill, Fill, and Grading
3. Section 02215 – Aggregate Materials

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D3786, Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
2. D4355, Test Method for Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
3. D4491, Test Method for Water Permeability of Geotextiles by Permittivity
4. D4533, Test Method for Trapezoid Tearing Strength of Geotextiles
5. D4632, Test Method for Grab Breaking Load and Elongation of Geotextiles
6. D4751, Test Method for Determining Apparent Opening Size of a Geotextile
7. D4833, Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
8. D5261, Measuring Mass Per Unit Area of Geotextiles.
9. D6241, Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

1.03 QUALITY ASSURANCE

A. General

1. Producer of fabric to maintain competent laboratory at point of manufacture to insure quality control in accordance with ASTM testing procedures.
2. Laboratory to maintain records of quality control results.

1.04 SUBMITTALS

A. Shop Drawings

1. Submit in accordance with SECTION 01300
2. Include manufacturer’s recommended method of joining of adjacent fabric panels.

B. Certificate of Conformance

1. Upon each shipment/delivery of product to the work site, furnish mill certificate(s) from the company manufacturing the fabric attesting that the fabric meets the chemical, physical, manufacturing and performance requirements specified. Fabric will be rejected if it is found to have defects, rips, flaws, deterioration or other damage.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide fabric in rolls wrapped with a heavy-duty protective covering to protect fabric from, mud, dirt, dust, debris and other deleterious sources until it is installed. Label each roll of fabric with number or symbol to identify production run.

B. Do not expose fabric to ultraviolet radiation (sunlight) for more than 20 days total in period of time following manufacture until fabric is installed and covered.

C. If Program Manager determines material is damaged in any way or has excessive sunlight exposure, the Contractor shall immediately make all repairs and replacements as directed by the Program Manager, at no additional cost to the Owner.

1.06 SCHEDULING

A. Schedule Work so that the covering of the fabric with a layer of the cover material is accomplished immediately after inspection and approval of the placed fabric by the Program Manager. Failure to comply with this requirement shall require replacement of the fabric.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER/MATERIAL

A. The geotextile fabric shall be nonwoven polypropylene designated as MIRAFI 140N as manufactured by US Fabrics, Cincinnati, Ohio; or acceptable equivalent and shall meet the following minimum requirements:

Property (Unit)	Unit	Test Method	Minimum Requirements
Weight	oz/sy	ASTM D5261	4.5
Grab Tensile Strength	lbs	ASTM D4632	120
Grab Tensile Elongation	%	ASTM D4632	50
CBR Puncture Strength	lbs	ASTM D6241	310
Trapezoid Tear Strength	lbs	ASTM D4533	50
Apparent Opening Size (AOS)	US Std. Sieve (mm)	ASTM D4751	70 (0.21)
Permittivity	sec^{-1}	ASTM D4491	1.7
Permeability	cm/sec	ASTM D4491	0.22
Flow Rate	gal/min/sf	ASTM D4491	135
Ultraviolet Resistance (strength retained at 500 hrs)	%	ASTM D4355	70

B. To keep the number of overlay joints to a minimum, fabric shall be provided in sections not less than fifteen (15) feet in width unless otherwise approved by the Program Manager prior to delivery to the site.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. For Riprap

1. Prepared areas to receive geotextile in accordance with SECTION 02100 and SECTION 02200
2. Clear subgrade of all sharp objects, large stones, roots, debris, or any other foreign materials that may contribute to puncturing, shearing, rupturing or tearing of the geotextile.
3. Grade area as smooth as possible and compact in accordance with SECTION 02200, with a vibratory roller or other method approved by the Program Manager.
4. Inspect subgrade and repair all unstable areas or soft spots with the installation of gravel and recompact prior to the placement of geotextile.

3.02 FABRIC INSTALLATION

A. For Riprap

1. Place at the locations shown on the Contract Drawings.
2. Unroll directly onto the prepared slope in a continuous manner. Join adjacent sections by overlapping the fabric a minimum of 12-inches. Join end sections by overlapping the fabric a minimum of 2-feet with field-sewn joints or as recommended by the manufacturer.
3. Place fabric on slopes creating a “shingled” effect in the direction of anticipated water flow.
4. Lay fabric smooth, maximizing surface contact with the prepared subbase, free of tension, stress, folds, wrinkles, or creases.
5. Securely anchor fabric sections at the top of the slope as recommended by the manufacturer. Use anchoring pins, nails, staples or other such means to secure fabric to the subbase surface to prevent fabric movement caused by wind uplift, and/or placement of cover material.
6. Maintain sufficient amount of cover material (minimum depth of 6-inches) to protect fabric during placement of riprap. Dozer buckets or blades, or other heavy or damaging equipment shall not be in direct contact with the fabric.
7. Minimize the height from which cover material is dumped and/or dropped directly onto the fabric material in order to avoid fabric damage or movement. Equipment used for spreading and compacting the cover material shall be of the type and size to avoid damage or movement to the underlying geotextile fabric.
8. Spread cover material in the direction of fabric overlap and in a manner that avoids creating undue tension, stress, sagging, buckling and/or other movement of the underlying fabric.

B. Fabric Installation in Trenches

1. In accordance with manufacturers recommendations
2. Place fabric in trench prior to placing crushed stone pipe bedding.
3. Overlap fabric 18-inches minimum for unsewn lap joints.

4. Do not permit equipment to travel directly on fabric.
5. Place fabric in smooth condition to prevent tearing or puncture.
6. Lay fabric loosely, without wrinkles or creases.
7. Leave slack in fabric to allow for adjustment.

3.03 PROTECTION

A. Protect the work before, during and after installation, and protect the installed work covered by other Sections.

3.04 REPAIR

A. Geotextile fabric damaged during installation shall be repaired by a piece of geotextile material cut, placed and adequately anchored over the damaged area, subject to a 3-foot minimum overlap requirement or as directed by the Program Manager.

B. If detrimental movement of the geotextile fabric occurs during any step of the installation, as determined solely by the Program Manager, the Contractor shall remove the cover material and/or sections of fabric to the limits deemed necessary and reinstall the fabric.

C. Any fabric damage during its installation or during placement of cover materials shall be replaced by the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 02276

SILT FENCE WITH HAY BALES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to perform all operations in connection with the sediment control, as indicated on the Drawings and as herein specified.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D3786, Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven fabrics
2. D4355, Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
3. D4491, Test Method for Water Permeability of Geotextiles by Permittivity.
4. D4533, Test Method for Trapezoid Tearing Strength of Geotextiles.
5. D4632, Test Method for Grab Breaking Load and Elongation of Geotextiles.
6. D4751, Test Method for Determining Apparent Opening Size of a Geotextile.

1.03 SUBMITTALS

A. In accordance with SECTION 01300.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Silt Fence as manufactured by Amoco Fabrics and Fibers, Austell, GA, Propex Operating Co, Chattanooga, TN or acceptable equivalent.

2.02 MATERIALS

A. Silt Fence

1. The silt fence shall be comprised of a sediment control fabric and reinforced netting stitched together with heavy duty thread top and bottom, stapled to hardwood posts.
2. Hardwood posts shall be 1 1/2-inch x 1 1/2-inch nominal, minimum, x 4.0 feet long, spaced a maximum 8.0 feet apart with lower ends tapered to facilitate driving into compacted soil.
   a. Provide larger posts to facilitate driving if required.
3. A 6-inch flap at the bottom of the fence shall be used to toe in the sediment control barrier to prevent silt migration under the barrier.
4. Each section of fence shall be supplied with a coupling to attach adjoining sections.
5. Silt fence shall conform to the following test requirements:

Property	Test Method	Value
Grab Tensile	ASTM D4632	120 lbs.
Grab Elongation	ASTM D4632	15 %
Trapezoid Tear Strength	ASTM D4533	60 lbs.
Apparent Opening Size (AOS)	ASTM D4751	US Std. Sieve 30
Ultraviolet Resistance	ASTM D4355	70 % @ 500 hrs

6. Roll Width: 3.0 feet.
7. Roll Length: 100.0 feet.

B. Hay Bales/Straw Wattles

1. Machine produced.
2. Straw filled tubes of compacted straw of rice, wheat or barley.
3. Straw wattles to be certified as weed free.
4. Netting for tubes to be seamless, high density polyethylene with ultra violet inhibitors.
5. Roll length to be 10.0 feet to 25.0 feet.
6. Weight per linear foot,
   a. 12-inch: 2.5 lbs. minimum
   b. 9-inch: 1.5 lbs. minimum
7. Stakes shall be wooden, 1 1/8-inch x 1 1/8-inch x 2.5 feet long, with lower ends tapered to facilitate driving into compacted soil. Rebar may be substituted for wooden stakes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Silt fence and hay bales shall be installed prior to any grubbing or earth excavation.

B. Install silt fence in accordance with manufacturers written recommendations. Excavated soils shall be thoroughly compacted back into trench after installation of erosion control devices.

C. Install hay bales “tight” against silt fence.

1. Remove all rocks, vegetation or other obstructions at straw wattle location.
2. Excavate a trench approximately 2 to 3-inches deep to accept the straw wattle and place straw wattle in trench.
3. Anchor straw wattle with stakes placed a maximum of 4-feet apart.
4. The end stakes shall be placed 6-inches from the end of straw wattle and angled toward previously laid straw wattle to force straw wattles together.

D. Install silt fence and hay bales at locations shown on the Contract Drawings or as directed by the Engineer.

3.02 MAINTENANCE

A. Maintain fence throughout the duration of the project.

B. Remove sediments when depths accumulate to 50% of the depth of the fence height, or as necessary.

3.03 REMOVAL AT PROJECT COMPLETION

A. Remove all sediment collected by the silt fence, remove the silt fence, and restore the area to pre-construction condition to the satisfaction of the Engineer.

END OF SECTION

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SECTION 02295

GEOTECHNICAL INSTRUMENTATION AND MONITORING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for furnishing, installing, monitoring, reporting data from, and maintaining geotechnical instrumentation.

B. Contractors Responsibilities

1. Furnish all instrumentation shown on the Contract Drawings.
2. Monitor, interpret, and report all data from all instruments shown on the Contract Drawings.
3. Protecting instrumentation from damage. Replacing damaged, malfunctioning, or worn-out instrumentation equipment and materials.
4. Implement response actions.
5. The Contractor shall install instrumentation, in addition to that specified herein, that the Contractor deems necessary to ensure the safety of personnel and the Work, at no additional cost.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 01390 – Pre- and Post-Construction Survey

D. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

E. Section 02240 – Construction Water Handling

F. Section 02260 – Support of Excavation

G. Section 02314 – Microtunneling

H. Section 02465 – Secant Pile Wall

I. Section 02466 – Slurry Diaphragm Wall

J. Section 02467 – Cutter Soil Mix Wall

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern.

B. American Society for Testing and Materials (ASTM)

1. C778 - Standard Specification for Standard Sand.
2. D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Sch 40, 80, and 120.

C. National Geodetic Survey (NGS)

D. National Institute of Standards and Technology (NIST)

1.04 DEFINITIONS (NOT USED)

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. The person in responsible charge of the surveyors shall be a Registered Land Surveyor in the State of Rhode Island with experience in measurements of the types and accuracies specified herein.
2. The Contractors instrumentation personnel shall include a Superintendent who will be in responsible charge during the geotechnical instrumentation program. The Superintendent shall have prior field experience in installation and monitoring of the types of instrumentation specified herein and shall have supervised instrumentation programs of similar magnitude in similar subsurface conditions. The Superintendent shall:
    a. Be on site and supervise all instrument installations and acceptance tests.
    b. Supervise data collection, reduction, plotting, and reporting, except for survey data.

C. Factory calibration shall be conducted on instruments prior to shipment. Certification shall be provided to indicate that the test equipment used for this purpose is calibrated and maintained in accordance with the test equipment manufacture's calibration requirements. Where applicable, calibration shall be traceable to the NIST.

D. The Contractor shall provide the manufacturer's warranty for each portable readout unit.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit 30 days prior to installation, and Instrumentation Work Plan. Include, at a minimum, the following:

1. Detailed step-by-step procedures for installation, together with a sample installation record sheet. The installation procedures shall include:
    a. Method to be used for cleaning the inside of casing or augers.

b. Specifications for proposed grout mixes, including commercial names, proportions of admixtures and water, mixing sequence, mixing methods and duration, pumping methods and tremie pipe type, size and quantity.

c. Drill casing or auger type and size.

d. Depth increments for backfilling boreholes with sand and granular bentonite.

e. Method of sealing joints in pipes to prevent ingress of grout.

f. Method of conducting post installation acceptance tests.

2. Detailed step-by-step procedures for conducting all optical survey measurements to the specified accuracies, including types of surveying instruments and data reduction procedures.

3. A schedule indicating the proposed time sequence of instrumentation installation.

C. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.

2. Manufacturers' product data, factory calibration, and manufacturers' test data for all instruments to be installed.

3. Submit location plan with surveyed coordinates, baseline readings, and borehole logs of all installed instruments in advance construction in the area where they are to be installed.

4. Submit Monitoring Instrumentation Reports as specified herein.

1.07 DESIGN CRITERIA (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall be new.

B. Whenever any product is specified by brand name and model number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the product desired. The term "acceptable equivalent" shall be understood to indicate that the "acceptable equivalent" product is the same or better than the product named in the specifications in function, performance, reliability, quality, and general configuration.

C. The Contractor shall furnish all installation tools, materials, and miscellaneous instrumentation components.

D. The Contractor shall provide readout units as needed for making acceptance tests and for taking readings during construction.

E. Surface protection shall be flush with the ground surface in paved or other areas. For all instruments, surface protection shall consist of a model 26T-6855 LF Top Only roadway box with a plain 5 ¼ inch lock lid as manufactured by Tyler Pipe, or a Model 00068 roadway box with matching lock lid cover, as manufactured by Bresnahan Foundry, or acceptable equivalent.

2.02 SURVEY INSTRUMENTS

A. Instruments used for vertical movement monitoring shall have a minimum accuracy of ±1.5 mm (standard deviation for one kilometer of double run leveling) and a minimum setting accuracy of ±1.0 arc seconds. Leveling staffs shall be non-telescopic in design (i.e., 'Chicago' style leveling staff). A bull's-eye bubble shall be used to plumb the leveling rod.

B. Instruments used for horizontal movement monitoring shall have a minimum accuracy of ±3.0arc seconds and a minimum display reading less than or equal to the accuracy. Distances greater than 30 feet shall be measured with an Electronic Distance Measuring (EDM) device. Electronic pointing shall be used to minimize error due to possible misalignment of the EDM axis and telescope. Centering shall be accomplished using high precision optical plummets or mechanical centering devices.

2.03 DEFORMATION MONITORING POINTS

A. DMP Type 1 shall consist of the following depending on the material it is installed in.

1. A 2-inch-long masonry nail with an identification tag. The nail shall be manufactured from hardened, zinc plated steel. The nail shall have ribbed thread along its shank and a conical point. It shall also have an indent in the center of its head to receive a surveyor's plumb bob. The identification tag shall be 1 ½ inch diameter and 3/32-inch-thick with a punched number for identification. The masonry nail shall be placed through the central hole of the identification tag and driven into an asphalt covered surface such that the identification tag lies directly between the asphalt covered surface and the head of the masonry nail.

2. A 2-inch-long PK nail with an identification tag. The PK nail shall be manufactured from hardened, zinc plated steel. The PK nail shall have ribbed thread along its shank and a conical point. It shall also have an indent in the center of its head to receive a surveyor's plumb bob. The identification tag shall be 1 ½ inch diameter x 3/32-inch-thick with a punched number for identification. The PK nail shall be placed through the central hole of the identification tag and installed in a ½ inch diameter hole filled with non-shrink grout in the concrete or granite block surface such that the identification tag lies directly between the concrete or granite surface and the head of the PK nail.

B. DMP Type 2 shall consist of the following:

1. To monitor and existing structure, use a 1/4-inch diameter x 1 1/2-inch long stainless steel socket head cap screw, ASTM A307 UNC thread, screwed into a 3/4-inch long x 1/2-inch diameter tamp-in screw anchor. The anchor and casing

shall meet the requirements of GSA Specification FF S 325 Group 1, Type 1, Class 1. These tamp-in screw anchors shall typically be installed into the vertical surface of a structure.

2. To monitor a support of excavation system, use an observable point punchmarked on the top horizontal surface of soldier pile, or other steel surface. The steel surface within 3 inches of the point shall be cleaned by wire brush to permit easy identification of the exact point. The point shall also be clearly identified using fluorescent spray paint adjacent to the point.

3.

C. DMP Type shall consist of a 5-foot-long, ¾ inch diameter steel rod and a surface roadway box. Top of rod shall be rounded, and punch marked at its center.

2.04 INCLINOMETERS

A. Inclinometer (INCL) casing shall be 2.75-inch OD ABS plastic casing for installation in the ground, internally grooved to receive the inclinometer.

B. Provide couplings, locking devices, caps and grout of the sizes and types recommended by the manufacturer.

C. Provide grout mix conforming to the recommendations of the manufacturer's instrument installation specification.

D. Provide medium size coated bentonite pellets by Enviroplug Medium, as manufactured by Wyo-Gen, Inc., or Holeplug, as manufactured by Baroid Division, Petroleum Services, Inc., or acceptable equivalent for the bentonite seal.

2.05 OBSERVATION WELLS

A. Provide slotted pipe 10 feet long. 1 ¼ inch Schedule 80 PVC pipe with three rows 0.01-inch-wide slots on 120 degree centers with the slot to leave 0.25 inch between rows. The riser pipe shall be 1 ¼ inch 80 flush-joint PVC pipe.

B. Provide filter sand conforming to ASTM C778, Standard Specification for Standard Sand, for 20-40 sand.

C. Provide medium size coated bentonite pellets by Enviroplug Medium, as manufactured by Wyo-Gen, Inc., or Holeplug, as manufactured by Baroid Division, Petroleum Services, Inc., or acceptable equivalent for the bentonite seal.

2.06 SEISMOGRAPHS

A. Seismic range: 0.01 to 4 inches per second with accuracy of ±5 percent of the measured peak particle velocity or better at frequencies between 10 Hertz and 100 Hertz, and with a resolution of 0.01 inch per second or less.

B. Acoustic range: 110 to 140 dB (referenced to 20 micro-Pascals) with an accuracy and resolution of ±1 dB.

C. Frequency response (±3 dB points): 2 to 200 Hertz.

D. Three channels for vibration monitoring.

E. Two power sources: internal rechargeable battery and charger and 115 volts AC. Battery must be capable of supplying power to monitor vibrations continuously for up to 24 hours.

F. Capable of internal dynamic calibration.

G. Direct writing to printer and capability to transfer data electronically. Instruments must be capable of producing strip chart recordings of readings on site within 1 hour of obtaining the readings. Provide computer software to perform analysis, produce reports of continuous monitoring, and to perform zero-crossing frequency analyses of waveform data.

H. Self-triggering wave form capture mode that provides the following information: plot of wave forms, peak particle velocities, peak overpressure, frequencies of peaks.

I. Continuous monitoring mode must be capable of recording single-component peak particle velocities, and frequency of peaks with an interval of 1 minute or less.

2.07 UTILITY MONITORING POINTS

A. Provide steel pipe flange, 1-inch-diameter, ASTM A 403, machined to fit within 3 ½ inch extra strong steel sleeve.

B. Provide 3 ½ inch extra strong steel sleeve pipe, threaded and coupled, ASTM A53 Grade B.

C. Provide 1 inch extra strong steel riser pipe, threaded and coupled, ASTM A53 Grade B.

D. Provide PVC centralizers. Centralizers shall consist of a Schedule 40 PVC pipe conforming to ASTM D1785, sized to provide a tight fit on the riser pipe, and spring-formed to a larger diameter to provide a loose fit in the sleeve pipe.

E. Provide 18 inch by 18 inches by ¼ inch steel plate with 4.25inch diameter central hole.

F. Provide steel pipe clamp to fit 3 ½ inch extra strong steel pipe. Steel plate and pipe clamp assembly shall be capable of transferring the total weight of the 3 ½ inch extra strong pipe to the soil underlying the steel plate. The assembly shall also be capable of maintaining its position on the 3 ½ inch extra strong steel pipe over time.

G. Provide oakum.

H. Provide 1-inch pipe cap with ¼ inch diameter round head stainless steel bolt set securely in cap.

2.08 IDENTIFICATION TAGS

A. Provide each instrument with a stainless-steel indented name tag designating the instrument number.

B. For name tags that cannot be attached directly to the associated instrument, mount on the associated structure or enclosure as close as practicable to allow convenient, unambiguous reading. Mount using epoxy or other adhesive as recommended by name tag manufacturer.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. When instruments are received at the site, the Contractors instrumentation personnel shall perform pre-installation acceptance tests to ensure that the instruments and readout units are functioning correctly prior to installation.

B. Installation procedures for instruments in boreholes shall be such that all steps in the procedure can be quality assured. Granular bentonite shall be placed in depth increments not exceeding two (2) feet. Volumes of each increment of backfilling with sand shall be small enough such that no bridging occurs. The depth to the top of each increment of sand or granular bentonite shall be checked after placement.

C. Prior to installing any instrument through drill casing or augers, all material adhering to the inside of the casing or augers, and all cuttings, shall be removed thoroughly.

D. After completion of installation, a record sheet shall be prepared, including appropriate items from the following list:

1. Project name.
2. Contract name and number.
3. Instrument type and number, including readout unit.
4. Personnel responsible for installation.
5. Plant and equipment used, including diameter and depth of any drill casing or augers used.
6. Date and time of start and completion.
7. A log of subsurface data indicating the elevations of strata changes encountered in the borehole.
8. Type of backfill used.
9. Notes, including problems encountered, delays, unusual features of the installation, and details of any events that may have a bearing on instrument behavior.

E. After completion of installation of a DMP, the as-built location in horizontal position and elevation shall be determined as follows:

1. For DMPs that require distance monitoring, horizontal deformation monitoring and vertical deformation monitoring, determine distance to an accuracy of ±0.01 foot, horizontal position to an accuracy of ±0.01 foot and elevation to an accuracy of ±0.01 foot (at 95 percent level of confidence).
2. For DMPs that require both distance monitoring and vertical deformation monitoring, determine distance to an accuracy of ±0.01 foot, horizontal position to an accuracy of ±0.1 foot and elevation to an accuracy of ±0.01 foot (at 95 percent level of confidence).
3. For DMPs that require vertical deformation monitoring only, determine horizontal position to an accuracy of ±0.1 foot and the elevation to an accuracy of ±0.01 foot (at 95 percent level of confidence).

F. For INCL, one set of grooves, defined as the A-axis, shall be oriented perpendicular to the excavation. Casing groove orientation shall be maintained throughout installation. A post-installation acceptance test shall be performed to verify that there is no grout in the inclinometer casing, that groove orientation and verticality are correct, and that the inclinometer probe tracks correctly in all four orientations.

G. After completion of INCL installation, the as-built location in horizontal position shall be determined to an accuracy of +0.03 foot, and the elevation of the top of the inclinometer casing to an accuracy of +0.01 foot. The point selected to determine horizontal position shall be indicated on the installation record sheet.

H. After completion of OW and UMP installation, the as-built location in horizontal position shall be determined to an accuracy of ±1 foot and the elevation to an accuracy of ±0.01 foot.

I. After completion of installation, establish baseline readings.

1. Baseline readings for a DMPs and UMPs will consist of three (3) readings with 24 hours minimum between readings.
2. A baseline reading for an INCL will consist of the average of stable readings over a 72-hour period.
3. The initial reading for a OW will consist of the average of three (3) readings taken an hour apart.

3.02 DATA COLLECTION

A. Monitor instruments as shown on the Contract Documents

B. The PM/CM may increase the reading frequency of readings at no additional cost.

C. Data shall be recorded on field data records in U.S. Customary Units, such as feet, inches, pounds, and shall include at least the following:

1. Project Name
2. Contract Name and Number
3. Instrument Type
4. Date and Time
5. Observer
6. Readout Unit Number
7. Instrument Number
8. Readings
9. Remarks
10. Visual Observations
11. Other causal data including weather, temperature, and construction activities.

3.03 REPORTING

A. The Contractor shall provide raw field data (daily) and plots (weekly) in electronic format. The weekly data should include a description of work conducted during that week.

B. The Monthly Instrumentation Report shall include the following:

1. A description and location of construction activities.
2. Raw and reduced data shall be on summary tables in printed tabular and electronic format.
3. Data plots shall show the Response Values for each type of instrument.
4. A report of any unusual events that may have affected the instrumentation readings. This report shall include a description of any remedial or precautionary measures that were implemented during the month in response to geotechnical instrumentation or other data, including when they were implemented and for what reason. The report shall also include a description of any future remedial or precautionary measures that are planned in response to existing geotechnical instrumentation.

C. The following types of plot types shall apply to the data the Contractor supplies.

1. Plots of OW data shall show water level elevation versus time.
2. Plots of UMP data shall show absolute vertical deformation versus time.
3. Plots of DMP shall show deformation versus time.
4. Plots of inclinometer data shall be “cumulative change” data, showing absolute horizontal deformation versus depth, and “change” data showing incremental deflection versus depth. The top of the inclinometer casing (excluding any extension length added during data collection) shall be used as a datum for depth measurement. Multiple plots shall be on the same sheet to provide a time history, each labeled with the date. Each plot shall include the instrument numbers and coordinate location.
5. Plots of seismograph data shall be the following types: strip charts and full waveform plots.

a. For seismograph data collected in continuous monitoring (strip chart) mode the Contractor shall provide a permanent record of single-component peak particle velocity. The strip chart shall also indicate the time and magnitude of maximum single-component peak particle velocity measured during each 1 hour interval of the monitoring period.

b. For seismograph full waveform data, the Contractor shall provide plots consisting of a graphical display of the three component particle velocities and overpressure levels during the entire course of the vibration-producing construction activity.

D. For any data from an instrument that has been installed to replace a damaged instrument, the formal initial reading for the damaged instrument shall be used as an initial reading for the replacement instrument so that data are plotted continuously,

without an offset at the time of damage. The time of damage and replacement shall be noted on the plot.

3.04 INTERPRETATION AND IMPLEMENTATION OF ACTION PLANS

A. The PM/CM will have the right to perform its own interpretation of the data collected and provided by the Contractor. However, the Contractor will have the primary responsibility for interpretation. Interpretation shall include making correlations between instrumentation data and specific construction activities. Instrumentation data shall be evaluated to determine whether the response to construction activities is reasonable.

B. The Contract Drawings indicate Response Values (where appropriate) for selected instruments. The actions associated with these Response Values are defined below. Response Values are subject to adjustment by the PM/CM as indicated by prevailing conditions or circumstances.

C. If a Review Value is reached for an instruments, the Contractor shall:

1. Meet with the PM/CM to discuss the need for response action(s).
2. If directed by the PM/CM, during the above meeting, that a response action is needed, within 24 hours of receiving instrumentation data from the Contractor indicating that a Review Value has been reached, submit a detailed specific plan of action, based as appropriate on the generalized plan of action submitted previously in accordance with this section.
3. If directed by the PM/CM, implement response action(s) within 24 hours of submitting a detailed specific plan of action.
4. Install additional instruments if directed by the PM/CM.
5. Increase frequency of readings if directed to do so by the PM/CM or as deemed necessary by the Contractor.

D. If an Alert Value is reached for an instrument, the Contractor shall:

1. Terminate further work activity that will impact the condition measured by the instrument.
2. Meet with the PM/CM to discuss the need for response action(s).
3. If directed by the PM/CM, during the above meeting, that a response action is needed, within 24 hours of receiving instrumentation data from the Contractor indicating that a Alert Value has been reached, submit a detailed specific plan of action, based as appropriate on the generalized plan of action submitted previously in accordance with this section.
4. If directed by the PM/CM, implement response action(s) within 24 hours of submitting a detailed specific plan of action.
5. Install additional instruments if directed by the PM/CM.
6. Increase frequency of readings if directed to do so by the PM/CM, or as deemed necessary by the Contractor.

E. The Contractor shall take all necessary steps so damage to adjacent and newly constructed facilities does not result. The Contractor may be directed to suspend

activities in the affected area with the exception of those actions necessary to avoid damage.

3.05 DISCLOSURE

A. The Contractor shall not disclose any instrumentation data to third parties and shall not publish data without prior written consent of the Owner.

3.06 DECOMMISSIONING

A. Remove salvageable instruments only when directed by the PM/CM. All salvaged instruments shall become the property of the Contractor.

B. Upon completion of the Work, as directed by the PM/CM, the Contractor shall remove and dispose of those portions of instruments constituting an obstruction, including DMPs, SMPs, INCLs and UMPs.

1. The upper two (2) feet of the instrument shall be removed, together with the ground surface protection.
2. The remaining open portions of the instrument and casing shall be backfilled with cement grout up to a level two (2) feet below the ground surface, and with lean concrete in the upper two (2) feet.
3. New pavement patches shall be constructed, in paved areas, of the same material and to the same thickness as existing adjacent pavement.
4. Disturbed or damaged surfaces shall be restored to the condition existing before installation of the instrument to the satisfaction of the PM/CM.

3.07 FIELD QUALITY CONTROL

A. Protect all instruments and appurtenant fixtures, leads, connections, and other components of instrumentation systems from damage due to construction operations, weather, traffic, and vandalism.

B. Replace damaged or inoperative instruments within 72 hours. Replacement shall be at Contractors expense. The Contractor shall notify the PM/CM at least 24 hours prior to replacing a damaged or inoperative instrument.

END OF SECTION 02295

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SECTION 02314

MICROTUNNELING

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies minimum design and performance requirements for the construction of three tunnel drives between Sta. 1+27 and Sta. 16+65 using microtunnel methods for a one-pass installation of concrete jacking pipe to the limits indicated on the Contract Drawings. Requirements for the reinforced concrete jacking pipe are specified elsewhere.

B. The microtunnel drives, approximate stationing, shaft designations, and length to manhole centers are as follows:

1. Drive 1 – Sta. 7+97 jacking/receiving shaft to Sta. 1+27 receiving shaft, 670 feet
2. Drive 2 – Sta. 7+97 jacking/receiving shaft to Sta. 12+57 jacking shaft, 460 feet.
3. Drive 3 – Sta. 12+57 jacking shaft to Sta. 16+65 receiving shaft, 408 feet.

C. Complete Drives in the following order: Drive 3, Drive 2, Drive 1.

D. The microtunnel drives will occur in contaminated groundwater and ground conditions.

E. Coordinate requirements for microtunneling operations with Section 02240 and Section 02260.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 02240 – Construction Water Handling

D. Section 02260 – Support of Excavation

E. Section 02295 – Geotechnical Instrumentation and Monitoring

F. Section 02317 – Reinforced Concrete Pipe for Microtunneling

G. Section 02465 – Secant Pile Wall

H. Section 02466 – Slurry Diaphragm Wall

I. Section 02467 – Cutter Soil Mix Wall

1.03 REFERENCES

A. The following Standards apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting

information exists, the most stringent requirement shall govern.

B. American Society of Civil Engineers (ASCE)

1. Standard Design and Construction Guidelines for Microtunneling, ASCE 36-15, Construction Institute.

C. American Welding Society (AWS)

1. D1.1 Structural Welding Code-Steel.

D. Occupational Safety and Health Administration (OSHA)

1. Regulations and Standards for Underground Construction.

1.04 DEFINITIONS

A. Annular Space: The theoretical volume between the gauge cut and the outside radius of the jacking pipe times the length of the installation, equal to annulus times length of tunnel.

B. Backfill Grout(ing): Grout injected into the void space between the jacking pipe and casing after the drive is completed.

C. Cohesionless Soils (noncohesive soils): Earth materials containing less than 20 percent soil particles passing the No. 200 sieve. Additionally, Atterberg Limits test on the fines, as defined by ASTM standards, classify the fines as ML or non-plastic.

D. Cohesive Soils: Earth materials containing 20 percent or more soil particles passing the No. 200 sieve. Additionally, Atterberg Limits test on the fines, as defined by ASTM standards, classify the fines as CL/CH.

E. Compression Ring/Packer: A ring fitted between the end-bearing area of the leading pipe bell and the trailing pipe spigot to help distribute jacking forces more uniformly. The compression ring compensates for steering corrections, pipe misalignment, and pipe dimensional tolerances. Compression rings are also referred to as packers.

F. Contact Grouting: Grout injected into the theoretical space between the jacking pipe and the ground after the drive is complete.

G. Controls: Part of the microtunneling system that allows synchronized excavation, removal of spoils, and jacking of pipe to balance forward movement with excavation so that so that ground settlement and heave are managed.

H. Cutter Wheel (Cutterhead): Any rotating tool or system of tools on a common support that excavates at the face of the bore.

I. Drilling Fluid: Water that may contain additives, including bentonite, polymers, soda ash, surfactants, or other materials, to enhance stability and excavatability. If the drilling fluid contains additives and is designed to have specific properties, it is considered to be an engineered drilling fluid, whether specified or selected by the Contractor.

J. Drive: Designation of the pipe installed from a jacking shaft to a receiving shaft.

K. Entrance and Exit Seals: Seals placed at the breakout into and out of the shaft or portal. The seals are intended to prevent groundwater inflow and loss of ground into

the shaft/portal. The seals shall also prevent the lubricant from escaping from the annular space during microtunneling.

L. Entry Seal: See Launch Seal

M. Face: The location where excavation is taking place.

N. Guidance System: System that locates the actual position of the microtunnel boring machine (MTBM) relative to the laser or other device.

O. Inadvertent Return: The loss of drilling fluid, including slurry and lubrication, from the slurry or lubrication system. A special form of inadvertent return, where the fluid pressure exceeds the strength and confining pressure of the ground and reaches the surface is called a hydrofracture.

P. Intermediate Jacking Station(s) (IJS): A fabricated steel cylinder fitted with hydraulic jacks, which is incorporated into a pipeline between two specially fabricated pipe segments. Its function is to provide additional thrust in order to overcome skin friction and distribute the jacking forces of the pipe string on long drives.

Q. Intermediate Shaft Location: A vertical excavation where a permanent civil structure will be placed before or after the microtunnel is constructed.

R. Jacking Frame: A structural component, that houses the hydraulic cylinders used to propel the MTBM and pipeline. The jacking frame cradles the MTBM and jacking pipes and serves to distribute the thrust load to the pipeline and the reaction load to the shaft wall or thrust block.

S. Jacking Force: The total force required to overcome the face pressure component and the frictional resistance component along the pipe to allow forward movement of the MTBM and trailing pipe string.

T. Jacking Shaft: Excavation from which the trenchless technology equipment is launched for the installation of the pipeline. The jacking shaft may incorporate a thrust wall to spread reaction loads to the ground and an entry launch seal to control inflows of groundwater and spoil at the face.

U. Jacking Pipe: Pipe designed to be installed using pipe jacking techniques.

V. Laser: A device commonly incorporated into the guidance system and used to track alignment and grade during the tunnel or jacking operations.

W. Launching Shaft: see Jacking Shaft.

X. Launch Seal: A mechanical seal, usually consisting of a rubber flange that is mounted to the wall of the jacking shaft. The flange seal is distended by the MTBM as the machine passes through the shaft. The seal is intended to prevent the flow of groundwater, soils, slurry, and lubrication into the shaft during tunneling operations.

Y. Lubrication: The act of injecting a fluid, normally bentonite and/or polymers, to reduce the skin friction and jacking forces on the jacking pipe during installation. The fluid fills the annular space.

Z. Maximum Allowable Jacking Force: The largest jacking force that can be applied to the jacking pipe during installation allowing for an appropriate factor of safety.

AA. Maximum Anticipated Jacking Force: The largest anticipated jacking force required to advance the MTBM and jacking pipe along a drive.

BB. Microtunnel Boring Machine (MTBM): A remote controlled, steerable, guided tunnel boring machine consisting of an articulated boring machine shield and a rotating cutterhead. Personnel entry into the MTBM is not required for the routine operation of the MTBM.

CC. Microtunneling: A remote controlled and guided pipe jacking process that provides continuous support to the excavation face and tunnel. The microtunneling process provides the ability to control the excavation and maintain face stability by applying mechanical and fluid pressure to counterbalance the earth and naturally occurring hydrostatic pressure. The jacked pipe provides continuous support to the bored tunnel/excavation.

DD. Mixed Face: An interface within the excavated microtunnel zone between two geological units that have a significant contrast in engineering properties (e.g., rock overlain by soft ground).

EE. Muck: Spoils or removal of same.

FF. Noncohesive soils: See Cohesionless Soils.

GG. Obstacle: A foreseen object that lies either within or near the direct path of the MTBM and is to be avoided or removed by other means.

HH. Obstruction: Any buried object that lies completely or partially within the cross section of the microtunnel and that impedes continued forward progress along the design path and within allowable tolerances.

II. Overcut: The theoretical difference between the radial measurement of the gauge cut and the MTBM shield; equal to (gauge cut OD – MTBM OD)/2. Actual overcut is reduced as the gauge cutter is worn and because of the differential cut.

JJ. Pipe Jacking: A system of using hydraulic jacks from a shaft to directly install pipes behind a shield or machine so that they form a continuous string in the ground.

KK. Pipe String: The succession of joined individual pipes being used to advance and support the excavation.

LL. Principal Dimension: The largest of an object's three mutually orthogonal measurements.

MM. Receiving Shaft: Excavation into which the microtunneling equipment is driven and recovered.

NN. Rescue Shaft: An unplanned additional shaft required to remove obstacles/obstructions and/or retrieve or repair the MTBM. The rescue shaft may need to function as a jacking shaft to complete the drive.

OO. Slurry: A mixture of engineered drilling fluid and spoils.

PP. Slurry Chamber: A chamber in which excavated material is mixed with engineered drilling fluid to become slurry for transport through the return line to the separation plant at the surface. The slurry chamber is located behind the cutter wheel of a slurry MTBM.

QQ. Slurry Lines: Parallel hoses or pipes that transport slurry from the face of the MTBM through the return line to the ground surface for separation, and then return the

cleaned slurry as engineered drilling fluid to the face for reuse through the feed line (the feed line is also known as a charge line).

RR. Slurry Pressure Balance Machine: A microtunneling system which uses a low pressure engineered drilling fluid to counterbalance the ground water pressure at the face of the tunnel and to transport the excavated material to the surface.

SS. Slurry Separation: A process in which excavated material is separated from the circulation slurry. Mechanical separation is typical, although gravity separation in tanks is possible with coarse-grained soil and rock pieces.

TT. Specials: Pipe section immediately ahead of and behind the IJS. Specials have ends that are specifically manufactured to physically accommodate the IJS.

UU. Sump Pump: A device placed at the base of a shaft, in a jacked casing, or in an MTBM to collect and remove fluids incidental to the construction process and resulting from leakage and to prevent the excavation from flooding.

VV. Thrust Block: An engineered structure located between the jacking frame and the shaft wall that distributes the jacking force developed by the hydraulic jacking frame over a large surface area to the ground behind the back wall of the shaft.

WW. Thrust Ring: A fabricated ring that is mounted on the face of the jacking frame. It is intended to transfer the jacking force from the jacking frame to the thrust-bearing area of the pipe section being jacked.

XX. Trenchless Technology Equipment: Equipment used to install pipe from the point of origin to the destination without the use of an open trench cut.

YY. Unanticipated Returns: See inadvertent returns.

ZZ. Water Jetting: Process of using the internal cleansing mechanism of the cutter head by which high-pressure water is sprayed from the nozzles to help remove cohesive soils or clay gouge.

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. Microtunneling Contractor Experience Record.

a. Listing that indicates the most recent 10 microtunneling projects, including all microtunneling projects completed for the Owner, and all projects demonstrating the required experience.

b. The experience record shall include name of project, the agency that contracted for the project, name of contact including all contact information, jacking pipe material, jacking pipe outside diameter, ground conditions, longest drive planned and completed, and total footage planned and completed. If the microtunneling work was performed as a Subcontractor, the record shall include name of General Contractor, name of contact and all contact information.

2. Microtunneling Project Superintendent: Experience requirements are as follows:

a. The construction and completion of a minimum of five pipeline projects with a minimum drive of 600 lineal feet that installed concrete jacking pipe between 42 and 54 inches inside diameter using microtunneling as the method of installation.

b. Qualified projects shall have been completed in the 5 years prior to the bid date.

c. One qualified project shall include the installation and use of an IJS.

d. Experience record shall include the most recent 5 pipeline projects including all tunneling projects completed for the Owner. Include name of project, the agency that contracted for the project, name of contact including all contact information and the record shall include name of General Contractor, name of contact and all contact information.

3. MTBM Operator: Experience requirements are as follows:

a. The construction and completion of a minimum of ten drives; each with a minimum of 600 lineal feet of installed concrete pipe between 42 and 54 inches using microtunneling as the method of installation.

b. Qualified projects shall have been completed in the 5 years prior to the bid date.

c. Operated a MTBM similar to the one proposed for the Work.

d. Utilized the same type of jacking pipe material as used in this Work on three of the 10 qualifying drives.

e. Successfully completed a project in similar ground conditions to those anticipated in this Work, as measured by ground type, soil strength as measured by “N” values, rock strength, and hydrostatic head.

f. Successfully completed two microtunnels of a drive length at least as long as Drive 1.

g. Experience record shall include the most recent 5 microtunneling projects including all tunneling project completed for the Owner. Include name of project, the agency that contracted for the project, name of contact including all contact information and the record shall include name of General Contractor, name of contact and all contact information.

4. Microtunnel Engineer: Experience requirements are as follows:

a. A Professional Engineer licensed in the State of Rhode Island.

b. An experience record demonstrating qualifications for designs and calculations to be performed and submitted.

c. Experience record shall include the most recent 5 microtunneling projects including all tunneling project completed for the Owner. Include name of project, the agency that contracted for the project, name of contact including all contact information and the record shall include name of General Contractor, name of contact and all contact information

5. The person in responsible charge of surveying shall be a Registered Land Surveyor in the State of Rhode Island.

a. An experience record demonstrating underground surveying experience including the transfer of points and line from the surface to below grade including all tunneling projects completed for the Owner.

b. Experience record shall include the most recent 5 underground projects including all underground project completed for the Owner. Include name of project, the agency that contracted for the project, name of contact including all contact information, design tolerance, results of as-built survey, and the name of project owner including name of contact and all contact information.

6. Any welding required shall be performed by certified welders in accordance with AWS D1.1.

C. Acceptance Criteria:

1. Carrier pipe installed within the line and grade tolerances specified herein.

D. Microtunnel preconstruction meeting prior to MTBM launch:

1. Agenda to include general information regarding:

a. Site safety orientation.

b. Microtunneling methods, including equipment layout, MTBM operation, and microtunneling process.

c. Means and methods.

d. MTBM data monitoring.

e. Contingency Plans.

2. Testing: Test all operating components of the MTBM before lowering into shaft for first time use on this project. Provide the following:

a. Clockwise and counterclockwise torque and pressure readings of the cutter wheel under 20, 40, 60, 80, and 100 RPM under freewheeling conditions.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data: Submit 60 days prior to the work

1. Preprinted machine specifications or a letter from the MTBM manufacturer demonstrating that the selected equipment is capable of progressing through the anticipated ground conditions, including ground strength as measured by “N” values, rock strength, cobble and boulder constituents, and hydrostatic head.

2. Jacking System Details:

a. Main jacking frame thrust capacity plus method of control to prevent the maximum allowable jacking force from being exceeded.

b. Jacking distance and speed measurement system.

c. Intermediate jacking stations and their proposed spacing, method of operation, thrust capacity, sleeve details, specials A and B, and method of control to maintain jacking forces below the acceptable limit.

d. Means and methods for removing IJS jacking components on completion of the drive and advancing jacking pipe to provide closure of the IJS joint.

3. Description of lubrication, mix equipment, and procedure for lubricating the jacking pipe during the jacking operations, including estimated volume for each of the anticipated ground types. Submit materials to be used for lubrication.

   a. Details demonstrating that the lubrication equipment can perform as intended without causing or contributing to the production of inadvertent returns.

   b. Calculations and operating parameters that shall be controlled with the intent of preventing inadvertent returns.

   c. Indicate the maximum allowable face pressure or slurry pressure that can be exerted at the face of the MTBM without fluid loss to the surface, heave of the ground, or movement or damage to existing structures and utilities.

4. Jacking Pipe:

   a. Theoretical jacking force calculations.

   b. Maximum allowable jacking force calculations.

   c. Joint detail drawing.

   d. Lubrication port size, orientation, and location.

   e. Manufacturer written recommendations for repairs of joint failures and jacking pipe sidewall failure.

5. MTBM Slurry System:

   a. Submit information of the proposed slurry mix and product data for the components.

   b. Safety Data Sheets (SDS) for the proposed slurry and lubrication materials and additives.

C. Shop Drawings:

1. MTBM, including configuration of cutterhead and overcut tolerances. Cutterhead drawing shall confirm that the machine is capable of ingesting, crushing, or excavation ground described in the Geotechnical Data Report (GDR).

   a. Indicate how the slurry chamber pressure will be measured, recorded, and monitored to ensure the MTBM is being operated to hydrostatically counterbalance the contaminated groundwater anticipated along the Drives.

2. Pipe lay schedule for the three Drives including the planned pipe storage at the jacking shafts and whether or not pipe will need to be marshalled from a temporary storage area.

3. Pipe lubrication system details.

4. Grade and alignment control system details.

5. Groundwater control provisions of tunneling machine.

D. Working Drawings and Methods Statements:

1. Construction Method and Sequence of Operations: Provide a description of the proposed method of construction and the sequence of operations to be performed during construction. This submittal shall include a general description and schedule of the tunneling procedure, including:
    a. Set-up of tunneling equipment, tunneling duration, and removal of tunneling equipment from the casing and receiving shaft.
    b. Method of spoil removal, spoil disposal transportation method, and disposal location.
    c. Methods of protection and maintenance of project work sites.
    d. Groundwater control methods.
    e. Tunnel and shaft ventilation system details.
    f. Electrical system, lighting system, and on-site power generation.
2. Procedures:
    a. Complete launch procedure commencing with any modification to the shaft wall for launch seal construction. Procedure is to include contingency plans for:
        i. Loss of ground during launch that either causes movement at the ground surface or ground loss of more than 1.0 cubic yard.
        ii. Inflow of water during launch exceeding 5 gallons per minute.
        iii. Loss of seal at entrance as evidenced by leaking water, lubricant, slurry, or combination thereof in excess of 5 gallons per minute.
        iv. Inability to inject lubricant.
        v. Machine dropping beyond the acceptable tolerances as defined herein upon entrance into the ground.
    b. Complete retrieval procedure commencing when the MTBM is within 10 feet of the designated casing entrance, or prior to modifying retrieval shaft shoring system to receive MTBM, with respect to the same threshold parameters as specified herein for launch procedures.
    c. Launch procedure for Drive 1 from the shaft at Sta. 12+57.
        i. Provide details on how the pipe installed for Drive 2 from this shaft will accommodate and be protected from the reaction wall required for Drive 1.
3. Details of slurry system and spoil separation methods, including:
    a. Proposed slurry formulations by ground type to be encountered.
    b. Calculations demonstrating system capacity and performance under the most adverse of operational and geometric constraints to which it will be subjected.
    c. Drawing showing the system layout. Include chamber pressure and volumetric gauge locations.

d. Calculations and operational parameters that prevent, mitigate, control, and measure inadvertent returns.

e. Operating parameters of slurry properties and their associated threshold values that shall be measured and controlled with the intent of modifying ground behaviors to prevent and mitigate ground movement and inadvertent returns and to counterbalance the groundwater.

f. Operating parameters of any jetting system including calculations demonstrating control with the intent of preventing and mitigating inadvertent returns and soil erosion. Include drawings detailing size, number, orientation, and projection of the water jets at maximum proposed operation pressure.

4. Storage, staging, equipment, and plant layout at and within each shaft.

5. Survey and instrument monitoring plans including:

a. Settlement surveying and monitoring plan in accordance with Section 02295,

b. Building and structures assessment plans.

c. Instrument type and locations.

d. Verification of line and grade for MTBM operations.

e. Location of utilities within 6 feet vertical or horizontal of tunnel.

f. As-built survey for the installed jacked pipe.

E. Mix Designs:

1. Engineered Drilling Fluid:

a. Mix designs including proportions, source of water, water quality, and pH that achieve the minimum viscosity as specified herein for non-cohesive ground.

b. Final mix properties including pH, density, viscosity, filter cake formation, and gel strength.

2. Lubricant:

a. Mix designs including proportions, water quality, and pH.

b. Submit final mix properties including pH, density, viscosity, and gel strength.

c. Submit SDS for lubricant additives.

F. Quality Assurance:

1. Qualifications:

a. Contractor Experience Record.

b. Microtunneling Project Superintendent Experience Record.

c. MTBM Operator Experience Record.

d. Microtunnel Engineer Experience Record.

e. Surveyor Experience Record.

2. Certifications:

   a. Jacking pipe in accordance with Section 02317.

3. Quality Control Plans:

   a. Contingency Plans in the event of the following:

      i. Failure to achieve separation of the excavated material from the slurry.

      ii. Inability to advance the MTBM.

      iii. Obstruction removal plan.

      iv. Laser or target misalignment for any reason, or distortion of the beam by ambient operating conditions.

      v. Jacking forces that exceed the calculated anticipated jacking force by 15 percent at any given distance.

      vi. Movements in excess of the action trigger levels as specified in Section 02295.

      vii. Inadvertent Return Plan, including cleanup methods, emergency telephone numbers, sources of equipment and materials needed for containment and cleanup, and corrective actions operational procedures such as reducing operating pressures.

      viii. Means and methods for monitoring and correcting jacking pipe damage or failure.

      ix. Non-cohesive soils operational plan with operational parameters observed, measured, and recorded to determine that slurry pressure at the face in non-cohesive soils is always higher than groundwater pressure encountered. The plan shall include replacing operators, slurry modification, and other operational modifications deemed important and acceptable to the Owner if face pressures cannot be maintained above hydrostatic pressure.

      x. Excessive ground movement plan including means and methods of expeditiously restoring any excessive ground settlement. Include changes to slurry formulation to increase viscosity if settlement is observed or measured in excess of the Contractor Response Level Values, Response Value, as defined in Section 02295.

4. Inadvertent Return Contingency Plan:

   a. Contractor shall provide a barrier around the perimeter of the launching and receiving work areas for the start and end of the microtunnel to prevent drilling fluids from leaving the work area.

   b. Unusable slurry may be dewatered on-site only if approved by regulatory permitting agencies and at the direction of the Owner Representative or be properly disposed of off-site at a commercial disposal site or other site approved by Owner Representative.

c. Contractor shall provide minimum one (1) on-site monitor during the jacking operations to look for observable inadvertent release conditions or lowered pressure readings on the microtunneling equipment that may indicate a potential inadvertent return.

d. If Contractor and/or machine operator suspect that there is an inadvertent return (i.e., notices a drop in chamber pressure or notices a loss of circulation of slurry and cuttings or slurry is observed at the surface) Contractor shall stop work and notify the Owner Representative.

e. In the event of an inadvertent return, Contractor shall cease microtunneling, including the recycling of the slurry, notify the Owner Representative, and implement measures to stop the inadvertent return, such as reducing the pressure or increasing the slurry viscosity (e.g., by using less water or more bentonite). If the slurry does not resurface, no other actions will be taken and, at the direction of the Owner Representative, microtunneling can resume.

f. If the slurry surfaces, Contractor shall surround affected area with a barrier (e.g., silt fence) to prevent further dissemination of the slurry.

g. Contractor may resume microtunneling upon approval by the Owner Representative once the inadvertent return is contained and measures have been implemented to minimize potential for continued release.

5. Recordkeeping:

   a. Survey data during microtunnel construction:

      i. Survey readings on the same day the readings are taken.

      ii. Interpretation of survey results on the following working day.

   b. Sample slurry log sheet including time, date, sampler, shaft location, pipe number, slurry additives type, quantity added, ground type, viscosity, specific gravity, water added, and system operating pressures and volumes. Submit 10 working days in advance of launching MTBM.

   c. Jacking Operations Log:

      i. Sample of logging reports and daily reports that shall be used to record the microtunneling operations. Submit 10 working days in advance of launching MTBM.

      ii. Submit at the end of each shift the jacking operations log, which shall include the following:

         (a) Date.

         (b) Time of Measurement.

         (c) Position of the cutterhead relative to design line and grade.

         (d) Number of each pipe installed and length of pipe.

         (e) Maximum jacking forces exerted on the pipe at the jacking shaft.

         (f) Total distance jacked on the current drive or pipe segment.

         (g) Instantaneous jacking speed.

(h) Starting and finish times for each crew shift each day.

(i) Position of steering jacks.

(j) Inclination and torque of cutterhead.

(k) Slurry pressure at the face.

(l) Hydraulic pressure.

(m) Volume of lubricant used, viscosity, and pumping pressure.

(n) Engineered drilling fluid density and viscosity.

(o) Volume of spoils exiting the cutterhead over contiguous and separate 4-foot reaches.

(p) Observations of settlement or heave.

(q) Water jetting operating parameters including maximum pressure, volume, and duration.

(r) Printed name of operator and signature.

d. If the automated data recording system is not working, manually record the above data with a minimum of three data points per each pipe segment is required. One data point shall be within one foot of the leading edge; another within one foot of the trailing edge; and additional data points spaced equally between at a spacing no greater than 8 feet.

e. Submit a sample of all information available for recording from the automated data recording system, including variations in sampling frequency, and available formats. All automated data is to be provided to the Owner in Excel compatible format on a daily basis in the requested format(s).

6. Notifications:

a. Immediately, in writing, when the MTBM is off line or grade by 50% of the maximum allowed.

b. Immediately, in writing, when the MTBM is off line or grade by 80% of the maximum allowed. Include written description of the operational changes being made to avoid attaining the maximum allowed.

c. Immediately stop tunneling and notify the construction manager in writing when the MTBM is off line or grade by 100% of the maximum allowed. Include written description of the operational changes being made and obtain acceptance from the Owner Representative before the resumption of microtunneling.

7. As-Built Data:

a. Establish control points located 15 feet beyond the measured microtunnel's zone of influence so as not to be affected by ground movement or damage.

b. Record the horizontal coordinate and elevations with accuracy of 0.01 feet for each survey point location.

c. Survey and establish the final installed line and grade of the pipeline.

d. Submit as-built record data within one week after each Drive segment is installed.

1.07 DESIGN CRITERIA

A. Jacking System:

1. The installed jacking system capacity shall exceed the maximum anticipated jacking forces by at least 20%.

2. The jacking pipe shall be designed for maximum anticipated construction loads, external loads, and jacking force, or service loads if governing.

B. Lubrication System: Lubrication shall be injected at the tail of the microtunnel boring machine and through grout ports in the jacked pipe delivered by an automatic lubrication system controlled by the operator, if calculations assume the use of lubrication.

C. Dewatering:

1. Refer to Section 02240.

2. Dewatering shall not be used to lower groundwater for microtunneling.

3. Sump pumping at the bottom of the shaft is permitted for the removal of storm water, incidental, construction water, and controlled leakage of shaft walls within the tolerances described in Section 02240.

4. Localized short-term shallow dewatering is permissible at the shaft portals to control the ground at the launch and retrieval locations.

D. Excavations:

1. No excavations deeper than 4 feet shall be permitted within 100 feet of the microtunnel alignment until after the microtunnel work is completed unless approved by the Owner Representative.

2. Potholing for utilities is permitted.

E. Engineered Drilling Fluid:

1. Adhere to the ASCE 36-15 recommendation to use an engineered drilling fluid with a bentonite base in non-cohesive ground. The initial engineered drill fluid design target viscosity is between 40 and 45 seconds as measured by Marsh Funnel.

2. For shaft penetrations through cementitious walls, provide details on how the slurry will be formulated to counteract the adverse effects of cement on bentonite-based drilling fluid.

F. Performance Requirements:

1. Select and design the microtunneling boring machine (MTBM) and system to excavate through the following ground conditions:

a. Ground conditions as reported in the GDR.

b. Rock with an unconfined compressive strength (UCS) as reported in the GDR.

c. Select tooling commensurate with the ground conditions, abrasivity, and cementitious shaft wall penetrations.

2. Launch and Receiving of MTBM:

3. Control the ground during launch and retrieval so that no more than 1.0 cubic yard of ground enters the shaft and that there is no measurable ground movement on the surface directly above the tunnel.

4. Prevent water from entering the wall seals at a rate greater than 5 gallons per minute at the launch portal.

5. Prevent MTBM from deviating from acceptable line and grade during launch.

G. Line and grade: The jacking pipe shall be constructed within:

1. Grade: Plus or minus 3 percent of the MTBM outside diameter of the design grade alignment.

2. Line: Plus or minus 6 percent of the MTBM outside diameter from design alignment.

3. When the excavation departs from the design line or grade, return to the design line or grade over the remaining portion of the drive or at a rate less than 1-inch over 25 feet.

H. Annular Space Grouting:

1. When grouting is required to control subsidence, pressure-injected grout shall fill voids outside the limits of the excavation created by caving or collapse of earth cover over the excavation while minimizing heave at the surface within acceptable limits.

I. Slurry System Requirements:

1. Provide a slurry transport system capable of pumping the slurry for the furthest distance from the separation plant while still maintaining maximum anticipated operating pressure plus a 10 percent factor of safety.

2. Pumping capacity for a slurry with a density that is the greater of:

a. 10 percent greater than the maximum in the Contractor’s design or

b. A viscosity of 90 seconds as measured in a Marsh funnel.

J. Options: The Contractor may employ water jetting only when in rock and with written approval by the Owner Representative.

1.08 PROJECT CONDITIONS

A. Project Site Information: A Geotechnical Data Report (GDR) and an Environmental Data Report (EDR) have been prepared for the Project. The GDR and EDR have been included as part of the Contract Documents.

B. The Contractor shall review the GDR and make a determination as to the need to perform additional test borings and conduct other exploratory operations necessary for microtunneling according to the performance requirements. The Contractor will be responsible for conducting these additional investigations including associated costs.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall either new or in serviceable condition.

B. The Contractor shall furnish all installation tools, materials, and miscellaneous components.

2.02 MATERIALS

A. Provide water used for making slurry and pipe lubricant that is clean, fresh, and free from oil, acid, alkali, organic matter, or other deleterious substances, and of a neutral pH.

B. Provide bentonite and polymers used for slurry and pipe lubrication that are non-toxic and that shall not adversely affect groundwater quality. The use of polymers shall be subject to review and acceptance of the PM/CM.

C. Cement grout shall be a readily pumpable mixture of Portland cement and bentonite or similar commercial product that shall harden to a minimum compressive strength of 500 pound per square inch (psi).

2.03 EQUIPMENT

A. MTBM and Components.

1. The microtunneling system selected shall be specifically designed for excavating, transporting, and separating the soil and rock materials that routinely could be encountered or expected along the alignment of the proposed pipeline.

2. Use MTBM equipment that is capable of handling the various anticipated ground conditions. Slurry MTBMs that meet the requirements of this specification and as manufactured by Iseki Polytech, Akkerman, Soltau-Wirth, or Herrenknecht are permitted. Contractors may request a waiver of this requirement for unlisted manufacturers that have produced ten MTBM’s that meet the requirements of this specification in the last five years and that design their machines to use an engineered drilling fluid for slurry transport, not water only.

3. Provide an MTBM with cutter head configuration and torque capacity compatible with the anticipated ground conditions.

   a. The MTBM shall be capable of excavating through soil, rock, cobbles and boulders and crushing cobbles and boulders with a maximum unconfined compressive strength of 30,000 psi.

4. MTBM shall be capable of the following:

a. Maintain the microtunnel face under wet, dry, and adverse ground conditions.

b. Prevent loss of ground through the MTBM during shutdowns.

c. Provide satisfactory support of the excavated face at all time and be capable of measuring, recording, and adjustment of the slurry chamber pressure.

d. Articulate to allow steering.

e. Guided to a predetermined reference point.

f. Incorporate a watertight seal between the MTBM and the leading pipe.

g. Provide protection to the electric and hydraulic motors and operating controls against water damage.

h. Use bi-directional drive on the cutterhead wheel, and/or adjustable fins or other means, to control roll.

i. Control the volume of excavated material removed at the tunnel face and the MTBM advance rate to avoid over-excavation.

j. Exert a controllable pressure against the face, during both excavation and shutdown periods, to support the excavation face, prevent groundwater inflows, and prevent loss or heave of ground. A closed face cutterhead designed to minimize loss of ground shall be provided. Control the volume of excavated material removed at the microtunnel face and the MTBM advance rate to avoid over-excavation.

k. Provide an automated data recording system to collect the parameters required herein.

B. Slurry System: MTBM shall include an automated spoil transportation slurry system that balances the ground water pressures by the use of a slurry pressure balance system. System shall be capable of adjustment required to maintain face stability for the particular ground condition encountered on the Work and shall monitor and continuously balance the ground water pressure to prevent loss of slurry or uncontrolled groundwater inflow. Slurry system shall:

1. Manage the pressure at the excavation face by use of the slurry pumps (which may operate at variable speeds), pressure control valves, a flow meter, and pressure gauge readings from the slurry chamber.

2. Include a slurry bypass unit in the system to allow the direction of flow to be changed and isolated, as necessary.

3. Have a spoil transportation system that has the capability for removal of the excavated material in balance with excavation and advance.

C. Slurry Separation Equipment:

1. Provide a slurry separation process that employs the use of mechanical shakers, screens, centrifuges, and hydro-cyclones. Slurry separation using only sedimentation tanks will not be permitted. Ensure that the separation process provides adequate separation of the excavated cuttings from the slurry so that engineered drilling fluid within the operating parameters can be returned to the cutting face for reuse.

2. Monitor the composition of the slurry to maintain the slurry weight, gel strength, sand content, and viscosity limits defined by the operating parameters.
3. Use the type of separation process suited to the size of the microtunnel being constructed, the ground type being excavated, and the work space available at each shaft.
4. Contain separated spoils for removal from the site.

D. Pipe Jacking Equipment:

1. Provide a jacking frame with suitable hydraulic jacks for developing a uniform distribution of jacking forces around the perimeter of the pipe. Provide a jacking frame that reacts against a thrust block, the face of which shall be perpendicular to the centerline of the jacked pipe alignment.
2. Hydraulic cylinder extension rates synchronized with the excavation rate of the MTBM.
3. Provide jacks with pressure limiting devices such that the ultimate jacking load capacity of the microtunneling pipe is not exceeded.

E. Remote Control System:

1. Allows for routine operation of the system without the need for personnel to enter the tunnel.
2. Display available to operator, showing the position of the shield in relation to a design reference together with other information such as roll, pitch, complete guidance system, valve positions, thrust force, cutterhead torque, rate of advance and installed length.
3. Integrates the system of excavation and removal of spoil and its simultaneous replacement by pipe. As each pipe section is jacked forward, the control system shall synchronize all the operational functions of the system.

F. Active Direction Control: Provide a MTBM that includes an active direction control system with the following features:

1. Controls line and grade by a guidance system.
2. Equipped with a high intensity laser within the maximum legal limit, gyro system, or total station guidance system as required for drive length.
3. Capable of maintaining line and grade to the tolerances specified in this section.
4. Provides active steering information that is monitored and transmitted to the operating console. As a minimum, this information shall include location of the laser beam on the target and location of the cutterhead or the location of the total station elements and prisms.
5. Provides positioning and operation information to the operator on the control console.
6. Provides a reference or self-correcting laser, or other submitted device, that indicates visually in the jacking shaft that the directional control laser or guidance system has not been accidentally moved.

G. Lubrication System: Shall include pressure gauge, volumetric gauge, and shut-off valve on the pump or at the point of injection.

H. Spare Components:

1. Provide motor bearings, electrical and mechanical parts, pumps, connectors, and other equipment as necessary to maintain microtunneling operations. Spare parts shall be maintained such that they can be on-site within 24-hours should the need arise.

I. MTBM Jacking System

1. Provide a slurry separation process that employs the use of mechanical shakers, screens, centrifuges, and hydro-cyclones. Slurry separation using only sedimentation tanks will not be permitted. Ensure that the separation process provides adequate and efficient separation of excavated solids from the slurry such that re-circulated slurry can be returned to the cutting face for reuse with negligible remaining fines and so the solids can be removed and disposed of in an efficient manner.

2.04 MIXES

A. Lubrication and Slurry:

1. Lubrication and slurry shall consist of high yielding Wyoming sodium montmorillonite bentonite, polymers, additives, and water.

2. Water shall be furnished by the Contractor from a potable water source.

3. All water shall be tested for pH and treated with soda ash, or approved equal, to adjust the pH of the water as required in the accepted mix design(s).

4. Bentonite, polymers, and additives, other than soda ash, shall be NSF/ANSI Standard 60 Certified or equal for clean water testing.

5. Use of water only as the drilling fluid is not allowed in the ground and rock conditions as described in the GDR.

6. Design slurry viscosity for ground to be within the ranges specified herein.

PART 3 EXECUTION

3.01 GENERAL

A. Commence only after design calculations and shop drawings have been reviewed and accepted by the PM/CM and applicable permits have been obtained.

B. Conduct all work within the construction limits established for the project.

C. The Contractor is responsible for the following conditions:

1. Means and methods of tunneling operations and safety of the Work, the Contractor’s employees, the public and adjacent property, whether public or private.

2. Organization of microtunneling surface equipment in such a manner as to enable proper operation at all times, to minimize impacts to property owners, and to maintain traffic control patterns as specified.

3. Any equipment operating with fuel, hydraulic, or lubrication oils shall be provided with suitable containment basins made of plastic lining and sand bags to ensure no loss of fluid to drains or water courses and no contamination of the ground.

3.02 INSTALLATION

A. Jacking and Receiving Shafts:

1. The Contractor is responsible for constructing jacking and receiving shafts for microtunneling in accordance with the requirements of Section 02260 and for installing the concrete pipe for Drives 1, 2 and 3.

B. Alignment Establishment

1. Surveyor shall check Owner benchmarks before commencing excavation and immediately report any errors or discrepancies to the PM/CM Representative.

2. Use the Owner benchmarks shown on the Drawings to furnish and maintain reference control lines and grades for the pipe construction.

3. Check the primary control for the microtunneling system against an undisturbed above ground reference at least once each week or not greater than every 250 feet of pipeline constructed.

C. Launch and Retrieval: The Contractor shall implement appropriate procedures and notify the PM/CM immediately in writing upon implementation of any contingency plan.

3.03 MICROTUNNELING

A. Adhere to the following requirements and conditions:

1. Do not launch the MTBM until all of the jacking pipe to be used is on-site or staged nearby for delivery to the jacking site and has been inspected in accordance with Section 02317.

2. Conduct microtunneling operations in accordance with applicable safety rules and regulations and use methods that include due regard for safety of workers, and protection for adjacent structures, utilities, and the public.

3. Keep microtunnel excavation within the rights-of-way indicated on the Plans, within the lines and grades designated on the Plans, and within the tolerances of this section.

4. Locate equipment powered by combustible fuels at suitable distances from shafts and protect equipment to prevent the possibility of explosion and fire in shafts or the pipe.

5. Synchronize the rate of advance of the MTBM with the rate of spoil removed to avoid over-excavating.

6. Operate the microtunneling system within the operating parameters established in the specifications and accepted submittals.
7. Make the annular space excavation of a minimum sufficient size to permit pipe installation by jacking with an allowance for injection of the lubricant.
8. Maintain an envelope of lubricant around the exterior of the pipe during jacking and excavation operations.
9. Do not employ water jetting without written acceptance of the PM/CM. Water jetting may be authorized only after slurry modifications prove ineffective in alleviating the need for water jetting.
10. In the event a section of pipe should be damaged during the jacking operation or joint failure occurs, as evidenced by visible groundwater inflow or other observations, use one of the following procedures to correct the damage, as accepted by the PM/CM.
    a. Non-structurally damaged pipe that passes leakage test and maintains pipe barrel and joint structural integrity, may be repaired in place with a method approved by the pipe supplier and if the proposed technique is accepted by the PM/CM.
    b. Structurally damaged pipe, or pipe where joint failure is evident, shall be removed by jacking it through the excavation and removing it at the receiving shaft. The removed pipe, after inspection is found to be without defect, may be jacked a second time by being placed into the same pipe string at the jacking shaft.

B. Maximize safety and avoid exposure of personnel and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards and Contractor's safety procedures.

C. Operate all microtunneling equipment and systems in accordance with the equipment manufacturer's guidelines and recommendations.

D. Complete all required set-up procedures and system checks and demonstrate that all required materials are at hand prior to commencing any microtunneling drive.

E. Measure and report the no-load torque required to turn the cutter head in both directions as specified herein before starting any microtunneling drive.

F. Jack each pipe section forward as the excavation progresses so as to provide complete and adequate ground support at all times.

G. Inject pressurized lubricant around the leading edge of the pipe being jacked and through the ports in the pipe being jacked as necessary.

H. Perform annular space grouting as required to fill the annular space to control settlement if over excavation is or has occurred during microtunneling. Submit a plan in advance of grouting accepted by the CM/PM.

I. Maintain a daily activity log during each drive and make it available for review by the PM/CM at any time. The daily activity log shall note a general description of ground conditions encountered and any delays greater than one hour other than normal breaks and shift changes.

J. Maintain an electronic version of data recorded by the MTBM control system as specified herein and submit daily.

K. Whenever there is an emergency which may potentially endanger the tunnel excavation, existing structures or utilities, operate a full work force for 24 hours a day, including weekends and holidays, without interruption until the emergency no longer jeopardizes the stability and safety of the microtunneling operations.

L. Rescue of the MTBM

1. If a rescue of the MTBM is required, the Contractor shall implement the submitted and accepted contingency plans.

2. If the MTBM and pipe cannot be advanced, a recovery access shaft may be permitted subject to review by the CM/PM. If the MTBM and pipe cannot be advanced for any reason other than an obstruction as defined herein, Contractor shall be responsible for recovery shafts for the MTBM, including permits, construction, demolition, utility relocation, resumption of tunneling, and restoration. Recovery shaft construction shall be performed in accordance with the requirements of Section 02465.

M. Obstructions During Microtunneling

1. Remove, clear, or otherwise make it possible for the microtunneling equipment and pipe to progress past or through an object in accordance with the Contractor's accepted contingency plan

2. The Contractor shall remove, clear, or otherwise make it possible for the microtunneling equipment to progress past an object that is not an obstruction.

3. Payment for obstruction removal, including the removal of the obstruction, shall be paid if the object is found to be an obstruction, and subject to the following requirements:

a. Notify the CM/PM immediately in writing upon encountering an object that stops forward progress.

b. Upon written authorization by the CM/PM, proceed with removal of the object by means of obstruction removal procedure.

c. No excavation shall be allowed within 5 feet of the MTBM without the CM/PM being present.

N. The proposal of alternative methods for removing, clearing or otherwise making it possible for the microtunneling equipment to progress past an object that does not allow for the direct observation, measurement and testing of the object to determine if the object satisfies the definition of an obstruction as provided herein shall not be considered for additional payment.

3.04 CONTACT GROUTING

A. After completion of a microtunneled segment, inject cement grout through the grout ports from the interior of the installed pipe to fill voids and displace lubrication outside of the jacked pipe in accordance with Section XX.

B. Contact grout pressure is not to exceed 10 psi above the ambient overburden pressure or is not to exceed one-half the ambient overburden pressure, whichever is less.

C. After grouting is complete, close off the grout port stopcocks or other suitable device until cement grout has set sufficiently for a minimum of 24 hours. After the grout is set, remove the grout ports, install a treaded plug in the port, and grout the holes by filling with a high strength fast setting grout and finished smooth to the all surface without evidence of voids or projections.

3.05 OBSTRUCTIONS

A. Obstructions are defined herein and can consist of any of the following::

1. Natural boulders with a maximum lateral dimension greater than one and one-third foot (1.33 feet) or an unconfined compressive strength greater than the machine capacity as specified herein.

2. Man-made objects in the fill ground such as metal, reinforced concrete, and clusters of timber (wood) piles to the extend they satisfy the definition of obstruction.

B. Encountering rock or boulders will not be considered an obstruction or a Differing Site Condition (DSC) unless they satisfy the definition of an obstruction herein.

C. The determination of whether or not the obstruction has stopped the forward progress of the microtunnel operations shall be made by the PM/CM as follows:

1. If the microtunneling machines forward progress is stopped and the operator perceives that an obstruction may exist, the Contractor shall notify the PM/CM immediately in writing and by direct contact.

2. Upon direction of the PM/CM, the Contractor shall initiate due diligence to attempt forward progress with the PM/CM present. Should forward progress be less than 6 inches per hour for a total of 4 hours, the PM/CM will authorize the Contractor to cease microtunneling operations.

3. Upon written direction of the PM/CM, the Contractor shall implement their obstruction removal contingency plan by first identifying the nature of the obstruction.

4. Do not remove the obstruction until written authorization is received from the PM/CM. Immediately upon receipt of authorization by the PM/CM, the Contractor shall take photographs and record dimensions of the obstruction stopping forward progress in its undisturbed position relative to the face of the MTBM and immediately provide the photographs and dimensions to the PM/CM.

5. Should the PM/CM determine that an obstruction, as defined herein was encountered, the PM/CM will compensate the Contractor for obstruction removal in accordance with the Contract Documents.

6. Should the PM/CM determine that an obstruction does not meet the definition of an obstruction as defined herein, the Contractor will not be paid for obstruction removal shaft.

3.06 INSTRUMENTATION AND MONITORING

A. Geotechnical instrumentation and monitoring shall be performed in accordance with Section 02295.

B. Allowable Settlement/Heave:

1. Limit ground movement as specified in Section -02295.

3.07 FIELD QUALITY CONTROL

A. Implement contingency plans and notify the CM/PM in writing immediately upon implementation of any contingency plan.

B. If allowable tolerances are exceeded, the Contractor shall pay all costs for correction, redesign, reconstruction, and re-inspection. If redesign is required, the Contractor shall obtain the services of a Professional Engineer licensed in the State of Rhode Island. Any redesigned pipe shall meet the design flow.

C. Perform a verification survey with a transit or total station of the installed pipe from shaft to shaft after removal of the MTBM. Document measured conformance to design line and grade of the pipe together with locations and deviation (distance and direction) of any out-of-tolerance locations.

3.08 CLEAN-UP

A. Unless otherwise shown or specified, restore all existing surface improvements to their original condition.

B. Restoration of the surface soil cap is to be completed in accordance with Section (TBD).

END OF SECTION 02314

SECTION 02317

REINFORCED CONCRETE PIPE FOR MICROTUNNELING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for designing, manufacturing, and furnishing of reinforced concrete pipe (RCP) for microtunneling, including all pipe joint components, and all related materials that shall remain as permanent components of the pipeline installed by one pass microtunneling approach, as specified herein and shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 02314 – Microtunneling

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern.

B. American Society of Civil Engineers (ASCE)

1. 27-00 - Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction

C. American Society for Testing and Materials (ASTM)

1. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. A185 - Standard Specification for Steel Wire, Fabric, Plain for Concrete Reinforcement Pipe.
3. A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
5. C33 - Standard Specification for Concrete Aggregate.
6. C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
7. C150 - Standard Specification for Portland Cement.
8. C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.

9. C497 - Standard Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile.
10. C822 - Standard Terminology Relating to Concrete Pipe and Related Products.
11. C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
12. C1619 - Standard Specification for Elastomeric seals for joining concrete structures.
13. C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

D. American Water Works Association (AWWA)

1. C302 - Standard for Reinforced Concrete Pressure Pipe

1.04 DEFINITIONS

A. Concrete Jacking Pipe: Precast reinforced concrete pipe with flush bell and spigot joints sealed with rubbers gaskets and specifically designed to handle loads due to jacking installation and may also serve as a product pipe. Refer to herein as jacking pipe.

B. See Section 02314 for additional definitions.

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Manufacturer's Qualifications:

1. Experience record listing projects with references and contact information. List projects for which RCP, 42-inch diameter or larger, was manufactured within the last 5 years.
2. The manufacturer of the RCP for microtunneling shall have at least five (5) years' experience in the design and manufacture of microtunneling or pipe jacking pipe and have manufactured at least five thousand (5,000) feet of jacking pipe at equivalent dimensions and configuration as required for this project.

C. RCP Design Engineer

1. The design for the RCP for microtunneling shall be performed by a Professional Engineer licensed in the State of Rhode Island with at least 5 years of experience in the design of 42-inch inside diameter or larger RCP with demonstrated experience in designing RCP installed by an MTBM.

D. Gasket Manufacturer:

1. Provide project references including project owner, pipe size, project name, and project owner contact with telephone number.
2. The gaskets shall be the product of a manufacturer having prior experience in the manufacture of gaskets for pipe joints to seal joints subjected to similar:
   a. Hydrostatic pressures in accordance with the GDR.
   b. Ground and groundwater contamination conditions and constituents in accordance with the project Environmental Data Report (EDR) in the Contract Documents.

E. Acceptance Criteria:

1. Acceptance will be based on the successful results of the following:
    a. Tests of materials
    b. D-load bearing tests
    c. Pressure tests.
    d. Inspection of the completed installation.
2. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe is subject to inspection by the PM/CM. Inspection may be conducted at the place of manufacture, or at the work site after delivery, or both.
3. The pipe is subject to rejection at any time due to failure to meet any of the requirements specified in the Contract Documents, even though sample units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
4. The PM/CM reserves the right to have any or all pipe units inspected or tested, or both, by an independent testing laboratory at either the manufacturer's plant or elsewhere. Such additional inspection and/or tests shall be at the Owner's expense and shall be the test results of record.

F. Pre-Manufacture Meeting:
1. A preconstruction meeting that includes the pipe manufacturer shall be arranged not less than 3 weeks and no more than 6 weeks prior to pipe fabrication to discuss manufacturing procedures, schedule, and QA/QC program.
2. Pipe handling, repair, written notification procedure, and gasket sealing shall be discussed.

G. Warranty
1. The Contractor shall obtain from the manufacturer its warranty that the pipe for microtunneling conforms to the specified requirements herein and will be free from defects in materials and workmanship for a period of one (1) year from the date of substantial completion of the Contract.
2. The manufacturer's warranty shall be in a form acceptable to and for the benefit of the Owner and shall be submitted by the Contractor.
3. The Contractor shall repair or replace, at the sole option of and at no additional cost, any pipe for microtunneling found to be defective within the warranty period. Repair or replacement shall include the cost of removal and reinstallation and all other cost required to affect removal and reinstallation.

H. Testing: Shall conform to ASTM C76 and ASTM C1103.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
1. RCP materials: In accordance with ASTM C76

C. Gasket Materials:

1. Dimensioned catalog cuts showing sizes, thicknesses, and type and grade of material to be furnished.
2. Test reports of the physical properties of the gaskets.

D. Submit the following 30 days prior to the work:

1. Design calculations and analysis for determining moments, shears, deflections and, if required, additional reinforcement due to handling, transportation, storage and installation procedures. Perform calculations in accordance with ASCE 27-00 and as specified herein for sanitary and combined sewage service. Include, at a minimum, the following information:
   a. Design criteria, assumed parameters, and formulas.
   b. Include factor of safety, maximum allowable jacking force, and maximum allowable contact grout pressure.
   c. Identify packer material information, including thickness and size, and angle of deflection assumed at each joint.
2. Detailed shop drawings certified by the pipe manufacturer for the RCP and appurtenances for a jacked installation. Shop drawings shall include:
   a. D-load, cement type, concrete strength, and details of the wall class, and fittings.
   b. Details of the pipe including weight per foot, length, and lay length.
   c. Detail drawings for the joint design.
   d. Details of the lubrication ports, including location, spacing, and orientation.
   e. Details of interfaces between pipes and the microtunneling machine and between pipes and the jacking ring.
   f. Fabrication drawings for reinforcing steel in accordance with ASTM C76.
   g. Piece mark for each pipe section.
   h. The gasket details shall include the diameter of the cross-section and the unstretched diameter and volume.
3. Packer design details, including packer dimensions, and materials.
4. Steel end ring design details (if used), including dimensions, and materials.
5. A description of the plans for storage and handling of pipe for microtunneling.
6. Working Drawings and Methods Statement that includes the following:
   a. Data on the fabrication plant proposed for use in fabricating the pipe and fittings, including:
      i. Name of supplier.
      ii. Plant location.
      iii. Plant volume or output quantity.
      iv. All other data necessary to show the supplier’s capability to produce RCP of the quality and quantity required.

b. Proposed procedure for shop hydrostatic testing.

c. Proposed method for field testing each joint.

7. Mix designs in accordance with Section XX for all concrete irrespective of plant location.

8. A description of the plan for inspection and testing the pipe and joints following installation.

E. Quality Control Submittals

1. Qualifications and experience records for:

a. Manufacturer

b. RCP design engineer.

2. Certifications: Certified copies in triplicate of test results/reports will be required for the materials and the finished pipe units as described below:

a. Certificate from an independent laboratory of compliance for each load of cement.

b. Certified copies of mill test reports from an independent laboratory covering the physical and chemical properties of reinforcing steel.

c. Test certificates guaranteeing that the pipe furnished hereunder complies with the requirements of the Contract Documents.

d. Certified copies of the test reports from an independent laboratory of the compound used in the gaskets.

e. Design engineer's certification that pipe has been designed to handle all applicable loading conditions with appropriate factors of safety.

f. Manufacturer's warranty for microtunnel pipe.

3. Lists of all pipe and fittings received in each shipment, including the manufacturing control number or piece mark, weight, class, size, and description.

4. Joint acceptance test results.

1.07 DESIGN CRITERIA

A. The Contractor is responsible for analysis and final design for the RCP jacking pipe for microtunneling and pipe joint design in accordance with design criteria indicated on the Contract Drawings and specified herein.

B. The Contractor is responsible for verifying that all aspects of pipe for microtunneling and pipe joint design are compatible with the Contractor's equipment and microtunneling methodology.

C. The Contractor is responsible for verifying that the jacking pipe and joints shall have been designed for the anticipated service conditions and all loads due to handling, storage, transportation, and installation to withstand jacking over the full length of the microtunneling drives shown on the Contract Documents without incurring damage.

D. Pipe for microtunneling shall meet the following criteria:

1. Concrete used in pipe for microtunneling shall have a minimum 28-day unconfined compressive strength of 6,000 pounds per square inch (psi) for the following pipe class:

a. Class XX, Wall CC in accordance with ASTM C-76

2. The ultimate jacking load capacity of the pipe shall be at least three (3) times the maximum anticipated jacking load.

3. Anticipated jacking load evaluations shall consider the Contractors proposed microtunneling equipment and methods, drive lengths, and anticipated ground conditions.

4. The pipe and pipe joint designs shall consider the range of potential eccentric loading during jacking.

5. Watertight joints in conformance with the requirements specified herein.

E. Design the pipe to:

1. Withstand long-term operational hydrostatic pressures of 20 psi, and short-term interior hydrostatic pressures of 25 psi without leakage.

2. Withstand long-term external hydrostatic pressures resulting from a water column measured from pipe invert to ground surface, or to the 100-year flood elevation, whichever results in the greatest hydrostatic pressures.

3. Withstand long-term ground loads based on the height of soil or rock cover and surcharge loads.

4. Withstand long-term durability considering interior and exterior exposure conditions based on corrosivity evaluation of known ground and groundwater contaminants.

F. Performance Requirements:

1. Acceptability of pipe will be based upon conformance with this Specification and ASTM C76.

2. Manufacturing Tolerances: In conformance with ASCE 36-15 or ASTM C76, whichever controls.

3. Joints:

a. The spigot ring shall have grooves to receive, hold and protect the gaskets. A special tube at each joint shall be cased in the joint for hydrostatic field-testing. Where hydrostatic field testing can be performed, spigot ends with reinforced thermosetting resin coupling or with steel coupling are acceptable. Steel coupling shall be coated with minimum 16 mils coal tar epoxy.

b. Gaskets shall be self-centering and designed so that when the pipe is installed, the gasket will not support the weight of the pipe and will function solely to seal the joint.

c. Joint shall not be installed deflected more than 50 percent of its maximum allowable deflection.

d. Joints shall be watertight when tested to the design pressure. Joint shall be watertight under all service conditions including expansion, contraction, and settlement.

G. Pipe Lengths:

1. The contractor shall select the standard length furnished based on their means and methods, and all standard pipe shall be uniformly of that length within manufacturing tolerances. Standard pipe length shall be 8 feet minimum.

1.08 SEQUENCING AND SCHEDULING

A. Schedule manufacturing so that pipe is available and meets the minimum specified concrete compressive strength before installation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with accepted submittals and manufacturer's written recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

C. Deliveries shall be scheduled so that the progress of the work is not delayed.

D. Delivery and Handling of Pipe:

1. Trucks, trailers, or rail cars used for transporting pipe shall be provided with bolsters between each layer of pipe curved to fit the outside of the pipe.

2. Care shall be exercised in handling, transporting, and placing pipe to prevent damage. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with exterior slings or with a suitable forklift. Heavy canvas or nylon slings of suitable strength shall be used for lifting and supporting materials; do not use chains or cables.

3. Pipe may be placed for jacking using one sling near the center of the pipe, provided the pipe is guided to prevent uncontrolled swinging and no damage will result to the pipe or harm to the workers.

4. Pipe shall be stored in an orderly manner, so that there will be a minimum of rehandling to the final position. Pipe can be stored at the tunnel site, at the Contractor's corporation yard or other offsite location approved by the PM/CM.

5. The Contractor shall limit the number of pipe segments at each work zone to the number necessary for continuous installation within one work shift. The Contractor shall obtain additional off-site storage area as necessary to store pipe prior to installation at no additional cost.

6. Store pipe materials in a manner that will not be a hazard to traffic or to the public in general, will not obstruct access to adjacent property, or will not obstruct other Contractor's working in the area.

7. When not being handled, the pipe shall be supported on timber cradles, on sandbags that keep the pipe off the ground and prevent roll, or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. Do not store pipe and fittings on rocks or gravel or other uneven hard surfaces.

8. Each pipe segment shall be marked on both ends to identify the manufacturer, factory location, date of manufacture, shift, lot number, and nominal diameter. A production lot shall consist of all pipes having the same lot marking.

9. Pipe gaskets shall be stored in a cool, well-ventilated place and do not expose to the direct rays of the sun prior to use. Do not allow contact with oils, fuels, petroleum, or solvents.

E. Pipe Acceptance at Project Site

1. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and acceptance by the PM/CM. Such inspection may be made at the place of manufacture, or on the site after delivery, or at both places. The pipe shall be subject to rejection at any time if it fails to meet the specified requirements; even if previously accepted.
2. Sections rejected after delivery to the project site shall be immediately marked with "Remove" for identification and shall be removed from the project within 24-hours.
3. Any installed pipe sections rejected after installation shall be acceptably repaired, if permitted by the PM/CM, or removed and replaced, at no additional cost.
4. All sections shall be inspected for general appearance, dimension, blisters, cracks, roughness, and soundness. The surface shall be dense and close-textured.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall be new.

2.02 PIPE FOR MICROTUNNELING

A. Manufacturers

1. Pipe for microtunneling shall be manufactured and supplied by one of the following manufacturers or approved equal.
    a. Hanson Pipe and Precast, Danielson, CT 06239
    b. Vianini Pipe Inc, Whitehouse, NJ 08876

B. Nominal pipe inside diameter shall be as shown on the Contract Documents.

C. Outside diameter, exterior roundness, end squareness, straightness and joint length in accordance with ASTM 36-15 or ASTM C76, whichever is most restrictive.

D. Individual sticks of pipe for microtunneling shall not be longer than 10 feet

E. Pipe for microtunneling shall be tested in accordance with ASTM C497 as required to ensure compliance with the requirements specified herein.

F. Concrete Materials:

1. Cement shall comply with ASTM C150-Type II.
2. Aggregates shall comply with ASTM C33.
3. Minimum steel cover: 1-1/2 inches on both faces.

G. Reinforcement

1. Shall consist of hot-rolled steel bars conforming to ASTM A615 placed in accordance with ASTM C76.
2. Double circular steel reinforcements shall be provided. The area of the outer cage steel reinforcement shall not be less than 75 percent of the inner cage. Not less than 12

longitudinal bars at approximately equal spacing shall be provided for each cage. Longitudinal bars shall be #3 or greater.

3. Only full circular cage reinforcement shall be used. No quadrant mat or elliptical cage will be accepted.
4. The spigot end of each pipe shall have additional external hoop reinforcement placed along the length of any reduced wall section.

H. Joints and Gaskets

1. Pipe joints shall be designed, tested, and manufactured in accordance with ASTM C361.
2. Pipe joints shall be gasket joints of the configuration shown on the Contract Drawings and shall be designed for the internal and external pressures as specified herein.
3. Pipe joints shall be flush or slightly recessed in relation to the pipe outside diameter.
4. Steel end rings, if used, shall be hot-dipped galvanized in accordance with ASTM A123 or zinc metalized with two (2) coats of 4 mils (one thousandth of an inch) minimum thickness each coat as per AWWA C302.
5. Gasket specimens shall be heated in a dry oven to 150 degrees Fahrenheit (F) for a 6-hour duration. Five (5) specimens shall be tested by immersion, one each as follows:
    a. 2-hour immersion in petroleum ether
    b. 72-hour immersion in saturated Hydrogen Sulfide solution
    c. 72-hour immersion in 1 percent Sodium Hydroxide solution
    d. 72-hour immersion in standard soap solution (80 percent alcohol)
    e. 72-hour immersion in 10 percent Sodium Chloride solution
    f. The specimens shall show no detrimental change in color, texture, or feeling upon completion of the above tests.
    g. The specimens shall be tested in accordance with ASTM C1619 Part 8 and the test results shall be within 10 percent of the values listed in Table 1 of ASTM C1619 for Class A gasket.
    h. The manufacturer shall supply test data and affidavits showing compliance with these requirements. Tests shall have been conducted within six (6) months of the start of the manufacture of the pipe.
6. Use only manufacturer-recommended lubricants.

I. Packers

1. The contact surfaces of all pipe joints that transmit axial (longitudinal) jacking forces shall be separated by a custom-designed cut plywood or fiberboard packer, that can transmit axial jacking forces uniformly and without producing transverse splitting forces, with a minimum thickness of ¾ inch.
2. Packers shall be designed and cut in consultation with the pipe designer such that the cushioning material does not adversely affect joint sealing and/or load-carrying capacity.
3. Packers shall be cut to adequate dimensions to ensure the full bearing width of the joint is protected.

4. Packers shall not extend over the outermost ¼ inch of the joint bearing area.

J. Pipe Lubricant Injection Ports

1. Pipe for microtunneling shall be supplied with factory-installed pipe lubricant injection ports of diameter, quantity, and orientation compatible with the Contractor's microtunneling methods. Each pipe for microtunneling shall be supplied with at least one (1) 2-inch diameter lubrication port. The ports shall alternate at 10, 12 and 2 o'clock for every 3 pipe sections.

2. Pipe lubricant injection ports shall be designed to withstand the design conditions for the pipe, and for lubricant fluid pressures anticipated by the Contractor during microtunneling.

3. Pipe lubricant injection ports shall be sealed with corrosion-resistant plugs or similar material complying with the pipe manufacturer's recommendations.

4. Install one-way valves to prevent infiltration during contact grouting.

K. Pipe Inspection and Testing during Manufacturing

1. The Contractor shall facilitate all requests by the PM/CM to inspect pipes or to witness pipe manufacture and testing at the manufacturing plant.

2. The Contractor shall require the pipe manufacturer to have pipe for microtunneling made sufficiently in advance so that a minimum of approximately 500 feet or the length of a microtunnel drive, whichever is smaller, can be observed and tested at the manufacturing facility.

3. The Contractor shall provide facilities for testing the effectiveness of the joints against leakage for each pipe run observed. Such tests shall be made by applying an internal or external pressure against the joint of at least 25 psi for a period of 20 minutes.

2.03 PIPE FABRICATION

A. General: RCP shall be manufactured in accordance with ASTM C76.

B. Fabrication of Joints:

1. The contact surfaces of the bell and spigot shall be smooth to prevent damage to the gaskets.

2. Joints shall be designed specifically for jacking and shall be designed to withstand the jacking force before applying a factor of safety.

C. Repair of Imperfections and Damage to Pipe:

1. In accordance with the approved submittals.

2. Repairs made to pipe during fabrication shall be made immediately prior to curing period with a minimum delay in the start of the curing.

3. Surface imperfections of 3/8 inch or greater on the interior of the pipe shall be filled and finished. If 6 or more imperfections, 1/4 inch or greater in maximum dimension, occur in 1 square foot, they shall be filled and finished. Repairs made to the interior pipe surfaces shall not have a roughness exceeding the adjacent formed surface and shall be flush with the adjacent surfaces.

4. Surface imperfections of the exterior pipe surfaces, 1/2 inch or greater shall be filled and finished. If 6 or more imperfections, 3/8 inch or greater in maximum dimension, occur in 1 square foot, they shall be filled and finished.

D. Marking:

1. Each pipe section shall be marked with the following information:

a. Name of manufacturer.

b. Date of manufacture.

c. Inside diameter of pipe, in inches.

d. Wall thickness, in inches.

e. Length of pipe, in feet.

f. Class of pipe or D-loading, in pounds.

g. Top of pipe if elliptical reinforcing is used.

h. Sequential numbering of each piece of pipe.

E. All markings shall be on the inside and outside of each section of pipe and affixed thereto as soon as practicable after the forms are removed.

F. Markings shall be acceptable to the PM/CM.

2.04 SOURCE QUALITY CONTROL

A. Inspection:

1. The Contractor shall require the manufacturer to provide the PM/CM with reasonable facilities and space for inspection and testing.

2. The PM/CM shall be notified a minimum of 2 weeks prior to start of fabrication. The PM/CM shall have access to all phases of fabrication for inspection.

3. If the PM/CM determines that the specified method of nondestructive testing cannot be used under conditions encountered in the work, an alternative method of inspection will be determined by the PM/CM.

B. Cement and Aggregates Testing: In accordance with the requirements of Section XXX.

C. Concrete Testing:

1. General: Conform to the requirements of Section XXX.

2. Any pipe that does not meet the compressive strength requirement shall be rejected.

D. Fit-Up Tests:

1. Following completion of fabrication, ends intended for field connection shall be checked in the fabricator's shop to ensure that a proper fit can be achieved during field erection. Shop fit-up shall be done without the use of jacks or other objects.

2. Fit-up for standard sections of pipe shall be checked in the shop by stabbing a minimum of two joints. Pipe sections for test fit of joints will be selected by the PM/CM.

PART 3 EXECUTION

3.01 GENERAL

A. Pipe for microtunneling shall be installed in accordance with Section 02314 and in accordance with the manufacturer's recommendations.

B. Contractor shall assure that the pipe jacking forces are within the manufacturer's jacking limits.

C. The Contractor's pipe manufacturer shall furnish the services of a competent factory representative to inspect the storage, handling, and installation of the pipe for a minimum of five (5) days during initial pipe installation. The factory representative shall be provided at no additional cost.

D. On completion of jacking and before contact grouting, the pipeline shall be thoroughly cleaned prior to final inspection.

E. Any pipe which has been damaged during installation shall be replaced by the Contractor. The cost of replacement of a new pipe shall be at no additional cost.

F. Any part of the pipeline, joints, or lining which fails inspection or testing shall be replaced at no additional cost.

3.02 FIELD QUALITY CONTROL

A. The Contractor shall perform infiltration acceptance tests of the installed pipe for microtunneling in accordance with ASTM C969 in the presence of the PM/CM.

B. All pipe shall be tested for leakage and thoroughly cleaned of any obstructions or debris. Pipes shall be tested and retested, at the Contractor's cost, as specified herein until acceptance by the PM/CM. All pipe shall be joint-tested prior to contact grouting.

C. Joints which show leakage shall be repaired subject to the approval of the PM/CM, and the joint retested. All joints shall have been tested and shall comply with the leakage requirement specified herein prior to acceptance of the work.

D. The Contractor shall maintain a current log of all pipe testing, including, but not limited to, the following information:

1. Type of test: i.e., hydrostatic, initial test, or retest number.
2. Time, beginning, and end.
3. Maximum pressure and pressure drop over test time.
4. All special precautions, considerations, or remarks concerning the particular test.

E. Hydrostatic Test for Double Gasket Joint, if used.

1. Test the annular space between double gaskets using two integral testing ports. Water shall be used as a testing medium. To test, remove the caps from both testing ports. Inject water into the lower testing port. When all the air has been displaced and water is coming out of the testing port located on the soffit of the pipe, place the pressure gage on the upper testing port.
2. Prior to backfill operations, the isolated joint shall be pressurized to 25 psi. If the pressure holds, or drops less than 1 psi in 30 seconds, the joint is acceptable.

3. If the pressure test at 25 psi fails, the pipe joint shall be pressurized to 25 psi and maintained for 2 minutes, the pressure bled off and again tested.

4. When individual joints have been tested and accepted, the testing tubes shall be capped securely with plugs at each testing port.

F. Hydrostatic Test for Single Gasket Joint

1. Joints shall be tested in accordance with ASTM Standards C1103.

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SECTION 02370

STORMWATER POLLUTION PREVENTION

PART 1 GENERAL

1.01 SCOPE.

A. The work specified in this section includes the installation, maintenance, and removal of perimeter erosion controls, check dams, temporary dewatering basins, storm drain protection, stilling basins for water pollution control, and construction accesses. Soil erosion and sediment controls shown on the Plans shall be installed by the Contractor. Some soil erosion and sediment controls specified herein may or may not be shown or detailed on the Drawings, but may be utilized by the Contractor. Soil erosion and sediment controls not detailed on the Plans shall be in accordance with this specification and the Rhode Island Department of Environmental Management Soil Erosion and Sediment Control Handbook, 1998, and all addendums. The methods described in this section are approved means for soil erosion and sediment control, the actual means and methods shall be determined by the Contractor. The Contractor shall be responsible for preparing and establishing a stormwater pollution prevention plan at each work site for approval by the Program Manager/Construction Manager.

B. Related Work Described Elsewhere:

1. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

1.02 GENERAL REQUIREMENTS.

A. Perimeter Erosion Controls: Work shall consist of the provision of perimeter erosion controls in reasonably close conformity with the dimensions and details indicated on the Drawings, all in accordance with these Specifications. Perimeter erosion controls consist of the following two types:

1. Baled Hay Erosion Checks. Baled hay erosion checks shall consist of straw wattles, or baled or straw, each bale of which is embedded and attached to the ground with wood stakes, and are constructed as indicated on the Drawings.

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2. Silt Fence. Silt fencing shall consist of oak fence posts to which are attached industrial support netting and sediment control filter fabric, and are constructed as indicated on the Drawings.

B. Check Dams: Work shall consist of the provision of check dams and dikes in reasonably close conformity with the RIDEM Soil Erosion and Sediment Control Handbook. Check dams consist of the following three types:

1. Baled Hay Ditch and Swale Erosion Checks. Baled hay ditch and swale erosion checks shall consist of baled hay or straw, each bale of which is embedded and attached to the ground with wood stakes.

2. Sand Bag Erosion Dikes. This work shall consist of the placement of sand bags across either riprap or earth ditches, thereby forming a dike, to create temporary stilling basins for pollution control.

3. Stone Check Dams. This work shall consist of the placement of stone in ditches or drainage swales to reduce flow velocities, to prevent soil erosion.

C. Temporary Dewatering Basins: Work shall consist of the provision of temporary dewatering basins for the purpose of controlling water pollution caused by sediment-laden discharge from excavation sites. The basins shall be constructed in reasonably close conformity to means and methods of the RIDEM Soil Erosion and Sediment Control Handbook. Temporary dewatering basins consist of the following two types:

1. Dewatering Basin. The basin consists of a rectangular concrete barrier enclosure, the bottom and sides of which are lined with filter fabric. The bottom fabric is stabilized with filter stone. The basin is divided into the required number of 12-foot sections by stone berms approximately 18-inches high.

2. Filter Fabric Retention Basin. The basin consists of a rectangular enclosure formed by a 2-foot high chain link fence. Both the fence and the bottom of the enclosure are lined with filter fabric which is stabilized by a layer of rock riprap.

D. Storm Drain Protection: Work shall consist of the provision of temporary storm drain protection facilities. Storm drain protection facilities shall consist of the following three types:

1. Sandbag Gutter Inlet Sediment Barrier. This work consists of placing a sandbag barrier upstream of a gutter inlet prior to the placement of roadway pavement.

2. Silt Fence Catch Basin Inlet Protection. This work consists placing a temporary filter fabric fence around inlet grates.

3. Baled Hay Catch Basin Inlet Protection. This work consists of placing baled hay around catch basin inlets. Baled hay inlet protection shall be constructed as indicated on the Drawings.

E. Stilling Basins for Water Pollution Control: Work shall consist of the provision of temporary and/or permanent stilling basins in accordance with the RIDEM Soil Erosion and Sediment Control Handbook.

1.03 QUALITY CONTROL.

A. Provide Quality Assurance / Quality Control services in accordance with Section 01400.

1.04 SUBMITTALS.

A. In accordance with Section 01300, submit a Stormwater Pollution Prevention Plan (SWPPP) in conformance with the requirements specified in the General Permit for Storm Water Discharges Associated with Construction Activities (Section 01060).

B. SWPPP to be stamped by a professional engineer registered in the State of Rhode Island in accordance with RIDEM requirements.

1.05 REFERENCE STANDARDS.

A. Rhode Island Department of Environmental Management (RIDEM). 1988. Recommendations of the Stormwater Management and Erosion Control Committee Regarding the Development and Implementation of Technical Guidelines for Stormwater Management. RIDEM, Office of Environmental Coordination, Providence, RI.

B. Rhode Island Department of Environmental Management and USDA Soil Conservation Service (SCS). 1989. Rhode Island Soil Erosion And Sediment Control Handbook. RIDEM, Providence, RI.

C. Rhode Island Pollutant Discharge Elimination System. General Permit for Discharges Associated with Construction Activities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Perimeter Erosion Controls:

1. Straw Wattles: Machine produced straw filled tubes of compacted straw of rice, wheat or barley. Straw wattles to be certified as weed free, and netting for tubes to be seamless, high density polyethylene with ultra violet inhibitors. Roll length to be 10.0 feet to 25.0 feet, and weight per linear foot, shall be: 12-inch: 2.5 lbs. minimum, 9-inch: 1.5 lbs. minimum. Stakes shall be wooden, 1 1/8-inch x 1 1/8-inch x 2.5 feet long, with lower ends tapered to facilitate driving into compacted soil. Rebar may be substituted for wooden stakes.
2. Baled Hay Erosion Checks. Baled hay or straw shall be baled within twelve months of use. Bindings shall be sufficiently strong to act as handles when placing bales in position by hand. The minimum dimension of any bale shall be 18-inches. Wood stakes shall be oak, 1-inch by 1-inch in section, and at least 3.0 feet in length.
3. Silt Fence. The filter fabric shall be a material suitable for erosion control applications. Wood posts shall be oak, 2-inch by 2-inch in section, and at least 4.5 feet in length. Support netting shall be heavy-duty plastic mesh. For prefabricated silt fence, 1-inch by 1-inch wood posts will be permitted.

B. Check Dams:

1. Baled Hay Ditch and Swale Erosion Checks. Baled hay or straw shall be baled within twelve months of use. Bindings shall be sufficiently strong to act as handles when placing bales in position by hand. The minimum dimension of any bale shall be 18-inches. Wood stakes shall be oak, 1-inch by 1-inch in section, and at least 3.0 feet in length.
2. Sand Bag Erosion Dikes. The sand bags and the sand material shall be of a quality acceptable to the Program Manager/Construction Manager. Dumped stone, when required, shall meet the requirements for Modified NSA Class R-4 riprap in Table II. The filled sand bags will weigh a minimum of 60 pounds.

3. Stone Check Dams. The stone shall meet the requirements for Filter Stone under RIDOT FS-2.

C. Temporary Dewatering Basins:

1. Dewatering Basins. Precast concrete barrier units shall conform to the RIDEM Soil Erosion and Sediment Control Handbook. Filter fabric shall conform to the applicable requirements of Article 2.01, Item A, Para. 2; Silt Fence, of these Specifications. Filter stone shall conform to the requirements of RIDOT FS-2. Sand bags shall be of a quality acceptable to the Engineer. Hay bales and wood stakes shall conform to the requirements of Article 2.01, Item A, Para. 1 of these Specifications.

D. Storm Drain Protection:

1. Sandbag Gutter Inlet Sediment Barrier. The sandbags and the sand material shall be of a quality acceptable to the Program Manager/Construction Manager.
2. Silt Fence Catch Basin Inlet Protection. The filter fabric shall be a material suitable for erosion control applications utilized. Wood posts shall be oak, 2-inch by 2-inch in section, and at least 4.5 feet in length. Support netting shall be heavy-duty plastic mesh. For prefabricated silt fence, 1-inch by 1-inch wood posts will be permitted.
3. Baled Hay Catch Basin Inlet Protection. Baled hay or straw and wood stakes shall conform to the requirements of Article 2.01, Item A, Para. 1 of these Specifications.

E. Stilling Basins for Water Pollution Control: The various materials required for the construction of stilling basins will be determined by the Contractor and provided in the Soil Erosion and Sediment Control Plan for approval by the Program Manager/Construction Manager.

PART 3 EXECUTION

3.01 GENERAL.

A. Construction Methods: Those erosion and pollution controls indicated on the Drawings shall be installed to the satisfaction of the Program Manager/Construction Manager before the commencement of any construction.

3.02 INSTALLATION.

A. Perimeter Erosion Controls:

1. Straw Wattles shall be constructed at the locations, and in accordance with the details indicated on the Drawings to the satisfaction of the Program Manager/Construction Manager. The following stipulations also apply:
   a. Wattles shall be placed in a single row, lengthwise on the contour, with ends of adjacent wattles tightly abutting one another. Remove all rocks, vegetation or other obstructions at straw wattle location.
   b. Excavate a trench approximately 2 to 3-inches deep to accept the straw wattle and place straw wattle in trench.

c. Anchor straw wattle with stakes placed a maximum of 4-feet apart.
d. The end stakes shall be placed 6-inches from the end of straw wattle and angled toward previously laid straw wattle to force straw wattles together.
e. Refer to detail on Drawings for additional installation requirements.

2. Silt Fence. Silt fence shall be constructed at the locations, and in accordance with the details indicated on the Drawings, to the satisfaction of the Program Manager/Construction Manager. The following stipulations also apply:

a. A 6-inch x 6-inch minimum trench shall be dug where the fence is to be installed.
b. The fence shall be positioned in the trench with the fence posts set at 8-feet on center (maximum).
c. The sedimentation control fabric and the industrial netting shall be stapled to each post. When joints are necessary, filter fabric shall be spliced together only at support posts. Splices shall consist of a 6-inch overlap, and shall be securely sealed.
d. Each wood post with industrial support netting and filter fabric attached shall be driven into the undisturbed soil in the trench as indicated on the Drawings.
e. The trench shall be backfilled and the soil compacted over the filter fabric.
f. The installed height of the fence shall be 2.5 feet (minimum). However, height shall not exceed 36-inches since higher barriers impound volumes of water sufficient to cause failure of the fence structure.

B. Check Dams:

1. Baled Hay Ditch and Swale Erosion Checks. Erosion checks shall consist of two or more bales placed and staked perpendicular to the flow line of a ditch formed by the intersection of its slopes. The following stipulations also apply:

a. A pair of erosion checks shall be placed a minimum of 12 feet apart at each location.
b. The ditch erosion checks shall be entrenched and backfilled. The trench shall be excavated the width of the bale(s) and the length of the check to a minimum depth of 3-inches. After the bales are staked and chinked, the excavated soil shall be backfilled against the check. Backfill shall conform to the ground level on the downhill side and shall be built up to 4-inches against the uphill side.
c. The bales are to be installed so that the bindings are oriented around the sides of the bales rather than their tops and bottoms.
d. The edges of overlapped bales shall overlap in such a manner that there will be no opening between the bales. Where bales butt together the gap between bales shall be chinked with loose straw to prevent water from escaping.
e. Each bale shall be securely anchored by a least two stakes driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together.
f. All earth ditch areas are required to have the protection of baled hay ditch erosion checks prior to their outfall onto existing ground, or natural or man-made water courses.
g. The haybale barrier shall be extended such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale. This configuration will insure that the sediment-laden runoff will flow either through or over the barrier, but not around it.

2. Sand Bag Erosion Dikes. Sand bags will be placed a minimum of four layers high. Over the center of the ditch the top layer of sand bags will have a weir opening equal to one

half the bottom ditch width. The sand bags shall be extended such a length that the bottom of the end sand bags are higher in elevation than the top of the lowest middle sand bag. When the sand bag dike is constructed across an earth ditch, the down stream side of the dike at the weir opening is to be protected with Modified NSA Class R-4 dumped riprap.

3. Stone Check Dams. Stone shall be placed across the ditch or swale to achieve complete coverage and shaped to the required configuration by the use of hand tools. The stone shall be sloped from the sides of the ditch/swale towards the center such that the center is 6-inches lower than the stone at the sides of the ditch/swale. The check dam shall have 2-horizontal to 1-vertical side slopes and shall not exceed 2-feet in height.

C. Temporary Dewatering Basins:

1. Dewatering Basin. The following stipulations shall apply:

   a. The precast concrete barrier units shall be placed on level, or nearly level, ground.
   b. Filter fabric shall be placed on the bottom of the entire area enclosed by the concrete barrier units. If more than one sheet of fabric is required, the adjacent section shall be overlapped a minimum of 12-inches to insure full coverage. Filter fabric shall be turned up along the inside face of the concrete barriers to the top of same, there to be folded across the top of the barriers. The fabric will be maintained in position by the placement of sand bags, end-to-end, along the top of the concrete barrier enclosure.
   c. A minimum layer of 6-inches of filter stone shall be spread over the bottom of the basin. Stone berms shall be constructed at 12-foot intervals along the length of the basin.

2. Filter Fabric Retention Basin. The following stipulations shall apply:

   a. The filter fabric retention basin will be placed on stabilized and level, or nearly level, ground to prevent erosion by water exiting the basin.
   b. A 6-inch by 6-inch minimum trench shall be dug where the basin is to be constructed.
   c. The filter fabric and wire backing shall be 3-feet wide (minimum) positioned in the trench and secured to metal posts positioned 4-feet on center (maximum).
   d. The metal posts shall be driven into undisturbed soil next to the trench to a minimum depth of 12-inches.
   e. Fill material shall be placed in the trench and compacted.
   f. The installed height of the fence shall be 2-feet (minimum).
   g. A minimum layer of 6-inches of filter stone (Modified NSA Class R-4 riprap) shall be spread evenly over the bottom of the basin.

D. Storm Drain Protection:

1. Sandbag Gutter Inlet Sediment Barrier. The following stipulations shall apply:

   a. The sandbags shall be placed in a curved row extending from the curb or berm. The row shall be at least 6-feet upstream of the inlet and should overlap the curb or berm.
   b. Several layers of sandbags shall be placed over the first layer to a minimum height of 1-foot. The bags shall be overlayed and packed tightly together.
   c. A gap of one sandbag should be left in the middle of the top row to serve as a spillway. The spillway shall be a least 8-inches high.
   d. Additional sediment storage capacity can be obtained by constructing a series of these barriers along the gutter upstream of the inlet.

2. Silt Fence Catch Basin Inlet Protection. The following stipulations shall apply:

    a. Posts shall extend at least 1 foot below grade.
    b. The filter fabric shall extend to a height at least 12-inches above the top of the inlet grate, but shall not exceed 3 feet in height.
    c. The support netting shall extend to the full height of the filter fabric.
    d. A trench shall be excavated approximately 6-inches wide and 6-inches deep around the outside perimeter of the stakes. The filter fabric and support netting shall extend at least 6-inches into the trench. After the fabric and support netting are fastened to the stakes the trench should be backfilled and compacted to original grade.
    e. The filter fabric and support netting fence shall be securely fastened to the stakes using heavy duty wire staples at least 1-inch long. Ends of the filter fabric must meet at a stake, be overlapped, folded and stapled to the stake.

3. Baled Hay Catch Basin Inlet Protection. The baled hay inlet protection shall be constructed as indicated on the Drawings. The following stipulations shall also apply:

    a. The bales shall be entrenched and backfilled. The trench shall be excavated the width of the bale and the length of the check to a minimum depth of 3-inches. After the bales are staked and chinked, the excavated soil shall be backfilled against the check. Backfill shall conform to the ground level on the inside and shall be built up to 4-inches around the outside.
    b. The bales are to be installed so that the bindings are oriented around the sides of the bales rather than along their tops and bottoms.
    c. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together.
    d. The gaps between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between bales.

E. Stilling Basins for Water Pollution Control:

1. The stilling basins will be constructed in such a manner to allow any material which may cause a natural water course or the surrounding environment to be damaged to be retained in the basin. During the life of the Contract, the Contractor will be required to periodically clean the pool and to maintain the basin to the satisfaction of the Program Manager/Construction Manager. If the basin is temporary, the Contractor will be required to fill the basin with suitable material and to restore the area in which the basin was located to either its original condition or to the requirements of the Contract.

2. In all cases the stilling basins are to be constructed immediately after the clearing and grubbing operation and before commencement of any excavation and/or embankment. The single exception to this requirement is the construction of a leveling course to create a work platform. Excavation for stilling basins is to take place from the downstream end of the basin and to proceed upstream. Prior to the start of excavation, temporary baled hay ditch erosion checks are to be constructed immediately beyond the downstream end of the basin. When the basin is complete the above temporary erosion control measures are to be removed.

3.03 MAINTENANCE AND CLEANING.

A. Definitions:

1. Cleaning consists of removing debris and accumulated sediment-laden deposits from the upstream side of perimeter controls, check dams and temporary drainage protection and from the bottom of temporary dewatering basins and stilling basins. All material so-removed shall be legally disposed of in accordance with Federal, State, and local regulations.
2. Maintenance consists of the repair and restoration to original configuration of damage sustained by erosion and pollution controls caused by "normal" rainfall events. (Abnormal weather events are defined in Article 3.03, Item I)

B. Methods:

1. Erosion and pollution controls shall be maintained by the Contractor to the satisfaction of the Program Manager/Construction Manager. Erosion and pollution controls must be able to prevent, under normal weather conditions, both the movement of soil materials and the intrusion of sediment-laden discharges into environmentally sensitive areas.
2. Construction shall not commence or continue until all specified erosion and pollution controls are in place, properly installed and accepted by the Program Manager/Construction Manager.
3. Erosion and pollution controls shall be routinely inspected by the Program Manager/Construction Manager. The Program Manager/Construction Manager shall notify the Contractor immediately if problems develop. The Contractor shall commence cleaning and maintenance measures no later than the next consecutive calendar day after receiving a directive from the Program Manager/Construction Manager to perform such measures. The Contractor shall aggressively and expeditiously perform such cleaning and maintenance work until the original problem is remedied to the complete satisfaction of the Program Manager/Construction Manager. In the event of a weekend storm, the Contractor must have resources available to restore, and, if necessary, to replace any damaged controls.

C. Applicable Controls:

1. The specific erosion and pollution control facilities to be cleaned and maintained under this Section are outlined in Article 1.02 and consist of the following:
    a. Perimeter Controls:
        1) Straw Wattles
        2) Baled Hay Erosion Checks
        3) Silt Fence
    b. Check Dams:
        1) Baled Hay Ditch and Swale Erosion Checks
        2) Sand Bag Erosion Dikes
        3) Stone Check Dams
    c. Temporary Dewatering Basins:
        1) Dewatering Basins
        2) Filter Fabric Retention Basins
    d. Storm Drain Protection:
        1) Sandbag Gutter Inlet Sediment Barrier
        2) Silt Fence Catch Basin Inlet Protection
        3) Baled Hay Catch Basin Inlet Protection
    e. Stilling Basins

D. Materials:

1. Materials required to repair and restore damaged erosion and pollution controls shall meet the applicable requirements of Article 2.01, Items A thru E; for Perimeter Erosion Controls, Check Dams, Temporary Dewatering Basins, Storm Drain Protection, and Stilling Basins, respectively, of these Specifications.

E. Threshold for Cleaning Erosion Controls:

1. Erosion and pollution controls will be cleaned when directed by the Program Manager/Construction Manager, after a rainstorm, and when sediment deposits reach the heights indicated in the following table:

	Height
a. Perimeter Controls	
1) Straw Wattels / Baled Hay Erosion Checks	1/2 Bale Height
2) Silt Fence	6-inches
b. Check Dams	
1) Baled Hay Erosion Checks	1/2 Bale Height
2) Sand Bag Erosion Dike	1/2 Dike Height
3) Stone Check Dam	1/2 Dam Height
c. Temporary Dewatering Basins	
1) Dewatering Basins	1/2 Original Basin Height
2) Filter Fabric Retention Basin	1/2 Original Basin Height
d. Storm Drain Protection	
1) Sandbag Gutter Inlet Sediment Barrier	1/2 Dike Height
2) Silt Fence Catch Basin Inlet Protection	6-inches
3) Baled Hay Catch Basin Inlet Protection	1/2 Bale Height
e. Stilling Basins	1/2 Depth Below Outlet Elevation

F. Other Requirements:

1. Perimeter Controls, Check Dams and Storm Drain Protection. The following requirements apply:

   a. Damaged controls will be repaired or replaced after each storm events.
   b. Before controls are removed all accumulated sediment on the upstream side shall be removed and legally disposed of.
   c. Erosion controls shall not be removed until the adjacent exposed areas are relatively free from future uncontrolled discharges.
   d. The Program Manager/Construction Manager has the authority to verify, enforce, and to specify maintenance activities and to ensure that erosion and pollution controls have been properly maintained.

2. Temporary Dewatering Basins and Stilling Basins. The following requirements apply:

   a. The basins will be periodically inspected for signs of erosion around the basin and downslope area.
   b. Repairs will be promptly carried.
   c. The Program Manager/Construction Manager has the authority to verify, enforce, and to specify maintenance activities and to ensure that controls have been properly maintained.

G. Failure of Erosion and Pollution Controls:

1. This Article 3.03; Maintenance and Cleaning, is based on the concept that erosion and pollution controls will essentially remain intact under normal rainfall events and that any damage sustained by said controls under normal rainfall may be repaired under the maintenance provisions set forth herein.

2. However, under abnormal weather events it is possible that erosion and pollution controls may be damaged to the extent that the Program Manager/Construction Manager may direct that they be replaced in their entirety. Under such abnormal conditions the Contractor will replace the particular facilities, and be compensated for same, under the applicable provisions set forth in regarding PERIMETER CONTROLS, CHECK DAMS, TEMPORARY DEWATERING BASINS, STORM DRAIN PROTECTION, and STILLING BASINS, respectively, of these Specifications.

H. Definition of Abnormal Weather Conditions:

1. For the purposes of Article 3.03, Item G, abnormal weather events are defined as follows:

   a. For a duration of 1-hour; rainfall equal to or greater than 1/2-inch.
   b. For a duration of 12-hours; rainfall equal to or greater than 2-inches.
   c. For a duration of 24-hours; rainfall equal to or greater than 3-inches.
   d. Extreme weather conditions such as hurricanes, tornadoes, floods, blizzards, etc. Daily rainfall records may be obtained from the National Weather Service.

3.04 REMOVAL.

A. Perimeter Erosion Controls:

1. Baled Hay Erosion Checks. All stakes must be removed from the haybales at a time designated by the Program Manager/Construction Manager. In general, the bales will be allowed to rot in place. If the Contract requires the haybales to be removed, they may be removed only when the adjacent exposed area has been stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the haybales shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications. Immediately upon removal of the bales the remaining exposed areas (under the bales) will be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

2. Silt Fence. This work will include the removal of the silt fence erosion checks and posts. Silt fence will not be left to rot in place. The silt fence may be removed only when the adjacent exposed area is stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the silt fence shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications. Immediately upon removal of the bales the remaining exposed areas (under the bales) will be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

B. Check Dams:

1. Baled Hay Ditch and Swale Erosion Checks. Bales of hay used in this work will not normally be left to rot in place. The bales may be removed only when the adjacent

exposed area is stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the respective erosion checks shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications. Immediately upon removal of the bales, the remaining exposed areas (under the bales) will be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

2. Sand Bag Erosion Dikes. Sand bag erosion dikes will be removed prior to the completion of the project at a time designated by the Program Manager/Construction Manager. Prior to such removal, however, all silt, mud, and debris entrapped by the erosion dike shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications.

3. Stone Check Dams. Stone check dams will be removed prior to the completion of the project at a time designated by the Program Manager/Construction Manager. Prior to such removal, however, all silt, mud and debris entrapped by the check dam shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications.

C. Temporary Dewatering Basins:

1. Dewatering Basin. The dewatering basin will not be removed until all dewatering operations are complete. Prior to such removal, however, all accumulated sediment within the basin shall be removed and legally disposed of in accordance with the applicable requirements of Article 3.03 of these Specifications. The area covered by the basin shall be seeded and mulched immediately after the basin is removed.

2. Filter Fabric Retention Basin. Removal requirements for the filter fabric retention basin are the same as set forth above for the dewatering basin.

D. Storm Drain Protection:

1. Sandbag Gutter Inlet Sediment Barrier. The sandbag sediment barrier will be removed prior to the completion of the project at a time designated by the Program Manager/Construction Manager. Prior to such removal, however, all silt, mud, and debris entrapped by the sediment barrier shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications.

2. Silt Fence Catch Basin Inlet Protection. The silt fence inlet protection shall be removed and the area prepared for pavement construction once the contributing drainage area is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the silt fence shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications.

3. Baled Hay Catch Basin Inlet Protection. The baled hay inlet protection shall be removed and the area prepared for pavement construction the contributing drainage area is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the baled hay shall be removed and the area cleaned up in accordance with the applicable provisions of Article 3.03 of these Specifications.

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SECTION 02465

SECANT PILE WALL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for providing all personnel, power, and equipment for designing, furnishing, installing, and maintaining a secant pile wall support of excavation system for shaft excavations at MH-217-6 and MH-217-7.

B. This specification is to be used as a guidance document for the Contractor and demonstrates the level of detail which the Contractor's final design must contain.

C. The Contractor shall coordinate the design of the secant pile wall with the support of excavation system requirements in Section 02260.

D. The Contractor shall coordinate the design and submittals of the secant pile wall with the dewatering systems and the water handling systems specified in Section 02240.

E. The Contractor shall be responsible for sizing the secant pile wall system.

1. The secant pile wall shall be adequately sized for construction of the permanent structures and pipelines indicated on the Contract Drawings and to provide adequate space to meet the requirements of the Contractor's selected means and methods of construction.

2. Pit excavation sizes larger than those indicated on the Contract Drawings shall be subject to review and acceptance of the PM/CM.

3. Modifications to approved traffic control measures and utility relocations shall be subject to review and acceptance of the PM/CM and completed at no additional cost.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

D. Section 02240 – Construction Water Handling

E. Section 02260 – Support of Excavation

F. Section 02295 – Geotechnical Instrumentation and Monitoring

G. Section 02314 – Microtunneling

H. Section 03300 – Cast-in-Place Concrete

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern. The latest editions of the Codes and Standards shall be used.

B. American Concrete Institute (ACI) Standards

1. 301-16 Specification for Structural Concrete
2. 318-11 Building Code Requirements for Structural Concrete and Commentary
3. 336.1 Specification for the Construction of Drilled Piers
4. 336.3R Report on Design and Construction of Drilled Piers

C. ASTM International Standards

1. A36 Specification for Carbon Structural Steel
2. A615 Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
3. C31 Practice for Making and Curing Test Specimens in the Field
4. C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
5. C138 Test Method for Unit Weight, Yield, and Air Content of Concrete
6. C143 Test Method for Slump of Hydraulic Cement Concrete
7. C172 Practice for Sampling Freshly Mixed Concrete
8. C1064 Test Method for Temperature of Freshly Mixed Portland Cement Concrete
9. C1077 Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
10. D7205 Test Method for Tensile Properties of Fiber Reinforced Polymer Matrix Composite Bars
11. D7957 Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement

D. U.S. Department of Labor, Occupation Safety and Health Administration (OSHA)

1. Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S. Section 1926.800, “Underground Construction.

1.04 DEFINITIONS

A. Groundwater Seepage: The act or process involving the movement of groundwater through the secant pile wall.

B. Secant Pile Wall: A continuous wall system constructed using rotary drilling techniques to excavate circular boreholes that are backfilled with concrete and reinforced with vertical steel reinforcement.

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. The design of the secant pile wall system shall be performed by a Professional Engineer licensed in the State of Rhode Island having not less than five successful projects of similar type, size, and complexity. Experience shall include designing excavation support systems in similar site and ground conditions.

2. Installation of a secant pile wall system shall be under the supervision of a Superintendent(s) having not less than five (5) years of recent experience and having successfully completed projects of similar type, size, and complexity. Experience shall include installation of slurry diaphragm walls in similar ground conditions.

3. The Contractor shall employ a Testing Agency using trained and experienced personnel in accordance with ASTM C1077 to perform the required tests as specified.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submittals for design, shop drawings, and work plans required herein shall be submitted at the same time and in full coordination with the required submittals of Section 02240.

C. Submit 30 days prior to the work, signed and sealed design calculations and shop drawings by a Professional Engineer licensed in the State of Rhode Island to include, at a minimum, the following:

1. A written summary, applicable code and design standard references, and design loading criteria for all stages of installation and excavation.

2. Working Drawings

a. Plans, elevations, sections, and details that clearly describe the secant pile wall to be installed, including tolerances, typical spacing, and minimum overlap for the secant piles.

b. Reinforcement placement drawings and details.

3. Proposed mix design.

D. Submit a Secant Pile Work Plan at least thirty (30) days prior to the start of construction. Include, at a minimum, the following:

1. Construction schedule, list of equipment and materials, and proposed construction sequence.

2. Methods and procedures of installation and bottom inspection, obstruction removal procedures, procedures for maintaining and measuring tolerances, and seam repairs/sealing procedures.

3. Methods and procedures of concrete and reinforcement placement, and casing withdrawal.
4. The method of groundwater control.
5. The method for the collection, placement in containers if used, and offsite disposal of all drilling and secant pile construction wastes.
6. Include contingency plans for excessive movement of ground, support wall system, or existing structures or utilities in excess of allowable movement indicated on the Contract Drawings. Contingency plans shall include positive measures by the Contractor to limit further movement of ground, support wall system, or existing structures or utilities. Coordinate the contingency plans with Section 02295.

E. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.
2. Manufacturers' product data, certificates, and manufacturers' test data for any manufactured materials incorporated.
3. Quality Control Field Reports daily during construction to include where applicable, date and time, soils encountered, obstructions or excavation problems, tests performed, verification of verticality, and deviations from planned locations.
4. Submit as-built record data within one week of secant pile wall completion.
5. Submit mitigation designs for review by the PM/CM for secant piles that do not meet the performance criteria specified.

1.07 DESIGN CRITERIA

A. The Contractor shall design the secant pile wall to include, at a minimum, the minimum loading criteria indicated on the Contract Drawings and any other loads that may be imposed.

B. The Contractors design shall include all phases of construction with appropriate factors of safety.

C. The Contractors design shall consider conditions that may occur during the various stages of construction including, but not limited to following:

1. Temporary or permanent alteration of the soils' in-situ properties caused by the selected methods of construction.
2. Installation, relocation, and removal of temporary bracing.
3. Excavation below bracing.
4. Dewatering of excavation.
5. Time related effects.
6. Load transfer to permanent structures.

D. At trenchless operation launching shafts, the Contractor shall consider microtunneling and pipe jacking thrust loads developed based on the jacking

procedures selected by the Contractor. Coordinate the design of the excavation supports systems with the thrust block and pipe design.

E. Contractor to provide FRP reinforcement at MTBM launch and receive locations along the shaft wall to accommodate penetrations without obstruction.

F. Contractor to provide structural support necessary at MTBM penetration locations to ensure a safe load path for the thrust around the opening.

G. The Contractor is solely responsible for design of each pit bottom to provide a stable support for guide rails, thrust block, and other construction operations. Include, at a minimum, a working slab (mudmat), a drainage layer, and geotextile fabric.

H. The Contractor shall design the excavation support system to limit movements in accordance with Section 02295.

I. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation system includes an analysis of the stability of the adjacent structure and includes, as necessary, any required bracing/underpinning of the adjacent structure.

J. Cased holes advanced with rotary or other techniques shall be used to install the secant piles. Open hole slurry or water support of drill holes without cased holes is not allowed.

K. The Contractor's secant pile wall Subcontractor shall be prepared to make modifications to construction methods if the interface between the overburden and bedrock is not sufficiently sealed to prevent migration of materials into the secant pile or if groundwater inflows prevent the required verification of bottom depth.

L. Design the work to achieve the minimum required clearances and tolerances necessary for the microtunneling work and for the permanent structures.

M. Minimum concrete compressive strength shall be 4000 pounds per square inch (psi) and tested in accordance with ASTM C39 at 28 days.

N. Welding of steel reinforcement is not allowed unless accepted in writing by the PM/CM.

O. Installation Tolerances

1. Secant pile shaft shall be designed considering a maximum in-plan installation tolerance of 1-1/2 inch from pile design locations.

2. Secant pile shaft shall be designed considering a maximum out-of-verticality tolerance of 1% applied such that two adjacent piles are diverging away from each other in the radial direction from shaft center.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall either new or in serviceable condition.

B. The Contractor shall furnish all installation tools, materials, and miscellaneous components.

2.02 MATERIALS

A. Steel

1. Steel casing shall conform to the requirements of ASTM A36. Steel casing shall be of sufficient strength to withstand the stress imposed on it.

2. Reinforcing steel shall be Grade 60 kips per square inch (ksi) and conform to ASTM A615.

B. Concrete

1. Concrete materials as specified in Section 03300.

2. Concrete for secant piles shall have a slump of six (6) to eight (8) inches.

2.03 EQUIPMENT

A. Use only equipment that has the necessary power and torque to excavate a hole and construct the secant piles to the required diameter and depth required.

2.04 SOURCE QUALITY CONTROL

A. Only materials meeting the requirements of these specifications shall be used.

PART 3 EXECUTION

3.01 GENERAL

A. Commence installation of support of excavations systems only after design calculations and shop drawings have been reviewed and accepted by the PM/CM and applicable permits have been obtained.

B. Key secant piles a minimum of three (3) feet into rock below shaft final subgrade.

C. Seal the inside face of the secant pile wall system at joints and penetrations as necessary to provide a watertight wall. The term “watertight” means that the allowable leakage rate shall not exceed:

1. One quarter (0.25) gallon per minute (gpm) per 250 square feet (sf) of wall and base.

2. One half (0.5) gpm from any single leak.

3. Maximum total inflow for the entire shaft shall not exceed five (5) gpm.

4. Moist patches are acceptable.

D. Any borehole that will remain open overnight shall be covered and protected to prevent foreign material and surface water from entering the borehole.

E. Conduct all work within the construction limits established for the project.

F. At a minimum, place fencing, gates, lights, and signs as necessary around the support of excavation work areas to provide for public safety.

G. Methods of construction for support using secant pile walls shall be such as to ensure the safety of the Contractor's employees, the PM/CM employees and inspectors, the public, and adjacent property owners.

H. Perform the work to achieve the minimum required clearances and tolerances necessary for the permanent structures.

I. If the PM/CM is of the opinion that at any point sufficient or proper supports have not been provided, additional supports may be ordered to be placed at no additional cost. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports.

J. If unstable material is encountered during excavation, all necessary measures shall be taken immediately to prevent ground displacement.

K. Maintain a sufficient quantity of materials throughout the conduct of the work for installation of temporary excavation support systems, protection of the work, or in cases of accident or emergency.

L. Care shall be taken to prevent voids outside of the excavation support system. If voids are formed, they shall be immediately filled with sand or stone. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete or other material as accepted by the PM/CM.

M. All underground utility lines shall be identified, located, and protected from damage or displacement. Refer to the Contract Drawings for instrumentation requirements.

N. Maintain temporary excavation support systems in place and functioning properly until no longer necessary.

3.02 SECANT PILE INSTALLATION

A. Sequencing

1. After installation of primary piles, allow concrete fill to set sufficiently to prevent hole stability issues. Do not drill within ten feet or three shaft diameters, whichever is less, from an adjacent secant pile until a minimum of three (3) days has past.

2. Drill secondary piles as soon as concrete has achieved ample strength to resist damage and deformation but has not achieved full strength.

3. Install steel casing as the excavation is advanced. Secant piles shall be cased to the top of bedrock.

4. Excavate through materials encountered to the dimensions and depths shown on the accepted submittals.

5. Clean the bottom of the secant pile excavation of loose material and free water.

6. Verify the depth, dimension, and alignment of each secant pile excavation. Measure the excavation depth with a suitable weighted tape or other acceptable reviewed methods.
7. Place reinforcement after verification of depth, dimension, and alignment is demonstrated.
8. Remove temporary casing while the concrete is workable. Maintain the casing at least five feet below the top of the concrete during withdrawal.
9. After concrete placement, extract temporary casing without disturbing setting concrete or installed reinforcing.

B. Placement of Reinforcement

1. Place and maintain steel reinforcement members in the center of the secant pile using centering devices.
2. Replace steel reinforcement damaged during transport, storage, or installation at no additional cost.

C. Concrete Placement

1. Concrete work shall conform to ACI 301-16.
2. Place concrete within 24 hours of reaching the excavation depth.
3. Prevent damage to steel reinforcement during concrete placement.
4. Place concrete by tremie methods from the bottom of the excavation. Do not start concrete placement until a concrete supply adequate to fill the secant pile is assured. Place concrete within a time limit during which the excavation remains clean and stable and the concrete maintains the required slump.

D. Records

1. Maintain a record of each secant pile installed on a form. Include, as a minimum, the following:
    a. Secant pile number, location including deviation from plan design location, vertical, diameter, and top and bottom elevation, rotation of any reinforcing members.
    b. Time and date of the start and finish of each secant pile, including times and dates of excavation and concrete placement.
    c. Casing dimensions, concrete strength, concrete volume, and size and location of splices in reinforcement.
    d. Subsurface conditions description and observations of water, and documentation of problems encountered or delays.
    e. Remediation and unacceptable secant piles.

E. Secant Pile Demolition

1. When backfilling, remove secant pile shaft wall to a depth of 5-feet below finished grade.

3.03 FIELD QUALITY CONTROL

A. The Contractors Testing Agency shall obtain samples of fresh concrete in accordance with ASTM C172 at the point of concrete discharge. At least one composite sample shall be obtained at a minimum rate of one (1) set of four (4) cylinders per shift that concrete is placed.

B. Sampled concrete used to mold strength test specimens shall be in accordance with ASTM C31 and include the following additional tests:

1. Compressive Strength: ASTM C39 for 28-day strength
2. Air Content: ASTM C138
3. Slump: ASTM C143
4. Temperature: ASTM C1064
5. Density: ASTM C138

C. Evaluation and Acceptance Tests of concrete shall conform to ACI 318-11.

D. Monitor placement and chart actual volume of concrete placed versus theoretical volume required.

E. Perform secant pile excavation inspection as the excavation progresses. Immediately inform the PM/CM of overexcavation, obstructions, or excavations out of tolerance. Correct secant piles that exceed permissible tolerances.

F. Provide a mitigation designs for review by the PM/CM for secant piles and the secant pile system that does not meet the performance criteria specified.

G. Inspect vertical seams between adjacent secant piles during excavation for incomplete bonding, separation, soil inclusion, seepage, and other defects. Seal seams as necessary to meet the allowable leakage criteria.

END OF SECTION 02465

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SECTION 02466

SLURRY DIAPHRAGM WALL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for providing all personnel, power, and equipment for designing, furnishing, installing, and maintaining a slurry diaphragm wall support of excavation system for shaft excavations at MH-217-6 and MH-217-7.

B. Installation of slurry wall shaft shall be by hydromill trench cutter only.

C. This specification is to be used as a guidance document for the Contractor and demonstrates the level of detail which the Contractor's final design must contain.

D. The Contractor shall coordinate the design of the slurry diaphragm wall with the support of excavation system requirements in Section 02260.

E. The Contractor shall coordinate the design and submittals of the slurry diaphragm wall shaft with the dewatering systems and the water handling systems specified in Section 02240.

F. The Contractor shall be responsible for sizing the slurry diaphragm wall system.

1. The slurry diaphragm wall shall be adequately sized for construction of the permanent structures and pipelines indicated on the Contract Drawings and to provide adequate space to meet the requirements of the Contractor's selected means and methods of construction.

2. Pit excavation sizes larger than those indicated on the Contract Drawings shall be subject to review and acceptance of the PM/CM.

3. Modifications to approved traffic control measures and utility relocations shall be subject to review and approval of the PM/CM and completed at no additional cost.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

D. Section 02240 – Construction Water Handling

E. Section 02260 – Support of Excavation

F. Section 02295 – Geotechnical Instrumentation and Monitoring

G. Section 02314 – Microtunneling

H. Section 03300 – Cast-in-Place Concrete

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the Work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern.

B. ASTM International Standards (ASTM)

1. A36 Specification for Carbon Structural Steel
2. A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
3. A490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
4. A572 Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
5. A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
6. A690 Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
7. A722 Specification for High Strength Steel Bars for Prestressed Concrete
8. A992 Specification for Structural Steel Shapes
9. C150 Specification for Portland Cement

C. American Petroleum Institute (API)

1. API SPEC P13A - Drilling-Fluid Materials
2. API RP 13B-1 - Recommended Practice Standard Procedure for Field Testing Water-Based Drilling Fluids

D. U.S. Department of Labor, Occupation Safety and Health Administration (OSHA)

1. Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S. Section 1926.800, “Underground Construction.

1.04 DEFINITIONS

A. Groundwater Seepage: The act or process involving the movement of groundwater through the slurry diaphragm wall.

B. Slurry Diaphragm Wall: Concrete walls that are reinforced with cages of reinforcing bars. The concrete is placed using the tremie method, below existing grade in fluid-filled trenches stabilized with bentonite slurry.

C. Slurry Diaphragm Wall Panel: One section of the completed slurry diaphragm wall, constructed as a single concrete pour. One panel may be excavated using one or more passes of the excavation equipment.

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. The design of the slurry diaphragm wall system shall be performed by a Professional Engineer licensed in the State of Rhode Island having not less than five successful projects of similar type, size, and complexity. Experience shall include designing excavation support systems in similar site and ground conditions

2. Installation of a slurry diaphragm wall system shall be under the supervision of a Superintendent(s) having not less than five (5) years of recent experience and having successfully completed projects of similar type, size, and complexity. Experience shall include installation of slurry diaphragm walls in similar ground conditions.

3. The Design-Builder shall employ a Testing Agency using trained and experienced personnel in accordance with ASTM C1077 to perform the required tests as specified.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submittals for design, shop drawings, and work plans required herein shall be submitted at the same time and in full coordination with the required submittals of Section 02240.

C. Submit 30 days prior to the work, signed and sealed design calculations and shop drawings by a Professional Engineer licensed in the State of Rhode Island to include, at a minimum, the following:

1. A written summary, applicable code and design standard references, and design loading criteria for all stages of installation and excavation.

2. Working Drawings

a. Plans, elevations, sections, and details that clearly describe the excavation support systems to be installed, including tolerances, typical spacing, and minimum overlap for the slurry diaphragm walls.

b. Proposed concrete mix design.

c. Proposed slurry mix design.

d. Details of guide wall design.

e. Reinforcing, including provision for lifting, stiffening, splicing, and orientation of fabricated cages with respect to the wall.

D. Submit a Slurry Diaphragm Wall Work Plan at least thirty (30) days prior to the start of construction. Include, at a minimum, the following:

1. Construction schedule, list of equipment and materials, and proposed construction sequence.

2. Methods and procedures of installation and bottom inspection, obstruction removal procedures, procedures for maintaining and measuring tolerances, and seam repairs/sealing procedures.
3. Method of monitoring and maintaining slurry level in excavation left open overnight and over extended periods of time.
4. Methods and procedures of concrete and reinforcement placement, and casing withdrawal.
5. The method of groundwater control.
6. The method for the collection, treatment, or placement in containers if used, for offsite disposal of all drilling and slurry construction wastes.
7. Include contingency plans for excessive movement of ground, support wall system, or existing structures or utilities in excess of allowable movement indicated on the Contract Drawings. Contingency plans shall include positive measures by the Contractor to limit further movement of ground, support wall system, or existing structures or utilities. Coordinate the contingency plans with Section 02295.

E. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.
2. Manufacturers' product data, certificates, and manufacturers' test data for any manufactured materials incorporated.
3. Quality Control Field Reports daily during construction to include where applicable, date and time, soils encountered, obstructions or excavation problems, tests performed, verification of verticality, and deviations from planned locations.
4. Submit as-built record data within one week of each installation completion that includes plans, elevations, dimensions, and installed excavation support system.
5. Submit mitigation designs for review by the PM/CM for slurry diaphragm wall panels that do not meet the performance criteria specified.

1.07 DESIGN CRITERIA

A. The Contractor shall design the slurry diaphragm wall system to include, at a minimum, the minimum loading criteria indicated on the Contract Drawings and any other loads that may be imposed.

B. The Contractors design shall include all phases of construction with appropriate factors of safety.

C. The Contractors design shall consider conditions that may occur during the various stages of construction including, but not limited to following:

1. Temporary or permanent alteration of the soils' in-situ properties caused by the selected methods of construction.
2. Installation, relocation, and removal of temporary bracing.
3. Excavation below bracing.

4. Dewatering of excavation.
5. Time related effects.
6. Load transfer to permanent structures.

D. At trenchless operation launching shafts, the Contractor shall consider microtunneling and pipe jacking thrust loads developed based on the jacking procedures selected by the Contractor. Coordinate the design of the excavation supports systems with the thrust block and pipe design.

E. Contractor to provide FRP reinforcement at MTBM launch and receive locations along the shaft wall to accommodate penetrations without obstruction.

F. Contractor to provide structural support necessary at MTBM penetration locations to ensure a safe load path for the thrust around the opening.

G. The Contractor is solely responsible for design of each pit bottom to provide a stable support for guide rails, thrust block, and other construction operations. Include, at a minimum, a working slab (mudmat), a drainage layer, and geotextile fabric.

H. The Contractor shall design the excavation support system to limit movements in accordance with Section 02295.

I. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation system includes an analysis of the stability of the adjacent structure and includes, as necessary, any required bracing/underpinning of the adjacent structure.

J. The Contractor's slurry diaphragm wall Subcontractor shall be prepared to make modifications to construction methods if the interface between the overburden and bedrock is not sufficiently sealed to prevent migration of materials into the slurry diaphragm wall or if groundwater inflows prevent the required verification of bottom depth.

K. Minimum concrete compressive strength shall be 4000 pounds per square inch (psi) and tested in accordance with ASTM C39 at 28 days.

L. Welding of steel reinforcement is not allowed unless accepted in writing by the PM/CM.

M. Installation Tolerances

1. Slurry diaphragm wall shaft shall be designed considering a maximum in-plan installation tolerance of 1-1/2 inch from panel design locations.
2. Slurry diaphragm wall shaft shall be designed considering a maximum out-of-verticality tolerance of 1% applied such that two adjacent panels are diverging away from each other in the radial direction from shaft center.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall either new or in serviceable condition.

B. The Contractor shall furnish all installation tools, materials, and miscellaneous components.

2.02 MATERIALS

A. Slurry

1. Bentonite drilling-fluid material and selected substances described in API RP 13A to produce a slurry having the properties and meeting the performance criteria specified below.

   a. Sufficient hydrostatic head to prevent water and soil inflow into the panel excavation. Maintain maximum head in panel excavations at all times.

   b. Sufficient gel strength to seal weak and open soil formations.

   c. Remains stable and fluid during excavation and until concreting is completed and flows without gelling under displacement by concrete

2. Properties

   a. A density that will prevent excessive caking, provide adequate trench support, and are readily displaced by the tremie concrete.

   b. Viscosity 70 seconds maximum by Marsh Cone Method.

   c. pH between 7.0 to 10.0.

   d. Minimum of 10 minutes dwell time in the mixer.

   e. Storage time: Six hours minimum hydration storage time prior to use in trench.

   f. Sand Content: Maximum five percent sand content measured within 48 inches from the bottom of the panel prior to concreting,

3. Additives and chemicals that meet all applicable laws, rules, and regulations may be added to the slurry to maintain the necessary properties.

B. Water shall be clean, potable, and free of impurities detrimental to slurry and compatible with the slurry mix design.

C. Reinforcing Bars shall conform to ASTM A 615/A 615M, Grade 60.

D. Grout shall be suitable for service when used for excavation support systems. Conform to ASTM C150, Type I, II, or III Portland Cement.

E. Concrete shall conform to Section 03300 when used for excavation support systems. Conform ACI 318 for compressive strength required for application.

2.03 EQUIPMENT

A. Use a hydromill trench cutter that has the necessary power and torque to excavate a hole and construct the slurry diaphragm wall to the required dimensions and depth required.

B. Trench Excavation

1. Capability to excavate conditions anticipated.
2. Permits the free vertical passage of slurry within the excavation and prevents development of suction or pressure.

C. Slurry Mixing

1. Use equipment that produces a stable suspension of bentonite and water along with necessary mechanical agitation.
2. Permits the free vertical passage of slurry within the excavation and prevents development of suction or pressure.

D. Use equipment that separates the bentonite from the excavated material to clean the bentonite of soil particles before recirculation.

E. Tremie Pipe

1. Fabricated of heavy gauge steel tube, capable of withstanding handling stresses and to overcome buoyancy.
2. Minimum diameter of ten inches and be constructed with sections having flange couplings fitted with gaskets that are watertight.
3. Marked to allow quick determination of the distance from the surface of the water/slurry to the mouth of the tremie.

2.04 SOURCE QUALITY CONTROL

A. Only materials meeting the requirements of these specifications shall be used.

PART 3 EXECUTION

3.01 GENERAL

A. Commence installation of support of excavations systems only after design calculations and shop drawings have been reviewed and accepted by the PM/CM and applicable permits have been obtained.

B. Key diaphragm wall panels a minimum of three (3) feet into rock below shaft final subgrade. Full excavated footprint of the cutter shall be considered as part of the minimum key depth.

C. Seal the inside face of the slurry diaphragm wall system at joints and penetrations as necessary to provide a watertight wall. The term “watertight” means that the allowable leakage rate shall not exceed:

1. One quarter (0.25) gallon per minute (gpm) per 250 square feet (sf) of wall and base.

2. One half (0.5) gpm from any single leak.
3. Maximum total inflow for the entire shaft shall not exceed five (5) gpm.
4. Moist patches are acceptable.

D. Any borehole that will remain open overnight shall be covered and protected to prevent foreign material and surface water from entering the borehole.

E. Conduct all work within the construction limits established for the project.

F. At a minimum, place fencing, gates, lights, and signs as necessary around the support of excavation work areas to provide for public safety.

G. Methods of construction for support slurry diaphragm walls shall be such as to ensure the safety of the Contractor's employees, the Owner's employees and inspectors, the public, and adjacent property owners.

H. Perform the work to achieve the minimum required clearances and tolerances necessary for the permanent structures.

I. If the PM/CM is of the opinion that at any point sufficient or proper supports have not been provided, additional supports may be ordered to be placed at no additional cost. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports.

J. If unstable material is encountered during excavation, all necessary measures shall be taken immediately to prevent ground displacement.

K. Maintain a sufficient quantity of materials throughout the conduct of the work for installation of temporary excavation support systems, protection of the work, or in cases of accident or emergency.

L. Care shall be taken to prevent voids outside of the excavation support system. If voids are formed, they shall be immediately filled with sand or stone. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete or other material as approved by the PM/CM.

M. All underground utility lines shall be identified, located, and protected from damage or displacement. Refer to the Contract Drawings for instrumentation requirements.

N. Maintain temporary slurry diaphragm walls in place and functioning properly until no longer necessary.

3.02 SLURRY WALL EXCAVATION

A. Use such means that minimizes over excavation, loosening, and caving of material outside specified trench width.

B. Contain excavated spoil.

C. Pump slurry to a central processing plant.

D. Excavate in a manner that does not cause movement or loss of ground in accordance with Section 02295.

E. Excavate in individual panels to provide the minimum internal dimensions designed. Panels shall be excavated in the sequence as shown on reviewed shop drawings.

F. Correct panels exceeding the permissible tolerances by backfilling with lean concrete or cement stabilized sand, and re-excavating them to the required tolerance before placement of reinforcement and final concreting proceeds.

G. Fill each excavated panel and maintain with a stable suspension of slurry.

H. Perform excavation through the slurry.

I. Add slurry to the excavated trench as necessary to maintain the slurry level greater than six feet above groundwater levels or one foot below the ground surface, whichever occurs first.

J. Dispose of all excavated materials in accordance with applicable permits and regulatory requirements.

K. Do not excavate new panel until concrete in adjacent panel has been in place a minimum of 72 hours.

3.03 SLURRY WALL INSTALLATION

A. Prior to placing reinforcing and concrete in the slurry filled trench, complete the following:

1. Clean the joints of adjacent previously poured panels to create a watertight bond.

2. Demonstrate that proper cleaning has taken place to limit leakage through the joint to meet specified leakage criteria.

3. Clean the bottom of the trench of all loose material and inspect the trench to verify that the specified depth, width, and length of excavation has been achieved.

B. Do not install reinforcing assemblies that are distorted. Use additional steel reinforcement to maintain rigidity during handling and positioning.

C. Accurately locate and secure in place the reinforcing steel assemblies prior to concrete placement.

D. Use suitable guides and spacers to maintain a minimum required cover between reinforcing and the walls of the panel excavation.

E. Tremie Placement

1. Verify panel dimensions a maximum of 12 hours before completion of the panel reinforcement placement.

2. If panel reinforcement has not been placed within eight hours after completion of the panel excavation, the following shall be completed prior to its placement:

a. Remove all loose materials from the bottom of the panel excavation.

b. Re-test slurry to ensure it conforms with the specifications.

3. Place concrete by tremie method within four hours after completion of the placement of the panel reinforcement.

4. Tremie concrete shall displace the slurry progressing from the bottom and rising uniformly level.

5. Tremie concrete shall be placed in a continuous operation until the panel is filled to the required elevation.
6. Place concrete in excavation with tremie pipes that are equally spaced within the panel.
7. Use interlocking type tremie pipes to mitigate potential for tremie loss during concrete placement.
8. Use one tremie pipe for every 10 linear feet of panel.
9. The mouth of the tremie shall be placed a maximum of 12 inches above the bottom of the panel at the start of concrete placement.
10. The mouth of the tremie shall remain embedded in fresh concrete at all times. Embedment shall be from three feet to five feet at all times after the initial mound of concrete has been established.
11. The rising concrete surface during placement shall be kept horizontal.
12. The top of wall reinforcing shall be cleaned to be free from any slurry and debris detrimental to future extension where applicable.

F. Records

1. Maintain a record of each slurry diaphragm wall panel installed on a form. Include, as a minimum, the following:
    a. Diaphragm wall panel number, location including deviation from plan design location, vertical, diameter, and top and bottom elevation, rotation of any reinforcing members.
    b. Time and date of the start and finish of each diaphragm wall panel, including times and dates of excavation and concrete placement.
    c. Panel dimensions, concrete strength, concrete volume, and size and location of splices in reinforcement.
    d. Subsurface conditions description and observations of water, and documentation of problems encountered or delays.
    e. Remediation and unacceptable diaphragm wall panels.

G. Diaphragm Wall Panel Demolition

1. When backfilling, remove slurry diaphragm wall shaft to a depth of 5-feet below finished grade.

3.04 FIELD QUALITY CONTROL

A. Slurry Testing

1. Provide test equipment and methods that conform to the requirements of API RP 13B-1.
2. The Contractors Testing Agency shall obtain fresh samples of slurry inside the trench excavations from the top and bottom of the trench and perform the following tests each day on each panel as follows:
    a. Density, by mud density balance.

b. Viscosity, by Marsh Cone Method.

c. pH.

d. Sand content.

3. The Contractors Testing Agency shall obtain fresh samples of slurry inside the trench excavations from the bottom of the trench and perform the following tests prior to placing reinforcing and concrete.

a. Immediately prior to placing reinforcing in any wall panel, take a sample of the slurry within 48 inches from the bottom of the trench and test it for density and sand content.

b. Modify or replace the slurry in the trench if the density of the sample is found to exceed limit specified.

c. Do not place any concrete in the trench until the density of the slurry and the sand content is as specified.

d. Perform additional tests when requested by the PM/CM.

B. Concrete Testing

1. The Contractors Testing Agency shall obtain samples of fresh concrete in accordance with ASTM C172 at the point of concrete discharge. At least one composite sample shall be obtained at a minimum rate of one (1) set of four (4) cylinders per shift that concrete is placed.

2. Sampled concrete used to mold strength test specimens shall be in accordance with ASTM C31 and include the following additional tests:

a. Compressive Strength: ASTM C39 for 28-day strength

b. Air Content: ASTM C138

c. Slump: ASTM C143

d. Temperature: ASTM C1064

e. Density: ASTM C138

3. Evaluation and Acceptance Tests of concrete shall conform to ACI 318-11.

4. Monitor placement and chart actual volume of concrete placed versus theoretical volume required.

C. Perform slurry diaphragm wall inspection as the excavation progresses. Immediately inform the PM/CM of overexcavation, obstructions, or excavations out of tolerance. Correct slurry diaphragm wall panels that exceed permissible tolerances.

D. Provide a mitigation design for review by the PM/CM for slurry diaphragm wall panels that do not meet the performance criteria specified.

E. Inspect vertical seams between adjacent slurry diaphragm wall panels during excavation for incomplete bonding, separation, soil inclusion, seepage, and other defects. Seal seams as necessary to meet the allowable leakage criteria.

END OF SECTION 02466

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SECTION 02467

CUTTER SOIL MIX WALL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes requirements for providing all personnel, power, and equipment for designing, furnishing, installing, and maintaining a Cutter CSM (CSM) CSM wall support of excavation system CSM for shaft excavations at MH-217-6 and MH-217-7.

B. This specification is to be used as a guidance document for the Contractor and demonstrates the level of detail which the Contractor's final design must contain.

C. The Contractor shall coordinate the design of the cutter soil mix wall with the support of excavation system requirements in Section 02260.

D. The Contractor shall coordinate the design and submittals of the CSM wall with the dewatering systems and the water handling systems specified in Section 02240.

E. The Contractor shall be responsible for sizing the CSM wall system.

1. The CSM wall shall be adequately sized for construction of the permanent structures and pipelines indicated on the Contract Drawings and to provide adequate space to meet the requirements of the Contractor's selected means and methods of construction.

2. Pit excavation sizes larger than those indicated on the Contract Drawings shall be subject to review and acceptance of the PM/CM.

3. Modifications to approved traffic control measures and utility relocations shall be subject to review and acceptance of the PM/CM and completed at no additional cost.

1.02 RELATED SECTIONS

A. The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the Contractors responsibility to perform all the work required by the Contract Documents.

B. Section 01300 – Submittals

C. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

D. Section 02240 – Construction Water Handling

E. Section 02260 – Support of Excavation

F. Section 02295 – Geotechnical Instrumentation and Monitoring

G. Section 02314 – Microtunneling

1.03 REFERENCES

A. The following Codes and Standards shall apply to the design, construction quality control, and safety of all the work performed for this Section. Where redundant or conflicting information exists, the most stringent requirement shall govern. The latest editions of the Codes and Standards shall be used.

B. American Concrete Institute (ACI) Standards

C. American Petroleum Institute (API)

1. API Spec P13A - Drilling-Fluid Materials

D. ASTM International Standards

1. C31 Practice for Making and Curing Test Specimens in the Field
2. C150 Specification for Portland Cement
3. C1077 Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
4. C1602 Specification for Mixing Water Use in the Production of Hydraulic Cement
5. D1633 Test Methods for Compressive Strength of Molded Soil-Cement Cylinders
6. D2160 Test Method for Unconfined Compressive Strength of Cohesive Soil
7. D4380 Test Method for Determining Density of Construction Slurries

E. U.S. Department of Labor, Occupation Safety and Health Administration (OSHA)

1. Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S. Section 1926.800, “Underground Construction.

1.04 DEFINITIONS

A. CSM Wall: A continuous wall system constructed using two sets of counter rotating, vertically mounted cutter wheels. The wheels cut the surrounding soil while at the same time blending the injected cement or bentonite slurry, or a combination of the two, with the in situ soil to form soil cement piles or panels.

B. Groundwater Seepage: The act or process involving the movement of groundwater through the CSM wall.

C. Single-Phase Mixing: A technique that involves injecting the desired final mix on both the downstroke and the upstroke.

D. Two-Phase Mixing: A technique that involves mixing with only water or bentonite and water on the downstroke and switching to the final cement based slurry mix on the upstroke.

1.05 QUALITY ASSURANCE

A. All Work shall be conducted in accordance with all applicable codes, standards, and permits.

B. Qualifications

1. The design of the CSM wall system shall be performed by a Professional Engineer licensed in the State of Rhode Island having not less than five successful projects of similar type, size, and complexity. Experience shall include designing excavation support systems in similar site and ground conditions.
2. Installation of the CSM wall system shall be under the supervision of a Superintendent(s) having not less than five (5) years of recent experience and having successfully completed projects of similar type, size, and complexity. Experience shall include installation of CSM walls in similar ground conditions.
3. The Contractor shall employ a Testing Agency using trained and experienced personnel in accordance with ASTM C1077 to perform the required tests as specified.

1.06 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submittals for design, shop drawings, and work plans required herein shall be submitted at the same time and in full coordination with the required submittals of Section 02240.

C. Submit 30 days prior to the work, signed and sealed design calculations and shop drawings by a Professional Engineer licensed in the State of Rhode Island to include, at a minimum, the following:

1. A written summary, applicable code and design standard references, and design loading criteria for all stages of installation and excavation.
2. Working drawings to include plans, elevations, sections, and details that clearly describe the CSM wall to be installed, including tolerances, typical spacing, and minimum overlap
3. Proposed mix design identifying materials and proportions.

D. Submit a CSM Work Plan at least thirty (30) days prior to the start of construction. Include, at a minimum, the following:

1. Construction schedule, list of equipment and materials, and proposed construction sequence.
2. Methods and procedures of installation, obstruction removal procedures, procedures for maintaining and measuring tolerances, and seam repairs/sealing procedures.
3. The method for the collection, placement in containers if used, and offsite disposal of all CSM construction wastes.
4. Include contingency plans for excessive movement of ground, CSM wall system, or existing structures or utilities in excess of allowable movement indicated on the Contract Drawings. Contingency plans shall include positive measures by the Contractor to limit further movement of ground, CSM wall system, or existing structures or utilities. Coordinate the contingency plans with Section 02295.

E. Quality Control Submittals

1. Submit qualifications and experience records for personnel as specified herein.

2. Manufacturers' product data, certificates, and manufacturers' test data for any manufactured materials incorporated.
3. Quality Control Field Reports daily during construction to include where applicable, date and time, elements installed, soils encountered, obstructions or excavation problems, tests performed, verification of verticality, and deviations from planned locations.
4. Submit as-built record data within one week of CSM wall completion.
5. Submit copies of the CSM wall equipment computer records showing alignment, flow rates, advance rates, and pressures to demonstrate conformance with the mix design, alignment, and depth requirements.
6. Submit mitigation designs for review by the PM/CM for CSM wall elements that do not meet the performance criteria specified.

1.07 DESIGN CRITERIA

A. The Contractor shall design the CSM wall to include, at a minimum, the minimum loading criteria indicated on the Contract Drawings and any other loads that may be imposed.

B. The Contractors design shall include all phases of construction with appropriate factors of safety.

C. The Contractors design shall consider conditions that may occur during the various stages of construction including, but not limited to following:

1. Temporary or permanent alteration of the soils' in-situ properties caused by the selected methods of construction.
2. Installation, relocation, and removal of temporary bracing.
3. Excavation below bracing.
4. Dewatering of excavation.
5. Time related effects.
6. Load transfer to permanent structures.

D. At trenchless operation launching shafts, the Contractor shall consider microtunneling and pipe jacking thrust loads developed based on the jacking procedures selected by the Contractor. Coordinate the design of the CSM wall systems with the thrust block and pipe design.

E. Contractor to provide structural support necessary at MTBM penetration locations to ensure a safe load path for the thrust around the opening.

F. Key the CSM wall a minimum of three (3) feet into rock below the shaft final subgrade. Full excavated footprint of the cutter shall be considered as part of the minimum key depth.

G. The Contractor is solely responsible for design of each pit bottom to provide a stable support for guide rails, thrust block, and other construction operations. Include, at a minimum, a working slab (mudmat), a drainage layer, and geotextile fabric.

H. The Contractor shall design the CSM wall systems to limit movements in accordance with Section 02295.

I. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation system includes an analysis of the stability of the adjacent structure and includes, as necessary, any required bracing/underpinning of the adjacent structure.

J. The Contractor's CSM wall Subcontractor shall be prepared to make modifications to construction methods if the interface between the overburden and bedrock is not sufficiently sealed to prevent migration of materials into the CSM wall elements.

K. Design the work to achieve the minimum required clearances and tolerances necessary for the microtunneling work and for construction of the permanent structures.

L. Minimum soil-cement compressive strength shall be 500 pounds per square inch (psi) and tested in accordance with ASTM D1633 at 7 days.

M. Installation Tolerances

1. CSM wall shall be designed considering a maximum in-plan installation tolerance of 1 inch from design locations.

2. CSM wall shall be designed considering a maximum out-of-verticality tolerance of 1% applied such that two adjacent elements are diverging away from each other in the radial direction from shaft center.

N. Target permeability for soil-cement mix shall not be more than $1x10^{-6}$ in/s at 7 days.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufactures recommendations.

B. Store materials and equipment to prevent corrosion, damage from equipment, environment, or other pertinent manmade or natural hazards.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall either new or in serviceable condition.

B. The Contractor shall furnish all installation tools, materials, and miscellaneous components.

2.02 MATERIALS

A. Bentonite shall conform to the standards set forth in the API Specification 13A, Section 9.

B. Cement shall conform to ASTM C150, Type I or II.

C. Mixing water shall be clean, potable, and meet the requirements of ASTM C1602. Potable water need not be tested.

D. Admixtures may be used but are subject to the acceptance by the PM/CM.

2.03 EQUIPMENT

A. Provide equipment of type and capacity suitable for the CSM wall installation through the anticipated ground conditions. Equipment shall be capable of achieving the required depth and the minimum dimensions in a single pass. Maintain equipment in operating conditions at all times.

B. Equipment shall be free of mud, debris, and clutter to avoid cross-contamination from other job sites. Equipment shall be free of excess grease, visible oil leaks, hydraulic leaks, and fluid leaks to prevent contamination of the ground, soil, and water. Portable catch basins and or diapers shall be used, as required, to prevent ground contamination.

C. The CSM rig shall be equipped with electronic sensors built into the leads to determine vertical alignment in both fore/aft and left/right directions. The output from the sensors shall be routed to a console that is visible to the operator during penetration.

D. The cutting head shall have cutting teeth and shear plates configured in such a manner so that they are capable of thoroughly blending the in-situ soils with the bentonite-cement slurry to the appropriate depths. Cutter teeth and shear plates on the cutting head shall extend the full width of the element being formed in order to thoroughly break-up the in-situ soils and blend them with the injected grout to form a homogenous mixture.

E. The power source driving the cutting head shall be sufficient to maintain the appropriate revolutions per minute and penetration rate from a stopped position at the maximum depths required. Mixing equipment shall be capable of advancing through previously installed and hardened soil-cement material.

F. The batch plant shall provide high shear colloidal mixing and shall be sized such that continuous flow of bentonite-cement slurry mix to the drill rig can be maintained.

G. The bentonite-cement slurry mixing equipment shall have a controlled weighing system to assure that the dry and wet constituents of the slurries are properly proportioned. Mixing equipment shall have the capability for easy access to slurry for obtaining fresh samples of any slurry made at the batch plant.

H. Include sufficient tanks for storage, pumps, valves, hoses, supply lines, tools, and other equipment and materials required for adequately supply.

I. Obtain and maintain a supply of spare critical replacement parts of backup equipment sufficient to allow the CSM wall construction to proceed with minimum loss of time due to mechanical breakdown or equipment failure.

J. The on-board computer system shall be viewable to the operator during the mixing, and record, at a minimum, the following:

1. Time versus depth
2. Inclination of the X and Y axis with depth
3. Panel deviation with depth of both the X and Y axis
4. Hydraulic pressure in each cutter head plotted versus depth
5. Grout quantity with depth for both the downstroke and upstroke

2.04 SOURCE QUALITY CONTROL

A. Only materials meeting the requirements of these specifications shall be used.

PART 3 EXECUTION

3.01 GENERAL

A. Commence installation of the CSM wall only after design calculations and shop drawings have been reviewed and accepted by the PM/CM and applicable permits have been obtained.

B. Seal the inside face of the CSM wall system at joints and penetrations as necessary to provide a watertight wall. The term “watertight” means that the allowable leakage rate shall not exceed:

1. One quarter (0.25) gallon per minute (gpm) per 250 square feet (sf) of wall and base.
2. One half (0.5) gpm from any single leak.
3. Maximum total inflow for the entire shaft shall not exceed five (5) gpm.
4. Moist patches are acceptable.

C. Conduct all work within the construction limits established for the project.

D. At a minimum, place fencing, gates, lights, and signs as necessary around the support of excavation work areas to provide for public safety.

E. Methods of construction for support using CSM walls shall be such as to ensure the safety of the Contractor's employees, the PM/CM employees and inspectors, the public, and adjacent property owners.

F. Perform the work to achieve the minimum required clearances and tolerances necessary for construction of the permanent structures.

G. If the PM/CM is of the opinion that at any point sufficient or proper supports have not been provided, additional supports may be ordered to be placed at no additional cost. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports.

H. Perform the work in accordance with the movement criteria indicated on the Contract Drawings.

I. If unstable material is encountered during excavation, all necessary measures shall be taken immediately to prevent ground displacement.

J. Maintain a sufficient quantity of materials throughout the conduct of the work for installation of the system, protection of the work, or in cases of accident or emergency.

K. Care shall be taken to prevent voids outside of the CSM wall. If voids are formed, they shall be immediately filled with sand or stone. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete or other material as accepted by the PM/CM.

L. Maintain the CSM wall systems in place and functioning properly until no longer necessary.

3.02 CSM WALL INSTALLATION

A. Mixing may be performed using either the Single-Phase or Two-Phase mixing techniques.

B. Mix through the materials encountered to the dimensions and depths shown on the accepted submittals.

C. Construct CSM wall elements without interruption until complete.

D. Install secondary CSM wall elements after a minimum of 12 hours has elapsed from installation of adjacent primary CSM wall elements.

E. Verify the depth, dimension, and alignment of each CSM wall element.

F. Dispose of waste materials in accordance with the regulations.

G. Maintain a record of each CSM wall element installed on a form. Include, as a minimum, the following:

1. Element number, time and date of the start and finish, location and elevation.
2. Subsurface conditions encountered and documentation of problems encountered or delays.

H. Following construction of the permanent structures, remove the CSM wall to a depth of 5-feet below finished grade.

3.03 FIELD QUALITY CONTROL

A. The Contractors Testing Agency shall measure the specific gravity of the bentonite-cement slurry at least twice per shift per every production day using the methods outlined in ASTM D4380.

B. The Contractors Testing Agency shall obtain wet grab samples of the CSM wall mix every two production days or for every 2,000 cubic yards of treated soil, whichever produces the higher sampling frequency. Wet bulk samples should be collected using a bailer-type sampling tool or similar.

1. Prepare a minimum of one (1) set of four (4) cylinders.
2. Test two (2) cylinder for compressive strength at 7-days in accordance with ASTM D1633.
3. The remaining cylinders shall be kept as a backup should additional testing be required.

C. Perform CSM wall excavation inspection as the excavation progresses. Immediately inform the PM/CM of overexcavation, obstructions, or excavations out of tolerance. Correct CSM wall elements that exceed permissible tolerances.

D. Provide a mitigation design for review by the PM/CM for the CSM wall system that does not meet the performance criteria specified.

E. Inspect vertical seams between adjacent CSM wall elements during excavation for incomplete bonding, separation, soil inclusion, seepage, and other defects. Seal seams as necessary to meet the allowable leakage criteria.

END OF SECTION 02467

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SECTION 02500

PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for construction of all temporary and permanent pavement on paved areas affected or damaged by the Contractors operations, whether inside or outside the normal trench limits, as indicated on the Drawings and as herein specified.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading

1.02 REFERENCES

A. This specification makes reference to the requirements of additional specifications as listed. The Contractor shall obtain and familiarize himself with all requirements referenced by this specification prior to preparation and installation of any pavements.

1. Rhode Island Department of Transportation, Standard Specifications for Road and Bridge Construction, including all addenda, issued by the State of Rhode Island Department of Transportation, (referred to as the Standard Specification).

1.03. PAVEMENT SCHEDULE

A. The Contractor’s attention is directed to the various pavements required under this contract as outlined on the Drawings.

B. All pavement thicknesses identified identified on the Drawings shall be of the thickness required after compaction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Tack

1. Tack coat shall consist of either emulsified asphalt, grade RS-1 or cutback asphalt grade RC-70 conforming to the requirements of the Rhode Island Standard Specification Section 403 and M.03.04.

B. Bituminous Base

1. Bituminous Base shall conform to the requirements of the Rhode Island Standard Specification Section 401 and and Class 12.5 HMA for Base Course.

C. Bituminous Leveling Course

1. Bituminous Leveling Course shall conform to the requirements of the Rhode Island Standard Specification Section 401 and Class 12.5 HMA for Leveling Course.

D. Bituminous Surface, (Curb to Curb)

1. Bituminous Surface Course shall conform to the requirements of the Rhode Island Standard Specification Section 401 and Class 9.5 HMA for Surface Course.

E. Temporary Pavement

1. Temporary Pavement shall be Base Course conforming to the requirements of the State of Rhode Island Standard Specification, Subsection 402 and M.03.01.1. for Binder Course.

H. Gravel Base Course

1. Gravel base course in accordance with State of Rhode Island Standard Specification, Subsection M.01.09, Meeting the gradation requirements of Table 1, Column 1, with 100% Passing 3-inch Square Mesh Sieves.

2.02 SOURCE QUALITY CONTROL

A. The paving plant used by the Contractor for preparation of bituminous paving materials shall be acceptable to the Program Manager/Construction Manager who shall have the right to inspect the plant and the making of the material.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to placing pavement, all backfill shall have been properly compacted as specified under SECTION 02200 to eliminate settling of backfill. No pavement shall be placed over poorly compacted backfill. Backfill and gravel base course shall be compacted, brought to the proper elevation, and dressed so that new pavement construction shall be at the required grade. The Contractor shall maintain the surfaces of all excavated and disturbed areas until the pavement is placed. If there is a time lapse of more than 24 hours between completion of preparation of subgrade or placing of gravel base course and placing of paving, or if subgrade or gravel base course has been eroded or disturbed by traffic, the subgrade or gravel base course shall be restored before placing pavement.

B. When installing permanent pavement on bituminous concrete roadway the edges of existing pavement shall be cut back 12-inches, or more as required, from the trench excavation wall or damaged area to sound undamaged material, straightened, cleaned, and painted with an accepted asphalt emulsion to ensure a satisfactory bond between it and the newly placed surface courses. Existing surface courses shall be stripped from the bituminous concrete base course for at least a 6-inch width and trimmed square and straight so that new permanent surfacing shall be placed on undisturbed bituminous concrete base course. Existing pavement shall be swept clean prior to placing any asphalt emulsion over it. Existing pavement that will be under new pavement shall be painted with asphalt emulsion to ensure a satisfactory bond.

C. Before permanent pavement is installed, the base shall be brought to the proper grade, and temporary pavement and excess gravel base shall be removed.

D. All manhole covers, catch basin grates, valve and meter boxes, curbs, walks, walls and fences shall be adequately protected and left in a clean condition. Where required, the grades of manhole covers, catch basin grates, valve boxes, and other similar items shall be adjusted to conform to the finished pavement grade.

E. The Contractor shall remove and acceptably dispose of all surplus and unsuitable material.

3.02 INSTALLATION

A. General

1. All construction methods and materials shall be satisfactory to the Program Manager/Construction Manager.
2. Unless indicated otherwise, all permanent bituminous pavement shall be installed in two courses or more. Bituminous base courses shall be carefully spread and raked to a uniform surface and thoroughly rolled before application of the top course.
3. All to courses of permanent paving shall be applied with acceptable mechanical spreaders in widths of at least 9 feet.
4. The rolling for all bituminous and gravel base courses shall conform to the standards listed in the appropriate Subsection of the Standard Specification.
5. Pavement shall be placed so that the entire roadway or paved area shall have a true and uniform surface, and the pavement shall conform to the proper grade and cross section with a smooth transition to existing pavement.

B. Gravel Base Course

1. The gravel base shall be placed to such depth that the furnished compacted gravel base course is the depth as indicated on the drawings and specified herein.
2. The top of the compacted gravel base shall be below the furnish grade a distance required to accommodate the compacted pavement material as indicated on the drawings and specified herein.
3. The gravel base as herein specified shall be 18-inches thick for flexible pavements and 6-inches thick for rigid pavements.

C. Temporary Pavement

1. Temporary pavement shall be placed over all trenches in paved areas where directed by the Program Manager/Construction Manager.
2. The Contractor, upon completing the backfilling and compaction of the trenches in the streets and the placing of the gravel base course, shall be required to construct temporary pavement unless otherwise directed by the Program Manager/Construction Manager.
3. Temporary Pavement in city roads shall be placed in one course and shall consist of 2-inch compacted thickness of hot bituminous mix, on a 18-inch compacted thickness gravel base as directed by the Program Manager/Construction Manager.
4. Temporary Pavement in state roads shall be placed in one course and shall consist of 3-inch compacted thickness of hot bituminous mix, on a 18-inch compacted thickness gravel base as directed by the Program Manager/Construction Manager.

5. The Contractor shall maintain temporary pavement in good repair and flush with the existing pavement at all times until the permanent pavement is placed.
6. The temporary pavement shall not be removed until such time that the Program Manager/Construction Manager authorizes the placement of permanent pavement.

D. Bituminous Base

1. Bituminous Base shall be used in city streets and parking areas as listed in Article 1.03 of this specification.
2. Bituminous Base shall be placed to the thickness as indicated in Article 1.03 of this Specification and installed in accordance with the requirements of the Standard Specification and as detailed in the Contract Drawings.
3. Prior to placing bituminous base, all temporary pavement and sufficient gravel base course shall be removed, to proper depths as detailed in the Contract Drawings.

G. Bituminous Surface

1. Bituminous Surface shall be used in the streets as listed in Article 1.03 of this specification.
2. Bituminous Surface shall be placed to the thickness as indicated in Article 1.03 of this Specification and installed in accordance with the requirements of the Standard Specification and as detailed in the Contract Drawings.

H. Sidewalks, Driveways, Parking Lots And Curbing

1. Sidewalks, driveways, parking lots and curbing that are removed or damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they are found immediately prior to the start of operations. Materials and methods used for such restoration shall be in conformance with the requirements of the State of Rhode Island Standard Specification.
2. Where the trench location is in a sidewalk, the entire width of the sidewalk shall be replaced with new material. Side forms shall be set so as to obtain and preserve a straight edge along both sides of the walk.
3. Where trench location is in a driveway, the driveway shall be repaved across its entire width with even edges.
4. Parking lots shall be repaved in accordance with Article 3.01 of this section.
5. Gravel base course under sidewalks and driveways shall not be less than 12" inch thick.

I. Surface Maintenance

1. During the guarantee, period, the Contractor shall maintain the bituminous surface and shall promptly make good all defects such as cracks, depressions, and holes that may occur. At all times, the surfacing shall be kept in a safe and satisfactory condition for traffic. If defects occur in surfacing constructed by the Contractor, the Contractor shall remove all bituminous concrete and base course as is necessary to properly correct the defect. After removing bituminous concrete and base course, the Contractor shall correct the cause of the defect and replace the base course and bituminous concrete in accordance with these specifications.

END OF SECTION

SECTION 02502

BITUMINOUS CONCRETE EXCAVATION BY MICROMILLING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for removing bituminous pavement by Micromilling in designated areas.

1.02 REFERENCES

A. This specification includes by reference, requirements of additional specifications as listed. The Contractor shall perform the Work in accordance with requirements of the referenced specification in addition to the requirements of this Specification Section 02502.

B. The Contractor shall obtain and familiarize himself with all requirements of these specifications prior to any milling.

1. Materials and construction methods shall conform, insofar as applicable, to the requirements of the or Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, together with all errata addenda additional revisions, and supplemental specifications.

1.03 PERFORMANCE REQUIREMENTS

A. The milling equipment must be equipped with an elevating device capable of loading milled material directly into dump trucks while operating. The milling equipment shall have necessary safety devices such as reflectors, headlights, taillights, flashing lights and back up signals so as to operate safely in traffic day and/or night.

B. The milling equipment shall be designed and built for milling pavements and posses the ability to mill cement concrete patches when encountered in bituminous pavement. It shall be self propelled and have the means for milling without tearing or gouging the underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed by the Program Manager/Construction Manager.

C. A 1 ½ inch cut to predetermined grade or any specified lesser depth may be required in one pass. The minimum width of pavement milled in one pass shall be 6 feet, except in areas to be trimmed and edged. The Contractor will be permitted to augment the large milling equipment with other more maneuverable machines for those areas inaccessible to the 6 foot machine such as curb or casting cuts.

D. The machine shall be adjustable as to crown and depth and meet the standards set by the Air Quality Act for noise and air pollution.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. The milled surface shall conform generally to the grade and cross section required. The surface shall not be torn, gouged, shoved, broken or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after the milling operation. Surface texture shall be as required by the Program Manager/Construction Manager and excess material shall be removed so that the surface is acceptable to traffic if required.

B. Asphalt cuttings shall be removed and legally disposed of by the Contractor.

C. The milled surface shall be swept clean and its condition accepted by the Program Manager/Construction Manager prior to installation of bituminous surface course.

END OF SECTION

SECTION 02503

FIBER REINFORCED JOINT AND CRACK SEALING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing all plant, labor, equipment and materials necessary to clean and seal construction joints and random cracks in bituminous concrete pavements.

1.02 SUBMITTALS

A. Shop Drawings

1. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

A. Certifications

1. If requested, a manufacturer's certificate of material compliance shall be furnished to the Owner certifying conformance to the above material specification.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crack Sealer

1. Asphalt fiber compound designed especially for improving strength and performance of the parent asphalt sealant.
2. Asphalt sealant to be Grade PG 58-28 (formerly AC-10), PG 64-22 or 64-28 (formerly AC-20) with a penetration of 75-100.
3. Fiber reinforcing materials shall be short-length polyester fibers having the following properties,

a.	Length	.25 inches
b.	Diameter	0.008 inch plus or minus 0.0001 inch
c.	Specific Gravity	1.32 to 1.40
d.	Melt Temperature	480 degrees F. minimum
e.	Ignition Temperature	1000 degrees F. minimum
f.	Tensile Strength	75,000 PSI plus or minus 5,000 PSI
g.	Break Elongation	33% plus or minus 9% when they are fully drawn.

B. Asphalt Fiber compound mixing rate to be 6-8% fiber weight of asphalt cement.

C. This compound having the same chemical base provides compatibility and exhibits excellent bond strengths.

D. Fiber functions to re-distribute high stress and strain concentrations that are imposed on the sealant by thermal sources, traffic loading, etc.

2.02 EQUIPMENT

A. General

1. Equipment used in the performance of the Work required by this section of the specification shall be subject to the approval of the Program Manager/Construction Manager and maintained in a satisfactory working condition at all times.

B. Air Compressor

1. Portable and capable of furnishing not less than 100 cubic feet of air per minute at not less than 90 PSI pressure at the nozzle.
2. Equipped with traps that will maintain the compressed air free of oil and water.

C. Sweeper

1. Manually operated, gas powered air-broom or self propelled sweeper designed especially for use in cleaning highway and airfield pavements shall be used to remove debris, dirt, and dust from the cracks.

D. Hand Tools

1. Utilize brooms, shovels, metal bars with chisel shaped ends, and any other tools which may be satisfactorily used to accomplish this Work.

E. Melting Kettle

1. Unit used to melt the joint sealing compound shall be double boiler, indirect fired type.
2. Annular space between the inner and outer shells shall be filled with suitable heat transfer oil or substitute having a flash point of not less than 600 degrees F.
3. Equipped with a satisfactory means of agitating the joint sealer at all times with either or both of the following,
   a. Continuous stirring with mechanically operated paddles,
   b. Continuous circulating gear pump attached to the heating unit.
4. Equipped with a thermostatic control calibrated between 200 degrees F. and 550 degrees F.

PART 3 EXECUTION

3.01 PREPARATION

A. General

1. No crack sealing material shall be applied in wet cracks or where frost, snow, or ice is present or when ambient temperature is below 25 degrees F.

B. Debris Removal

1. Cracks shall be blown clean by high pressure air.
2. Old material and other debris removed from the cracks shall be removed from pavement surface immediately by means of power sweepers, air brooms or hand brooms.

C. Vegetation

1. Remove vegetation from cracks then sterilize by the use of propane torch unit generating 2000 degrees F. and 3000 foot/second velocity to eliminate all vegetation, dirt, moisture and seeds.

3.02 INSTALLATION

A. Sealer

1. Heated and applied at a temperature specified by the manufacturer and approved by the Program Manager/Construction Manager.
2. Minimum application temperature to be 320 degrees F.
3. Delivered to the pavement surface through a pressure hose line and applicator shoe.

B. Boiler slag aggregate

1. Broadcast over cracks to prevent sealer pickup when traffic requires immediate use of the roadway.

3.03 WORKMANSHIP

A. General

1. All workmanship to be of the highest quality
2. Excess of spilled sealer shall be removed from the pavement by approved methods and discarded.
3. Workmanship determined to be below the high standards of the particular craft involved will not be accepted and will be corrected and/or replaced as required by the Program Manager/Construction Manager.

3.04 PROTECTION

A. Supply and maintain traffic cones and barricades for the protection of workers and the Work.

3.05 PERFORMANCE

A. General

1. Properly formulated and mixed asphalt compound over-banding shall not expand beyond 4-inches in width due to temperature or traffic compression after placement.
2. Penalties may be imposed upon the contractor for expansion of over-banding beyond 4-inches.

END OF SECTION

SECTION 02530

RESTORATION OF CURB, SIDEWALKS AND VEGETATED AREAS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for removal and replacement of granite curb, concrete and bituminous sidewalks including sidewalks at driveways and wheelchair ramps.
2. Requirements for restoration of vegetated areas, plantings and tree beds.
3. Restoration to include those areas designated by the Contract Drawings and those affected or damaged by the construction operations, outside the limits of Work.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading

1.02 REFERENCES

A. This specification makes reference to the requirements of additional specifications as listed. The Contractor shall obtain and familiarize himself with all requirements referenced by this specification.
1. Rhode Island Department of Transportation, Standard Specifications for Road and Bridge Construction, , including all addenda, issued by the State of Rhode Island Department of Transportation, (referred to as the Standard Specification).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300,

1. Sieve analysis for aggregates and loams.
2. Mix designs for batched materials.
3. Certifications for landscape material.
4. Samples when requested by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel Borrow

1. In accordance with State of Rhode Island Standard Specification, Subsection M.01.02, Meeting the gradation requirements of Table 1, Column 1, with 100% Passing 3-inch Square Mesh Sieves.

B. Granite Curb

1. In accordance with the requirements of the State of Rhode Island Standard Specification, Section M.09.

C. Cement Concrete

1. In accordance with the requirements of the State of Rhode Island Standard Specification, Section M 02.

D. Bituminous Concrete

1. In accordance with the requirements of the Rhode Island Standard Specification Section 401 for Surface Course, Class I-2 and the gradation requirements for Class I-2 or sidewalk in section M.03.01.

E. Loam, Seed, Lime, Fertilizer, Mulch and Water

1. In accordance with Section M.18 of the Rhode Island Standard Specification.

2.02 SOURCE QUALITY CONTROL

A. The plants used by the Contractor for preparation of bituminous paving materials and cement concrete shall be acceptable to the Engineer who shall have the right to inspect the plant and the making of the material.

PART 3 EXECUTION

3.01 INSTALLATION/RESTORATION

A. Excavation to be in accordance with Section 02200 unless noted otherwise by the referenced specifications below.

B. Granite Curb

1. Installing or Remove, Salvage and Reset granite curb at the locations indicated on the Drawings or as directed by the Engineer shall be in accordance with Section 906 of the State of Rhode Island Standard Specification.

C. Sidewalks

1. Installation of new or replacing existing sidewalks, driveways and wheelchair ramps at the locations shown on the Drawings or as directed by the Engineer to be in accordance with Section 905 of the State of Rhode Island Standard Specification.

D. Vegetated Areas, Plantings and Tree Beds

1. Restore all disturbed areas in accordance with the following Sections of the State of Rhode Island Standard Specification.

    a. Loam in accordance with l.01
    b. Seeding in accordance with L.02
    c. Plantings and Tree Beds in accordance with L.08

E. Stonedust Sidewalk

1. The work shall include the construction of stone dust sidewalk on an existing gravel borrow sub-base. This specification shall govern work performed near the trunk base of trees designated by the City's Representative as "Sensitive Tree Areas" and is intended to minimize damage to the root system of the trees which lie within the sidewalk area.
2. Installation of stone dust shall be done after the excavation of the existing sidewalk in the Sensitive Tree Area is complete.
3. Remove protective loam before the stone dust is installed. The remaining gravel sub-base will be left in place. The stone dust shall be applied to a four (4) inch depth on the existing gravel sub-base with in the designated "Sensitive Tree Area" The stone dust will be fine graded smooth and level.
4. The stone dust will be tamped in place by using hand tools only, the use of vibrating compactors will not be allowed. All roots will be left in place unless they are above the finish grade of the sidewalk. If root trimming is necessary, it will be done in accordance with Section L.10, Tree Root Pruning of the State of Rhode Island Standard Specifications.
5. Roots are not to be left exposed for more than one (1) hour. Stone dust will be installed immediately after the loam has been removed. Heavy equipment will be excluded from the "Sensitive Tree Areas" at all times.

F. Restoration Limits

1. Where the trench location is in a sidewalk, the entire width of the sidewalk shall be replaced with new material. Side forms shall be set so as to obtain and preserve a straight edge along both sides of the walk.
2. Sidewalks shall be cut at existing joints or as directed otherwise by the Engineer.
3. Where trench is in a driveway, the driveway shall be repaved across its entire width with even edges.

G. Restoration outside Limits of Work

1. Sidewalks, driveways, parking lots and curbing that are or damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they are found immediately prior to the start of operations. Materials and methods used for such restoration shall be in conformance with the requirements of the Standard Specification.
2. There shall be no cost to the Owner for this work.

END OF SECTION

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SECTION 02607

PRECAST CONCRETE MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for modular precast concrete manhole sections and structures with tongue-and-groove joints, cast iron covers or aluminum hatches, accessories and appurtenances.

B. Related Sections

1. Section 02200 – Earth Excavation, Backfill, Fill and Grading
2. Section 02240 – Construction Water Handling
3. Section 02260 – Support of Excavation
4. Section 03300 - Cast-In-Place Concrete
5. Section 9907 – Geopolymer Concrete Lining System

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A48, Standard Specification for Gray Iron Castings.
2. A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. C32, Standard Specification of Sewer and Manhole Brick (Made from Clay or Shale), AASHTO Designation M91-42, Red Sewer Brick Only Grade SS.
4. C144, Standard Specification for Aggregate for Masonry Mortar.
5. C150, Standard Specification for Portland Cement.
6. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
7. C443, Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.
8. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
9. C890, Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
10. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
11. C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
12. C1244, Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure.
13. D4101, Standard Specification for Propylene Plastic Injection and Extrusion Materials.

B. American Concrete Institute

1. ACI 318, Building Code Requirements for Structural Concrete
2. ACI 350, Environmental Engineering Concrete Structures

1.03 SYSTEM DESCRIPTION

A. Design Requirements

1. Manholes and structures shall conform in shape, size, dimensions, materials, and other respects to the details indicated in the Contract drawings.
2. All manholes and structures shall have concrete bases. Invert channels may be formed in the concrete of the base or brickwork upon the base.
3. Manhole and structure walls, barrels and cones shall be precast concrete sections. The top of the cone (not to be more than 12-in.) shall be built of brickwork to permit adjustment of the frame to meet the finished surface.
4. The inverts shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerlines of adjoining pipelines.
5. For Structures, the thickness of the bottom slab of the pre-cast bases shall not be less than the top slab.
6. When the depth of the manhole exceeds twenty-four (24) feet, the following shall be included in the design of the manhole:

    a. Check the manhole for flotation (buoyancy).
    b. Verify the exterior water pressure on the precast concrete manhole section joints from the ground water conditions will not exceed the requirements of the ASTM C443 for rubber gaskets, ASTM C990 for preformed flexible joint sealants, and the specifications.
    c. Verify that the water pressure on the pipe to manhole connections from the groundwater conditions will not exceed the requirements of ASTM C923 and the Specifications.
    d. Pressure on walls of all buried structures should be calculated using the equations provided in ASTM C890. Structures must be designed for all possible loading including conditions including lateral earth, hydrostatic and surcharge loads.

B. Design Responsibility

1. The Contractor shall be fully responsible for providing a complete and adequately designed sanitary sewer structure as required and/or directed by the Program Manager/Construction Manager in accordance with the provisions set forth herein.

2. The Contractor shall engage, at his own expense, the services of a fully competent and qualified Professional Engineer, hereinafter referred to as the “Contractor’s Engineer”, registered in the State in which the pumping station is being installed, for the design of all reinforced concrete, and for completing flotation calculations, as necessary to accomplish the Work specified.

3. The Contractor’s Engineer shall be acceptable to the Program Manager/Construction Manager and demonstrate a minimum of five (5) years documented experience in the field of structural design.

C. Design Criteria

1. Design load requirements shall be determined by local conditions, applicable codes, structure end use, and shall be in accordance with the Building Code of the State in which the structure is being constructed.
2. The structure shall be designed to adequately and safely support all live and dead loads to which the structure will be subjected, and to withstand all conditions that may be encountered, including burial depth, and the dead and live loads anticipated for the structure. The structures shall have adequate wall, base and top slab thickness and steel reinforcement sufficient for the depth of burial shown on the Drawings.
3. Design precast reinforced concrete structures to withstand earth and groundwater loads. Groundwater elevation shall be assumed to be at the top of the structure. An at-rest lateral soil pressure coefficient of 0.5 shall be used.
4. Design precast reinforced concrete structure to withstand an AASHTO HS-20 vehicle loading with an impact factor of 1.3. Design shall account for vehicle positions both above and alongside the structure, including directly on manhole covers and hatches.
5. Design and install the structures to withstand hydrostatic uplift caused by a groundwater elevation at grade level or equal to the top of the structure, whichever produces the most severe condition. Use only the weight of the empty structure (no fill) and submerged soil directly over any base perimeter to resist hydrostatic uplift with a minimum safety factor of 1.10. The weight of submerged soil may be 60 pounds per cubic foot maximum. Do not include side friction of soil on walls.
6. Design, as a minimum, shall be in accordance with the requirements and recommendations of ACI 350 and ASTM C890 as referenced in Section 1.02 herein.

1.04 SUBMITTALS

A. Shop Drawings

1. In accordance with Specification SECTION 01300 - SUBMITTALS.

B. Samples

1. Provide representative samples of materials if requested by the Program Manager/Construction Manager.

C. Design Calculations

1. For documentation ONLY, submit design calculations bearing the Professional Seal and signature of the Contractor's Engineer. Design calculations shall include reinforced concrete design and buoyancy calculations for the sanitary sewer structure, and address design load requirements of Section 1.03C.
2. Included as part of this submission, the Contractor's Engineer must provide a complete listing of all references, codes and specifications that are used by the Contractor's Engineer.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

A. **Reinforced precast concrete shall be produced in the United States in accordance with the American Iron and Steel requirements of P.L. 113-76, the Consolidated Appropriations Act of 2014**

B. Conform to the ASTM C478 with the following exceptions and additional requirements:

1. All cast in place concrete shall be Class A and shall conform to the requirements specified under SECTION 03300.
2. Wall sections to be 5-inch thick minimum.
3. Type II cement in accordance with ASTM C150.
4. 4.0 feet and 5.0 feet diameter manholes minimum of 4,000 psi - 28 days compressive strength.
5. 6.0 feet and 8.0 feet diameter manholes and structures minimum of 5,000 psi. - 28 days compressive strength except as otherwise permitted.
6. No more than two lift holes may be cast or drilled in each section.
7. The date of manufacture and the name of trademark of the manufacturer shall be clearly marked on the inside of the structure.
8. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.
9. All sections shall have tongue and groove gasketed, leak proof joints.
10. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 5,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.
11. The thickness of the bottom slab of the pre-cast bases shall not be less than the top slab.

C. Manhole Flat Slab Tops

1. Thickness and reinforcement as indicated on the drawings and in accordance with ASTM C478.

D. Manhole Cones

1. Cones shall be precast sections of construction similar to above.

E. Manhole Bases

1. The tops of the bases shall be suitably shaped by means of accurate bell-ring forms to receive the barrel sections.
2. All holes for pipes shall be cast in the base sections so that there is a clear distance of four inches minimum between the inside bottom of the base section and the pipe invert.
3. Base pad shall be pre-cast with extended base as indicated on drawings and herein specified.
4. Openings for pipe and materials to be embedded in the wall of the base for these joints

2.02 COMPONENTS

A. Pipe Seals

1. Premolded elastomeric-sealed joints fitted or cast integrally into the pipe opening of the manhole base and/or wall section.
2. Provide a watertight joint.
3. Maximum 10-degree omni-directional deflection.
4. Conform to ASTM C923.
5. Seals to be:
   a. Lock Joint Flexible Manhole Sleeve made by Interpace Corp., Parsippany, NJ;
   b. Kor-N-Seal made by National Pollution Control Systems, Inc., Nashua, NH;
   c. A-LOK manhole pipe seal made by A-LOK Corp., Trenton, NJ;
   d. or an acceptable equivalent product.
6. All materials, accessories and construction methods used in making the joints shall be supplied or approved by the manufacturer of the premolded elastomeric-sealed joint. Furnish manufacturer's written instructions to the Program Manager/Construction Manager.

B. Aluminum Manhole Steps

1. Cast into walls of the precast sections to form a continuous ladder with a distance of twelve inches (12) between steps.
2. Aluminum drop-front type.
3. Stock No. 12653B made by Aluminum Company of America, Pittsburgh, PA.
4. Stock No. F-14-2-B made by New Jersey Aluminum Co., New Brunswick, N.J.,
5. Or an acceptable equivalent product.
6. Before the steps are built into the masonry and after thorough cleaning, those parts of aluminum steps which will be embedded shall be given a protective coating of an acceptable, heavy-bodied, bituminous material. The cleaning shall be done by suitable means and with suitable cleaning agents to ensure that the surfaces to be coated are free from all foreign matter such as dirt, oil, and grease. The steps shall be thoroughly rinsed and dried before the coating is applied and the coating shall have become thoroughly dry before the steps are built into the masonry.

C. Plastic Manhole Steps

1. Install in walls of the precast sections to form a continuous ladder with a distance of twelve inches (12) between steps.
2. Copolymer Polypropylene plastic manhole step Model PS2-PFSL as manufactured by M. A. Industries, Inc., Peachtree City, Georgia.
3. Plastic steps to be in conformance with ASTM D-4101 for type II propylene copolymers.
4. Plastic to encase 1/2-inch grade 60 steel reinforcing rod conforming to ASTM A-615.

D. Exterior Coating

1. The material shall be:
   a. Minwax Fibrous Brush Coat made by the Minwax Co., New York, N.Y. or
   b. Tremco 121 Foundation Coating made by the Tremco Inc., Cleveland, OH; or
   c. Non-fibrated type liquid asbestos-free emulsion, Sonneborn 700, Toch RIW marine mastic D or equal Acceptable equivalent product.

E. Interior Coating

1. The material shall be:
   a. Sikagard 7600 made by Sika Corporation, Lynhurst, NJ or
   b. GacoFlex LM-60 AR by Gaco Western, Seattle, WA.

F. Rubber Gaskets (between manhole sections)

1. In accordance with ASTM C443.
2. Gasket configuration per manufacturers recommendation.

G. Butyl Resin Gaskets (between manhole sections)

1. In accordance with ASTM C990.
2. Gasket configuration per manufacturers recommendation.

2.03 ACCESSORIES

A. Manhole Frames and Covers

1. **Manhole frames and covers shall be produced in the United States in accordance with the American Iron and Steel requirements of P.L. 113-76, the Consolidated Appropriations Act of 2014**
2. Furnish all cast-iron manhole frames and covers conforming to the details shown on the drawings, or as hereinbefore specified.
3. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.
4. Casting shall be thoroughly cleaned and subject to a careful hammer inspection.
5. Castings shall be at least Class 25 conforming to the ASTM A48.
6. Standard sewer manhole frames and covers to have 30 inch opening, and be East Jordan Iron Works Cover Model 00149577B02, Frame Model 00148012, or approved equal. Pattern of cover and lettering shall comply with the Owner's standards.
7. For locations where the proposed rim elevation is below the 100-year flood elevation provide watertight sewer manhole frames having 32 inch diameter covers with 4 bolts, and gasket, and be East Jordan Iron Works, or approved equal. Pattern of cover and lettering shall comply with the Owner's standards.
8. Where specified sewer manhole frames and covers having a 24-inch opening shall be East Jordan Iron Works: Cover Model 0MA211000043, Frame Model 0MA211000002 or equal meeting requirements of this section. Pattern of cover and lettering shall comply with the Owner's standards.

B. Structure Entrance Hatches:

1. Manufacturers:

   a. Bilco Company, New Haven, CT.
   b. Halliday Products, Orlando, FL.
   c. Equivalent

2. Provide aluminum hatches of the type and size indicated on the drawings and as follows:

   a. Fabricate hatch and frame with ¼ inch (6 mm) extruded aluminum frame and ¼ inch (6mm) diamond checkered aluminum plate covers.
   b. Reinforce cover, with aluminum bars and angles welded to underside of covers, to withstand AASHTO H-20 wheel loading.
   c. Provide hatch with hinges, hold-open safety lock bars and flush lift handles, factory assembled, and shipped complete ready for installation.

d. Provide stainless steel hardware throughout. Hinge covers to frames with heavy duty stainless steel concealed hinges and stainless steel pins. Attach hinges to covers and frames with countersunk/flathead stainless steel machine screws. Covers shall fit flush to frame.
e. Provide slam latch, flush-mounted grip handle, and removable plug and key wrench.
f. Fabricate gutter-type hatches with 1-½ inch (38mm) drainage coupling in one corner of the channel frame
g. Provide frost proof inner hatch.
h. Provide ladder-up safety post.
i. Provide safety grating under the hatch door(s). Grating shall be hinged and locked separately from the hatch door(s). Grating shall be designed to withstand 300 psf and be painted safety orange by the hatch manufacturer.
j. Provide a forged brass case padlock with hardened steel shackle. The padlock shall be furnished with two (2) keys that are compatible with the Owner's Master Locking System.
k. Install hatch in accordance with manufacturer's instructions.
l. The hatch shall be cast into the structural slabs. Coordination of the hatch installation is the responsibility of the Contractor.
m. All hatch operating equipment shall be manufactured to be flush or below the hatch surface.

C. Brick

1. Sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Program Manager/Construction Manager.
2. In accordance with ASTM C32, Red Sewer Brick Only Grade SS.
3. In accordance with AASHTO M91-42, Red Sewer Brick Only Grade SS.
4. Reject brick shall be immediately removed from the work.

D. Mortar for Brickwork

1. Composed of Portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volume of cement and lime.
2. The proportions of cement and lime shall be 1:1/4.
3. Cement shall be Type II Portland cement in accordance with Specification SECTION 03300.
4. Hydrated lime shall be Type S conforming to the ASTM C207.
5. Hydrated lime shall be "Mortaseal" manufactured by U.S. Gypsum or
6. "4X Hydrate" manufactured by the New England Lime Company or
7. An acceptable equivalent product.
8. The sand shall conform to ASTM C144.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manhole and Structure Sections

1. Set so as to be vertical and with sections and steps in true alignment.
2. Rubber gaskets shall be installed in all joints in accordance with the manufacturer's recommendations.

3. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose or with mortar. The mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

B. Rubber and/or Butyl Resin Gaskets (between manhole sections)

1. In accordance with manufacturers recommendation.
2. Install in all joints between precast sections.

C. Brickwork

1. Only clean bricks shall be used.
2. Bricks shall be moistened 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.
3. Each brick shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded.

D. Plastering And Curing Brick Masonry

1. Outside faces of brick masonry adjustment courses shall be plastered with mortar to a thickness of 1/2-inch.
2. If required, the masonry shall be properly moistened prior to application of the mortar.
3. The plaster shall be carefully spread and troweled. After hardening, the plaster shall be carefully checked by being tapped for bond and soundness.
4. Unbonded or unsound plaster shall be removed and replaced.
5. Brick masonry and plaster shall be protected from too rapid drying by the use of burlaps kept moist, or by other suitable means, and shall be protected from the weather and frost, to insure maximum strength.

E. Exterior Coating

1. The exterior surfaces of all manholes shall be given two coats of waterproofing material.
2. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer.
3. 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.

F. Interior Coating

1. Where required in the Contract Documents, the interior surfaces of identified manholes and structures shall be coated with an approved interior lining system. See Specification Section XXXXX.

3.02 SETTING MANHOLE FRAMES AND COVERS

A. Manhole frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings or directed. Frames shall be set concentric with the top of the masonry and in full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

B. Manhole covers shall be left in place in the frames on completion of work at the manholes.

3.03 CLEANING

A. Manholes to be free of construction debris prior to final inspection.

END OF SECTION

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SECTION 02614

REINFORCED CONCRETE PIPE FOR OPEN CUT INSTALLATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing and installing the reinforced-concrete pipe as indicated on the drawings.

B. Related Sections

1. Section 02200 – Earthwork
2. Section 03300 – Cast-In-Place Concrete

1.02 QUALITY ASSURANCE

A. Reinforced-concrete pipe shall be made by a manufacturer of established good reputation in the industry and in a plant adapted to meet the design requirements of the pipe.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
2. C361, Specification for Reinforced Concrete Low-Head Pressure Pipe.
3. C443, Specification for Joints for Circular Concrete Culvert and Sewer Pipe, Using Rubber Gaskets.

1.04 SUBMITTALS

A. In accordance with SECTION 01300 submit for review drawings showing the pipe dimensions reinforcement, joint, and other details for each type and class of pipe to be furnished for the project. All pipe furnished under the contract shall be manufactured only in accordance with the specifications and the reviewed drawings.

PART 2 PRODUCTS

2.01 PIPE

A. Each unit of pipe shall have an interior surface, which is free from roughness, projections, indentations, offsets, or irregularities of any kind. The pipe units shall be of the classes

indicated on the drawings and shall conform to ASTM C76 with the following exceptions and additions:

1. Type II cement shall be used unless otherwise permitted by the Program Manager/Construction Manager. Admixtures shall not be used except with the prior permission of the Program Manager/Construction Manager.
2. Aggregates shall conform to the requirements set forth hereinafter.
3. Elliptical reinforcement will not be permitted. Longitudinal reinforcement shall be continuous. Reinforcement shall have a minimum cover of 3/4 in.
4. Absorption shall be as specified under "inspection, Tests and Acceptance."
5. Pipe units have a minimum laying length of 8 ft., except as otherwise indicated or permitted by the Program Manager/Construction Manager.
6. Pipe units shall be cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 130 degrees. F for a period of not less than 12 hours or, when necessary, for such additional time as may be needed to enable the pipe units to meet the strength requirements.
7. Pipe units shall not be shipped until they have aged for at least 450 day-degrees which includes the steam curing period. Day-degrees are the total number of days times the average daily air temperature at the surface of the pipe units. (Example: Five days at a daily average temperature of 60 degrees. F equals 300 day-degrees.) Wherever the average daily temperatures are below 60 degrees. F the Contractor shall submit to the Program Manager/Construction Manager records of average daily temperatures and number of days the pipe units have been cured.
8. There shall be no lift holes in the pipe.
9. Mortar used for repairs shall have a minimum compressive strength of 4,000 psi. at the end of 7 days and 5,000 psi. at the end of 28 days, when tested in 3-in. by 6 in. cylinders stored in the standard manner. Only those repairs permitted by the above-mentioned ASTM C76 will be allowed.
10. The date of manufacture, class of pipe unit, size of pipe unit, and trademark of the manufacturer shall be clearly and permanently marked on the inside and the outside at one end of each pipe unit.
11. Certified copies of tests on materials and the pipe units will be required.

B. Specials, if required, shall conform to the specifications for straight pipe insofar as applicable. Special design or construction necessary for specials shall be subject to acceptance by the Program Manager/Construction Manager.

2.02 JOINTS

A. Pipe joints shall be of the rubber gasket type in which the gaskets are in compression and which will permit both longitudinal and angular movement. Each unit of pipe shall be provided with proper ends made of concrete formed true to size and formed on machined rings to ensure accurate joint surface. Joints and gaskets shall be O-ring or ribbed gasket type and shall conform to the requirements of ASTM C443 or C361 and to the additional requirements specified.

2.03 INSPECTION, TESTS AND ACCEPTANCE

A. Acceptance will be on the basis of tests of materials, absorption tests, plant load-bearing tests, pressure tests, and inspection of the complete product. The required tests are enumerated hereinafter. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to inspection by the Program Manager/Construction Manager. Inspection may be made at the place of manufacture, or on the work site after delivery, or both, and the pipe shall be subject to rejection at any time due to failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

B. Tests and certified copies in triplicate of test results will be required for the materials and the finished pipe units as described herein. If less than 100 units of a given size and class of pipe are required, the Contractor may submit certified copies of tests made on identical pipe units made by the same manufacturer within the past year. If more than 100 units of a given size and class of pipe are required, the Contractor shall, at his own expense, engage the services of an acceptable independent testing laboratory to perform or witness all tests, other than mill tests on reinforcing steel and cement, and certify the results. In addition, the Owner reserves the right to have any or all pipe units inspected or tested, or both, by an independent testing laboratory at either the manufacturer's plant or elsewhere. Such additional inspection and/or tests shall be at the Owner's expense and shall be the test results of record.

C. All pipe units to be tested shall be selected at random by the Program Manager/Construction Manager. Unless otherwise permitted, all load-bearing tests on pipe units shall be made in the presence of the Program Manager/Construction Manager.

D. All tests shall be made in accordance with the latest applicable ASTM specifications.

1. Reinforcing Steel--Mill test reports, or reports on samples taken from each shipment to the pipe manufacturer, shall be submitted for reinforcing steel to be used on this project stating that the reinforcing meets the specified requirements.
2. Cement--Mill test reports shall be submitted for each shipment to the pipe manufacturer of cement to be used on this project stating that the cement meets the specified requirements. All cement accepted for this project shall be kept segregated from other cement.
3. Aggregates--Tests reports shall be submitted stating that the aggregates to be used on this project meet the requirements for concrete aggregates as specified "Fine Aggregate" and "Coarse Aggregate" under SECTION 03300. The first report shall be submitted prior to the manufacturer of any pipe for this project. Additional tests and reports shall be made monthly thereafter during the production of the pipe.
4. Absorption Tests--Three cores shall be taken from each pipe unit that is to be load tested. The cores shall be taken before the load-bearing tests are performed. All cores shall be tested for absorption by the boiling absorption test. Average absorption shall not exceed 8 percent of the dry weight and no single test shall exceed 9 percent.
5. Pipe Unit Load-Bearing Tests--A load-bearing test shall be made on one pipe unit of each size and class and the report of the test submitted before delivery to the project of that size and class of pipe unit. An additional test will be required for each 200 units of each

size and class of pipe. The load-bearing test shall be performed after the cores for the absorption tests have been taken. Each load-bearing test shall be carried to the specified load to produce the 0.01 in. crack. If the 0.01 in. crack is not formed, the pipe unit may be used in the project. Cored holes shall be plugged with the mortar specified above for repairs.

6. Pressure Test--A pressure test shall be made on two pipe units of each size and class to be used. Each pipe unit shall be bulkheaded independently and then joined together in a normal manner with the joint to be used in the work. The pipe units shall be held in place in such manner that no external compression force is exerted on the joint during the test. The test pressure shall be an average internal hydrostatic pressure of 10 psi and shall be maintained for at least 10 minutes without visible leakage from the joint. A description of the bulk-heading and pipe holding arrangement shall be submitted to the Program Manager/Construction Manager for review prior to performing the test. All pressure tests shall be made in the presence of the Program Manager/Construction Manager.
7. Concrete Cylinders--Compression tests shall be made on standard concrete cylinders for the first or test pipe unit and then for every 100 cubic yards of concrete used in pipe manufacture, or for each additional 200 units of pipe, whichever represents the lesser amount of concrete. Four cylinders shall be made for each test and they shall be broken at 7, 14, and 28 days with one cylinder as a spare to be used in the event of an unsatisfactory break. The reports shall be submitted within three days after each of the compression tests.

PART 3 EXECUTION

3.01 HANDLING PIPE

A. Each pipe unit shall be handled into its position in the trench only in such manner and by such means as is acceptable to the Program Manager/Construction Manager.

B. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

3.02 INSTALLATION

A. Each pipe unit shall be inspected before being installed. Any pipe discovered to be defective either before or after installation shall be removed and replaced with a sound pipe.

B. Except as otherwise indicated on the drawings, the pipe shall be supported by compacted crushed stone. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Crushed stone shall be as specified under SECTION 02200.

C. Suitable bell holes shall be provided, so that after placement only the barrel of the pipe receives bearing pressure from the supporting material.

D. All pipe units shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the completed work.

E. Pipe and fittings shall be installed to the lines and grades indicated on the drawings or as required by the Program Manager/Construction Manager. Care shall be taken to ensure true alignments.

F. Before any joint is made. the unit shall be checked to assure that a close joint with the next adjoining unit has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be given down to the required grade by striking it with a shovel handle, timber, or other unyielding object.

G. 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. 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 unit together so that they will fit with a minimum open recess inside and outside and have tightly seated joints. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends. Joints shall not be pulled or cramped without the permission of the Program Manager/Construction Manager.

H. Immediately after the pipe joint is completed, the position of the gasket in the joint shall be inspected using a suitable feeler gage furnished by the Contractor, to be sure it is properly put together and is tight. Joints in which the gasket is damaged or not properly positioned shall be pulled apart and remade using a new gasket.

I. Where any two pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units and new gaskets.

J. Details of gasket installation and joint assembly shall follow the directions of the manufacturer of the joint materials and of the pipe, all subject to acceptance by the Program Manager/Construction Manager. The resulting joints shall be watertight and flexible.

K. After each pipe to be supported on screened gravel has been properly bedded, enough gravel shall be placed between the pipe and the sides of the trench, and thoroughly compacted, to hold the pipe in correct alignment. Bell holes provided for jointing shall be filled with screened gravel and compacted, and then screened gravel shall be placed and compacted to complete the pipe bedding, as indicated on the drawings.

L. The Contractor shall take all necessary precautions to prevent floatation of the pipe in the trench.

M. At all times when pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs or by other suitable means. If water is in the trench when work is to be resumed, the plug shall not be removed until all conditions are suitable to prevent water, earth, or other material from entering the pipe.

N. Pipelines shall not be used as conductors for trench drainage during construction.

O. Interior Coating

1. Where required in the Contract Documents, the interior surfaces of pipelines shall be coated with an approved interior lining system. See Specification Section XXXXX.

3.03 CLEANING

A. Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out pipelines and manholes, being careful to prevent soil, water, and debris from entering any existing pipe.

END OF SECTION

SECTION 02629

UNDERGROUND UTILITY MARKING TAPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing metallic (detectable) and non-metallic (non-detectable) marking tape over buried pipelines and conduits.

1.02 REFERENCES

A. A.P.W.A. - American Public Works Association

1.03 SUBMITTALS

A. Shop Drawings

1. Submit in accordance with SECTION 01300 - SUBMITTALS

B. Samples

1. Provide samples of submitted products.

1.04 DESCRIPTION

A. General

1. Marking tape to be installed over all pipelines and conduits installed under this Contract.
2. Marking tape for non-ferrous pipe or conduits to be Detectable, magnetic type.
3. Marking tape for ferrous pipe or conduits to be Non-detectable, non-magnetic type.
4. Tape to be 6-inches wide.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Underground utility marking tape to be:

1. Detectable: Magnatec by THOR Enterprises, Inc., Sun Prairie, WI.
2. Non-detectable: Shieldtec by THOR Enterprises, Inc., Sun Prairie, WI.
3. Or product deemed equal by the Program Manager/Construction Manager.

2.02 MATERIALS

A. Detectable Underground Utility Marking Tape

1. Minimum overall thickness: 5.0 mil (0.005”).
2. Aluminum foil core: 35 gauge (0.00035”) minimum.
3. Foil visible from both sides of tape.

4. Protective plastic jacket applied to both sides of foil.
5. Jacket adhesive applied directly to the film and foil.
6. No printing to extend to the edges of the tape.
7. No Dilutants, pigments or contaminants in the adhesive.
8. Adhesive formulated to resist degradation by elements normally found in soil.

B. Non-detectable Underground Utility marking Tape

1. Minimum overall thickness: 4.0 mil (0.004”).
2. Polyethylene plastic film: 100% virgin, low density acid- and alkali-resistant.
3. Printing: Permanent, black, environmentally safe.
4. Coloring: color-fast, lead free, organic pigments suitable for direct burial and prolonged exposure to the elements normally found in soil.

C. Marking

1. Tape to printed with “BURIED *UTILITY* LINE BELOW”, replacing the word “*UTILITY”* with the word “WATER”, “SEWER”, “DRAIN”, “ELECTRIC’, “GAS”, or otherwise appropriate, repeating continuously every 30-inches max.

D. Color Code in accordance with A.P.W.A. Standards as follows:

1. Safety Red	Electric power and high voltage lines
2. High Visibility Safety Yellow	Gas and oil distribution/Transmission Dangerous materials/Steam
3. Safety Alert Orange	Fiber optic/telephone/CATV
4. Safety Precaution Blue	Water and irrigation lines
5. Safety Green	Sewer/storm/sanitary systems, non-potable water
6. Safety Brown	Force mains and effluent lines
7. Alert Purple	Reclaimed and effluent re-use lines

PART 3 EXECUTION

3.01 INSTALLATION

A. Install marking tape directly above the pipeline or conduit approximately 18-inches below the proposed finished grade.

B. Install marking tape in accordance with manufacturers recommendations.

C. Install marking tape over existing utilities disturbed by the Contractors operation.

END OF SECTION

SECTION 02650

RELOCATION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to relocate existing utilities which conflict with the proposed Work.

1. Relocations by Contractor

a. The Contractor shall coordinate with the respective utility company to the extent necessary to relocate the conflicting utility with the Contractor's forces, comply with the Utility Company's requirements and not cause delays in this Contract.

2. Relocation by the Utility Company

a. The Contractor shall coordinate with the respective utility company in order schedule the work with the Utilities forces and not cause delays in this Contract.

1.02 SUBMITTALS

A. In accordance with Section 01300 submit utility relocation plans indicating limits and details of the relocation work.

1.03 PROJECT/SITE CONDITIONS

A. Existing conditions

1. The presence of utilities within the streets, roads and right of ways customarily indicate service lines connecting the buildings and structures along the route. Safeguard all utilities and there respective service connections from damage during the performance of the Work.

2. The presence of utility poles indicates overhead wires for electric, telephone and cable TV also exist. Protect all overhead wires, including service lines, from damage caused by equipment used to perform the Work.

3. Existing utilities, as indicated on the Drawings are from the best available information. The accuracy of such is not guaranteed.

B. Relocation of Utilities

1. Relocation of existing utilities will be required when;

a. The existing utility interferes with the location of a proposed structure, microtunnel shaft, open cut piping installations, or;
b. Realignment of the proposed Work will have detrimental effects on the proposed Work or existing utility.

C. Support of Utilities

1. Support of existing utilities will be allowed when;

a. The location of the existing utility does not interfere with the proposed excavation, excavation support, microtunnel operation, installation of piping, structures.
b. Support in place will not be detrimental to the utility itself.
c. Support of utility is in accordance with the requirements of the utility in question.

1.04 SCHEDULING

A. Coordination

1. Coordinate all existing utility relocation work with the appropriate utility company.
2. Notify underground utility locating service (Dig Safe, Call Before You Dig, etc.) in accordance with State requirements.
3. Conduct test pits to identify utility locations needed to perform the Work only after coordination with the utility company and in time to prevent delay of the Work.
4. Coordinate with local water authority to operate water valves as required.

PART 2 PRODUCTS

2.01 MATERIALS

A. As required by the utility company, or as specified, or as approved by the Program Manager/Construction Manager.

B. Material shall be new.

PART 3 EXECUTION

3.01 EXAMINATION

A. After test pit excavations are performed, submit as built information to utility company and the Program Manager/Construction Manager.

3.02 INSTALLATION

A. In strict accordance with the requirements of the Utility Company responsible for the Work.

3.03 TESTING

A. Perform pressure and leakage testing on water lines relocated and infiltration or exfiltration testing on storm drains and sewers relocated in accordance with local agencies responsible for the utility.

3.04 INSPECTION

A. Allow access to the relocation work for inspections and recording as-built information.

END OF SECTION

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SECTION 02665

DOMESTIC WATER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to furnish, lay, joint, and test ductile-iron pressure pipe, fittings (including special castings), and appurtenant materials and equipment indicated on the Drawings and specified herein.

1.02 REFERENCES

A. American Water Works Association (AWWA)/American National Standards Institute (ANSI)

1. C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems
3. C110/A21.10, Ductile-Iron and Gray-Iron Fittings, 3-inch. through 48-inch., for Water and Other Liquids.
4. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings.
5. C115/A21.15, Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. C150/A21.50, Thickness Design of Ductile-Iron Pipe.
7. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast for Water.
8. C153/A21.53, Ductile-Iron Compact Fittings, 3 inches through 24 inches, and 54 inches through 64 inches for Water Service
9. C600, Installation of Ductile-Iron Water Mains and Their Appurtenances
10. C65l, Disinfecting Water Mains

B. American Society of Testing and Materials (ASTM)

1. A536, Standard Specification for Ductile Iron Castings

1.03 REQUIREMENTS

A. This Specification makes reference to the requirements of additional specifications as listed. The Contractor shall familiarize himself with all requirements referenced by this specification prior to the installation of any water works.

1. The Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013, as attached to this Specification.

B. Location of restrained joints shall be based on Thrust Restraint Design for Ductile Iron Pipe (Second Edition), published by Ductile Iron Pipe Research Association.

1.04 SUBMITTALS

A. In accordance with SECTION 01300 submit the following:

B. Shop Drawings

1. Piping layouts in full detail.
2. Location and type of backup block or device to prevent separation.
3. Schedules of all pipe, fittings, special castings, couplings, expansion joints, restrained joints and other appurtenances.

C. Certificates

1. Sworn certificates of shop tests showing compliance with specified standard.

D. Manufacturer's Literature

1. Catalog cuts of joints, couplings, harnesses, expansion joints, restrained joints gaskets, fasteners and other accessories.
2. Brochures and technical data of coatings and lining's and proposed method of application.

1.05 QUALITY ASSURANCE

A. Pipe and fittings shall be inspected and tested at the foundry as required by the corresponding standards listed in Article 1.02 of this specification.

B. Owner reserves right to inspect and/or test by independent service at manufacturer's plant or elsewhere at his own expense.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials shall be provided in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013, and this specification. In the case of a discrepancy between the Pawtucket Water Supply Board requirements and this specification, the Pawtucket Water Supply Board Requirements shall govern.

2.02 PIPE

A. Ductile-Iron Pipe

1. Designed in accordance with AWWA/ANSI C150/ A21.50.
2. Manufactured in accordance with AWWA/ANSI C151/A21.51.
3. Unless otherwise indicated or specified, ductile-iron pipe shall be at least thickness Class 52

B. Pipe For Use With Couplings

1. As specified above except that the ends shall be plain (without bells or beads)

cast or machined at right angles to the axis.

2.03 FITTINGS

A. General

1. Mechanical-joint fittings shall be all-bell fittings unless otherwise indicated or specified.
2. Compact fittings in accordance with AWWA/ANSI C153/A21.53 and shall have a working pressure rating of 350 psi.
3. Mechanical-joint fittings shall utilize "MegaLug" restraining glands.

B. Nonstandard Fittings

1. Fittings having nonstandard dimensions and cast especially for this project shall be of acceptable design.
2. Manufactured to meet the requirements of these specifications and shall have the same diameter and thickness as standard fittings, but their laying lengths and types of ends shall be determined by their positions in the pipelines and by the particular piping to which they connect.

2.04 ADAPTERS/TRANSITIONAL COUPLINGS

A. Where it is necessary to joint pipes of different type, furnish and install the necessary adapters unless solid sleeves are indicated on the drawings or permitted. Adapters shall have ends, conforming to the above specifications for the appropriate type of joint, to receive the adjoining pipe. Adapters joining two classes of pipe may be of the lighter class provided that the annular space in bell-and-spigot type joints will be sufficient for proper jointing.

2.05 JOINTS

A. Push-On and Mechanical

1. In accordance with AWWA/ANSI C111/A21.11.
2. The plain end of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.
3. Push-on and mechanical-joint pipe and fittings shall be provided with sufficient quantities of accessories conforming to AWWA/ANSI C111/A21.11.

B. Restrained

1. Restraining glands will be required on all fittings.
2. Pipe, fittings and appurtenances for restrained joints shall be in accordance with AWWA/ANSI C153/A21.53 for compact fittings. Only restraining glands which impart multiple wedging action against the pipe increasing its pressure as the pipe pressure increases will be allowed. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536. Twist off nuts shall be used to insure proper actuating of the restraining device.
3. Mechanical joint restraint shall have a working pressure rating of at least 250 psi.
4. Glands to be MegaLug manufactured by EBAA Iron, Inc., Eastland, Texas.

C. Gaskets

1. Gaskets shall be of a composition suitable for exposure to the product which the pipe is intended.

2.06 COUPLINGS

A. Flexible Connections

1. Where flexible connections in the piping are specified or indicated on the drawings, they shall be obtained by the use of sleeve-type couplings, split couplings, or mechanical-joint pipe and/or fittings as herein specified.

B. Sleeve Type Couplings

1. Pressure rating at least equal to that of the pipeline in which they are to be installed.
2. Provide style 441 Cast Coupling by Smith Blair, Inc, Texarkana, Texas; or be acceptable equivalent products.
3. Provided with galvanized-steel bolts and nuts, unless noted otherwise.
4. Provided with gaskets of a composition suitable for exposure to the liquid within the pipe.
5. Provided gaskets with metallic tips for electrical continuity through joints.

C. Solid Sleeve Couplings

1. Solid sleeve couplings and accessories shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.
2. Couplings shall be ductile iron with gaskets of a composition suitable for exposure to the liquid within the pipe.

2.07 ACCESSORIES

A. Tapped Connections

1. Tapped connections in pipe and fittings shall be made in such manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses shall not exceed the listed size in the appropriate table of the Appendix to the above-mentioned ANS A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.
2. Where the size of the connections exceeds that given above for the pipe in question, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or permitted by the Program Manager/Construction Manager.
3. All drilling and tapping of cast-iron pipe shall be done normal to the longitudinal axis of the pipe; fitting shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

2.08 VALVES, HYDRANTS AND APPURTENANCES

A. Provide in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

2.09 TAPPING SLEEVES AN VALVES

A. Provide in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

2.10 INSERTION VALVES

B. Provide in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

2.11 SERVICE CONNECTIONS

A. Provide in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

1. Service corporations to be a minimum 1-inch diameter.
2. Contractor to provide pipe and couplings as required to reconnect new service pipe to existing building service.

2.12 FINISHES

A. Lining

1. Inside of pipe and fittings shall be coated with double thickness cement lining and a bituminous seal coat conforming to AWWA/ANSI C104/A21.4.

B. Coating

1. Outside of pipe and fittings shall be coated with the standard bituminous coating conforming to AWWA/ANSI C151/A21.51
2. Outside surfaces of castings to be encased in concrete shall not be coated.
3. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after being machined.

2.13 METALIZED DETECTABLE IDENTIFICATION TAPE

A. Provide in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

PART 3 EXECUTION

3.01 GENERAL

A. Methods shall be performed in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013, and this specification. In the case of a discrepancy between the Pawtucket Water Supply Board requirements and this specification, the Pawtucket Water Supply Board Requirements shall govern.

3.02 OPERATION OF VALVES

A. Unless precluded by unexpected events, the Contractor shall notify the Pawtucket Water Supply Board Supply Board at least seventy-two (72) hours prior to a water main shutdown. The PWSB shall determine if the operation of valves will be performed by PWSB work forces, the Contractor, or a PWSB Subcontractor. **The immediacy of water main shutdowns or valve operation is not warranted by PWSB**. In the operation of valves, for the purpose of shutting down existing mains, the PWSB does not guarantee or imply that shut down will be completely effective in stopping the flow of water to open ends.

B. The Contractor should expect each water shutdown to take up to four (4) hours to complete. No claims for delays will be considered for any down time up to four (4) hours while the PWSB perform shutdowns.

C. If so directed by the Owner, the Contractor shall operate all valves required to shut down (and subsequently reopen) existing water mains. If the Contractor is unable to shut down a valve after two (2) hours of attempting to do so, the Owner will direct the Contractor as to how to proceed.

3.03 HANDLING

A. Pipe and Fittings

1. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coatings.
2. Any fitting showing a crack and any pipe or fitting which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the Work.
3. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least 12-inches form the visible limits of the crack.

3.04 CUTTING

A. Pipe

1. Except as otherwise approved, all cutting shall be done with a machine having rolling wheel cutters, knives, or saws adapted to the purpose. Hammer and chisel or so-called wheel span cutters shall not be used to cut pipe. All cut ends shall be examined for possible cracks caused by cutting.
2. Cut ends to be used with push-on joints shall be carefully chamfered to prevent cutting the gasket when the pipe is laid or installed.

3.05 INSTALLATION

A. Pipe and Fittings

1. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.
2. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.
3. Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or required. Care shall be taken to ensure a good alignment both horizontally and vertically.
4. Pipe shall have a firm bearing along its entire length.
5. The deflection of alignment at a joint shall not exceed the appropriate permissible deflection as specified in the tabulation titled PIPE DEFLECTION ALLOWANCES.

PIPE DEFLECTION ALLOWANCES

Maximum permissible deflection, in.*

Size of pipe, in.	push-on joint	Mechanical joint
4	19	31
6	19	27
8	19	20
10	19	20
12	19	20
14	11	13-1/2
16	11	13-1/2
18	11	11
20	11	11
24	11	9
30	11	9
36	11	8
42	7-1/2	7-1/2
48	7-1/2	7-1/2
54	5-1/2	--

*Maximum permissible deflection for 18-ft. lengths; maximum permissible deflections for other lengths shall be in proportion of such lengths to 18 ft.

6. When mechanical joint, push-on joint or similar pipe is laid, the bell of the pipe shall be cleaned of excess tar or other obstructions and wiped out before the cleaned and prepared spigot of the next pipe is inserted into it. The new pipe shall be shoved firmly into place until properly seated and held securely until the joint has been completed.

B. Castings

1. Castings to be encased in masonry shall be accurately set with the bolt holes, if any, carefully aligned.
2. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign material.

C. Temporary Plugs

1. At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed.

D. Appurtenances

1. Valves, fittings and appurtenances shall be set and jointed as indicated on the drawings.

3.06 ASSEMBLING

A. Push-On Joints

1. Make up by inserting the gasket into the groove of the bell and applying a thin film of special nontoxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe.
2. The chamfered end of the plain pipe shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket.

B. Bolted Joints

1. Before the pieces are assembled, rust-preventive coatings shall be removed from machined surfaces.
2. Pipe ends, sockets, sleeves, housings, and gaskets shall be thoroughly cleaned and all burrs and other defects shall be carefully smoothed.

C. Mechanical Joints

1. Surfaces against which the gasket will come in contact shall be thoroughly brushed with a wire brush prior to assembly of the joint. The gasket shall be cleaned. The gasket, bell, and spigot shall be lubricated by being washed with soapy water.
2. The gland and gasket, in that order, shall be slipped over the spigot, and the spigot shall be inserted into the bell until it is correctly seated.
3. The gasket shall then be seated evenly in the bell at all points, centering the spigot, and the gland shall be pressed firmly against the gasket.
4. After all bolts have been inserted and the nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint to the proper tension, preferably by means of a torque wrench.
5. The correct range of torque as indicated by a torque wrench and the length wrench (if not a torque wrench) used by an average man to produce such range of torque, shall not exceed the values specified in the tabulation titled TORQUE RANGE VALUES.

TORQUE RANGE VALUES

Nominal pipe size, in.	Bolt diameter, in.	Range of torque, ft.-lb.	Length of wrench, in.
3	5/8	40-60	8
4 thru 24	3/4	60-90	10
30, 36	1	70-100	12
42, 48	1-1/4	90-120	14

If the effective sealing of the joint is not attained at the maximum torque indicated above, the joint shall be disassembled and thoroughly cleaned, then reassembled. Bolts shall not be over stressed to tighten a leaking joint.

D. Restrained Joints

1. Install in accordance with manufacturers written instructions.
2. Do not exceed manufacturer's permissible pipe deflection allowance.

E. Sleeve Type Couplings

1. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8-inches
2. Soapy water may be used as a gasket lubricant.
3. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-inches from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint.
4. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid.
5. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.
6. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts. The correct torque as indicated by a torque wrench shall not exceed the manufacturers recommended values
7. After assembly and inspection and before being backfield, all exterior surfaces of buried sleeve-type couplings, including the middle and follower rings, bolts, and nuts, shall be thoroughly coated with an approved heavy-bodied bituminous mastic. Care shall be taken and appropriate devices used to ensure that the undersides, as well as the more readily accessible parts, are well coated.

3.07 VALVES, HYDRANTS AND APPURTENANCES

A. Install in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

1. Contractor to maintain pressure differential at all Division Valve locations during water main work.

3.08 TAPPING SLEEVES AND VALVES

A. Install in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

3.09 SERVICE CONNECTIONS

A. Install in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

3.10 PIPING SUPPORT

A. Where necessary, bends, tees, and other fittings in pipelines buried in the ground may be backed up with Class B concrete placed against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then restraining devices shall be provided.

3.11 CLEANING

A. Prior to the pressure and leakage tests, thoroughly clean piping of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to avoid damage to linings and coatings.

3.12 METALIZED DETECTABLE IDENTIFICATION TAPE

A. Install in accordance with the Pawtucket Water Supply Board, Specifications for Water Main and Service Materials, revised April 2013.

3.13 TESTING

A. Except as otherwise directed, pipelines shall be given combined pressure and leakage tests in sections of approved length.

B. Furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gages, relief valves, other necessary equipment; and all labor required.

C. Subject to approval and provided that the tests are made within a reasonable time considering the progress of the project as a whole, and the need to put the section into service, the Contractor may make the tests when he desires.

D. However, pipelines to be embedded in concrete shall be tested prior to placing of the concrete and exposed piping shall be tested prior to field painting.

E. Unless it has already been done, 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 hydrants or blow offs are not available at high points for releasing air the Contractor shall make the necessary excavations and do the necessary backfilling and make the necessary taps. After completion of the tests, if directed by the Program Manager/Construction Manager, remove corporations and plug said holes.

F. 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.

G. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test and corrected to the gage location) to a pressure in pounds per square inch numerically equal to the pressure

rating of the pipe but not to exceed 200 psi. Do not apply this pressure to items of equipment known to be incapable of withstanding such pressure.

H. If the Contractor cannot achieve the specified pressure and maintain it for a period of **one** hour with no additional pumping, the section shall be considered as having failed to pass the test.

I. 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 his 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 and is considered acceptable by the Program Manager/Construction Manager.

J. If, in the judgment of the Program Manager/Construction Manager, it is impracticable to follow the foregoing procedure exactly for any reason, modifications in the procedure may be made as required and approved by the Program Manager/Construction Manager, but in any event the Contractor shall be fully responsible for the ultimate tightness of the line within the above leakage and pressure requirements.

K. All testing to be witnessed by the Program Manager/Construction Manager.

3.14 DISINFECTING AND FLUSHING OF PIPELINES

A. The Contractor shall disinfect the lines carrying potable water.

B. Furnish all equipment and materials necessary to do the work of disinfecting, and shall perform the work in accordance with the procedure outlined in the AWWA Standard C651 except as otherwise specified herein.

C. Upon completion of installation and testing, the Contractor shall disinfect all water mains in the following manner:

1. Pipes shall be completely filled with water, all air released, and then thoroughly flushed out in the amount of twice the capacity of the section to be treated. Chlorine gas shall be introduced into the main near the point of water supply, in the concentration of 100 parts of available chlorine per million parts of water. The main shall then be wasted or bled from the extreme end opposite to the point of application of the disinfecting solution has reached the end opposite to the point of application in the concentration of not less than fifty (50) parts available.
2. Close all gates. Leave the disinfecting solution in the mains under full pressure for a period of not less than 48 hours. The entire section shall then be flushed through Sulphur Dioxide Gas, which neutralizes Chlorine, until all traces of chlorine are removed from the water main.
3. The Owner shall then take a sample, and perform laboratory analyses to determine the effectiveness of treatment. **Two sets of samples should be taken at least 24 hours apart and analyzed for total coliform and heterotrophic plate count.**
4. Repeatedly treat any section of main that fails to meet laboratory standards until the desired results are obtained.

D. Particular attention is directed to the requirement that a double check valve installation shall be made in the water supply to the main under treatment, to prevent possible backflow or siphonage of treated solution into the distribution system in service.

E. Bacteriological sampling and testing shall be done in accordance with AWWA C651 and this specification for each main and each branch. Sampling shall be accomplished with the use of hose or fire hydrants. A corporation stop installed on the main, with a removable copper tube gooseneck assembly, is the recommended method.

F. Permission of the Owner must be obtained by the Contractor before any main is placed into service.

G. Dispose of the water used in disinfecting and flushing in an approved manner.

END OF SECTION

SECTION 02668

TEMPORARY POTABLE WATER BYPASS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements to furnish, install, disinfect, maintain and remove temporary potable water bypass pipe, connections, laterals and services required to adequately serve water customers.
2. The work includes excavation and backfilling, constructing ramps and/or burying piping at driveways and other access ways, replacement of temporary and permanent pavement, restoration of public and private property.

B. Related Sections

1. Section 01570 – Traffic Regulations
2. Section 02200 - Earth Excavation, Backfill, Fill and Grading
3. Section 02500 - Pavement
4. Section 02665 – Domestic Water Systems

1.02 SYSTEM DESCRIPTION

A. Design Requirements

1. The Contractor shall review the City of Pawtucket's water plans, available at the office of the Pawtucket Water Supply Board, to determine the extent of the by-pass, especially where dead ends and division gates may require bypass piping. No additional payment shall be considered for the extension of bypass to feed services fed from dead ended pipe or pipe where flow is interrupted by a division gate. This may or may not be noted on the plan. In either case the Contractor is responsible for determining the locations of all dead ends and all locations which require bypass piping.
2. The Contractor shall provide coordination with Pawtucket Water Supply Board and as needed, obtain approval or any necessary permits with Pawtucket Water Supply Board.
3. The number of temporary hydrants to be installed within the bypass piping system shall be equal to the number of hydrants existing within that system.
4. The Contractor shall provide temporary services for the customers whose permanent service line is:
    a. Out of service due to the main pipe to which it is connected to is being replaced.

b. Out of service due to the main pipe to which it is connected to is being served only by the main being rehabilitated or replaced, including dead end pipes and pipes ending at division gates.
c. Out of service for any other reason in connection with work under this contract.

5. The bypass shall not be less than the sizes indicated in these specifications and in any case not less than 2-in. diameter. All temporary hydrants must be feed by either an in service hydrant or a direct connection to an underground water main with 4-in. temporary bypass piping.
6. Water for the temporary connection shall be from Owner's nearest available hydrants remaining in service.

B. Performance Requirements

1. The pipe and appurtenances utilized for temporary connections shall be suitable for potable water transmission and distribution and be capable of withstanding a service pressure of 150 psi.
2. The Contractor shall have readily available sufficient additional quantity of bypass pipe, connections, lateral and service material of suitable sizes to replace or supplement the temporary facilities in the event these prove inadequate in any way.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals,

1. Proposed layout plan and operations schedule for installing and removing temporary bypass, connections, services, valves and temporary hydrant locations.
2. Details of the installation, operation, maintenance, testing, disinfection and removal of temporary facilities including bypass, connections, laterals, customer services and customer connections and temporary fire hydrants.
3. List of materials with sizes for temporary bypass, connections and services.
4. The Contractor shall submit and obtain approval from the Engineer, for the temporary by-pass system prior to start of construction.

1.04 QUALITY ASSURANCE

A. The Engineer's permission will be required for bypass pipelines, connections, services, and laterals to be laid across streets.

B. The Engineer's permission will be required to remove permanent customer services, laterals and water mains from normal services and to return these to normal service.

C. Safety

1. The proposed temporary connections shall be capable of preventing contamination of contiguous potable water distribution system and services.
2. The Contractor shall coordinate and cooperate with the Owner's water utility and fire department to maintain water distribution and fire protection capability.

3. The Contractor shall be responsible to ensure that all precautions have been taken for public safety considerations.
4. The Contractor's attention is directed to requirements within the Specifications regarding water supply for Contractor's operations.
5. The Contractor's attention is directed to requirements of Section 01570 regarding traffic control.

PART 2 PRODUCTS

2.01 MATERIALS

A. All pipes, fittings, hoses, connections, and valves suitable for potable water services shall be capable of supplying a service pressure of a minimum of 150 psi and have prior approval of the Engineer.

1. All hose must be NSF approved.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contract Drawings provide the size and location of most known fire pipes on the main streets impacted by the construction. The Contractor shall become familiar with the existing water systems and be responsible for the adequate temporary feed of all fire service lines.

3.02 PREPARATION

A. The Contractor shall obtain all street opening permits required by the Town and/or State if applicable.

B. The Contractor shall notify the Owner, the Owner's water utility and the fire department 48 hours in advance of the time of connecting and disconnecting temporary and permanent facilities so that representatives of the Owner's water utility and fire department may be present at installation or removal of permanent and temporary connections and to permit the Owner to inform customers and users as the Owner deems necessary.

3.03 OPERATION OF EXISTING VALVES

A. In accordance with Specification Section 02665, 3.02, Operation of Valves.

3.04 INSTALLATION

A. The Contractor shall furnish, install, maintain and later remove devices necessary to ensure public safety as required and as approved.

B. Excavation and backfill in accordance with Section 02200.

C. The Contractor shall not operate the Owner's valves, stops and hydrants without the Owner's prior approval.

D. Temporary bypass, connections, laterals, and customer services shall not be installed across streets except as permitted and approved by the Engineer.

E. Water main laterals that are to remain in service shall be connected to the temporary bypass.

F. Work on existing water mains to be in accordance with Section 02665.

G. The bypass shall be laid out of the traveled way in a manner as to protect the bypass piping from damage. Whenever possible the temporary bypass shall be laid in the gutter unless otherwise directed by the Engineer.

H. Where bypass has received prior approval to cross streets and street intersections, it must be valved on both sides and should be laid in a trench with temporary pavement placed over it except as permitted otherwise, in writing by the Engineer.

I. Where the bypass crosses driveways and similar access ways to properties, suitable ramp shall be constructed of cold patch to allow driving and passing over the pipe except where the Engineer requires bypass to be laid in a trench with temporary pavement placed over it. All 6-inch bypass crossing driveways, handicap ramps and similar access ways shall be buried to a minimum depth of 3” or as directed by the Engineer.

J. The bypass shall have shut off valves approximately every 400 feet.

K. During freezing, stormy and inclement weather, no work shall be done except work incidental to temporary connections or as directed by the Engineer.

L. Backflow device shall be installed at all feed hydrants.

M. Contractor to maintain pressure differential in the by pass system similar to the existing water system as delineated by the Division Valves as shown on the Utility Drawings.

3.05 HYDRANTS

A. The Contractor shall keep existing fire hydrants in service and make appropriate connections to the bypass or install and maintain temporary fire hydrants adjacent to each existing fire hydrant affected by work until the existing fire hydrants are restored to services. All hydrants temporarily out of service shall be bagged.

B. At locations where hydrants are out of service due to work under this contract, the Contractor shall provide temporary hydrants. A hydrant being used to feed temporary hydrants must be fed by a 4-inch bypass pipe including whip connections.

C. The Contractor shall provide each temporary fire hydrant with individual valve control.

D. The temporary fire hydrants which the bypass is connected to for the temporary water supply shall be flushed satisfactorily prior to making connections to prevent stagnant or discolored water from entering the bypass.

E. The existing hydrants which the bypass is connected to for the temporary water supply shall be flushed satisfactorily prior to making connections to prevent stagnant or discolored water from entering bypass. A separate valved connection from the steamer/pumper nozzle (4”) must be supplied for fire service.

3.06 TEMPORARY SERVICE CONNECTIONS

A. The Contractor shall furnish, install, maintain and later remove the temporary service connections from the bypass to each building and service required to be supplied by the water main to be removed from service.

B. Temporary connections shall be laid out of the traveled and access ways where possible.

C. Temporary service connections shall be ramped or installed in a trench where directed and approved by Engineer.

D. Temporary service connections shall be of equal size than the permanent service connections.

E. The Contractor shall install and maintain pressure regulators for temporary services where necessary.

F. The installation and removal of temporary service connections and back cleaning of permanent services shall take place only at times when the work can be observed by the Engineer and other representatives of the Owner.

G. The Contractor shall coordinate and cooperate with the service user and the Owner's water utility and fire department to assure the minimum disturbance to the user's fire protection system and other special and automated use.

H. The temporary service connections shall be made to the user's service line at the sill cock or other convenient and reasonable point or where acceptable to Engineer.

I. Temporary “wye” fittings must be supplied at the sill cock to accommodate use of garden hoses, etc.

3.07 TESTING

A. The temporary connections shall be tested to be shown to be of sufficient pressure and without leaks as demonstrated to the Engineer.

B. If the bypass proves inadequate for the temporary service, the Contractor shall replace or supplement the bypass as appropriate to provide adequate temporary service, including replacement with a larger diameter bypass, and as approved by the Engineer.

3.08 DISINFECTION AND FLUSHING PIPELINES

A. Disinfect temporary facilities prior to use to Owner and Engineers satisfaction in accordance with Specification Section 02665, 3.14, Disinfecting and Flushing of Pipelines.

B. Contractor shall demonstrate that all valves are operational prior to activation and there is an adequate supply of on site replacement material.

3.09 MAINTENANCE

A. The Contractor shall be responsible for providing labor, materials, and equipment on a twenty-four (24) hour stand-by status to maintain continuous water service to all PWSB costumers (connected to the temporary potable water bypass) no additional cost to the Owner. Any service interruptions, whether caused by defective piping, pipe jointing or other components; physical damage by vehicles; vandalism; frost action; or other unforeseen reasons, shall be immediately corrected and repaired so as to restore the temporary service to all PWSB customers as soon as possible.

3.10 RESTORATION

A. After water mains are returned to service, the Contractor shall remove all temporary facilities not required for remaining work, and restore and clean up affected areas.

B. Pavement restoration to be in accordance with Section 02500.

END OF SECTION

SECTION 02720

CATCH BASINS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Requirements to construct, adjust abandon, or rebuild all catch basins as indicated on the drawing and as specified.

B. Related Sections
1. Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).
1. A48, Specification for Gray Iron Castings.
2. C32, Specification for Sewer and Manhole Brick (Made from Clay or Shale).
3. C139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
4. C150, Specification for Portland Cement.
5. C207, Specification for Hydrated Lime for Masonry Purposes.
6. C478, Specification for Precast Reinforced Concrete Manhole Sections.

1.03 DESIGN REQUIREMENTS

A. Catch basins shall conform in shape, size, dimensions, materials, and other respects to the details indicated on the drawings or bound in the specifications or as ordered by the Program Manager/Construction Manager.

PART 2 PRODUCTS

2.01 MATERIALS

A. Catch basin walls shall be precast concrete masonry units. The top of the cone (not to exceed 6 inches.) shall be built of brickwork to permit adjustment of the frame to meet the finished surface.

B. Catch basin sumps shall be one piece precast concrete or concrete masonry units on cast-in-place or precast concrete bases.

C. The cast-iron frames and grates shall be the standard as indicated on the drawings.

D. All cast-in-place concrete shall be 4,000 psi and shall conform to the requirements specified under SECTION 03300.

2.02 PRECAST CONCRETE MASONRY UNITS

A. Precast concrete masonry units shall be machine-made solid segments, conforming to ASTM C139 with the following exceptions and additional requirements:
1. Type II cement shall be used except as otherwise permitted.

2. The width of the units shall be as indicated on the drawings.
3. The inside and outside surfaces of the units shall be curved to the necessary radius and so designed that the interior surfaces of the structures shall be cylindrical, except the top batter courses shall be designed to reduce uniformly the inside section of the structure to the required size and shape at the top.
4. Units shall be designed such that only full-length units are required to lay any one course.
5. Acceptance of the units will be on the basis of material tests and inspection of the completed product.

2.03 PRECAST CONCRETE SUMPS

A. Precast concrete sumps shall conform to the ASTM C478, with the following exceptions and additional requirements:
   1. The wall section shall be not less than 6-inch thick.
   2. Type II cement shall be used except as otherwise permitted.
   3. Sumps shall be cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 130 degrees F. for a period of not less than 12 hours or, when necessary, for such additional time as may be needed to enable the sections to meet the strength requirements.
   4. No more than two lift holes may be cast or drilled in each sump.
   5. Acceptance of the sumps will be on the basis of material tests and inspection of the completed product.

B. All holes in sumps used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose or with mortar. The mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

2.04 BRICKS

A. The brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Program Manager/Construction Manager. Brick shall conform to ASTM C32 for Grade SS, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight.

B. Rejected brick shall be immediately removed from the work.

2.05 MORTAR FOR BRICKWORK

A. The mortar shall be composed of Portland cement, hydrated lime, and sand, in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as directed and may vary from 1:1/4 for dense, hard-burned brick to 1:3/4 for softer brick. In general, mortar for Grade SS Brick shall be mixed in the proportions of 1-1/2:4-1/2.

B. Cement shall be Type II Portland cement conforming to the ASTM C150.

C. Hydrated lime shall be Type S conforming to the ASTM C207.

D. The sand shall comply with the specifications for fine aggregate, specified in Section 03300, except that all of the sand shall pass a No. 8 sieve.

2.06 MORTAR FOR MASONRY UNITS

A. Mortar shall be composed of one part portland cement and two parts of sand by volume with sufficient water to form a workable mixture. Cement and sand shall be as specified for mortar for brickwork.

2.07 CATCH BASIN FRAMES AND GRATES

A. Furnish and install all cast-iron catch basin frames and grates conforming to the details indicated on the Drawings and as specified.

B. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sand holes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of grates and frame seats shall be machined to prevent cocking of grates.

C. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

D. Castings shall be at least Class 25 conforming to the ASTM A48.

E. Unless otherwise specified or indicated on the drawings, castings in paved areas shall be capable of withstanding AASHO H-20 loading and shall meet the requirements of the municipality in which they are installed.

2.08 CURB INLETS

A. Granite for curb inlets shall have a horizontal bed. The stone shall be sawn or peen hammered on top, and the front and back edges shall be pitched true to line. The back face for a distance of 3-inches down from the top shall have no projection greater than 1 inch. The front face shall be straight split, free from drill holes, and it shall have no projection greater than 1-inch or depression greater than 1/2 inch for a distance of 10-inch down from the top, and for the remaining distance there shall be no depression or projection greater than 1 inch. The ends shall be squared with the top for the depth of the face finish and so cut that the curb inlet can be set with joints of not more than 1/2 inch.

B. Granite curb inlet shall be, 3 ft. minimum in length, plus or minus 1/2 inch, from 17 to 19 inches in depth, 7 inch wide at the top and at least 7 inches wide at the bottom.

C. A gutter mouth at least 3 inches in depth and at least 2 feet in length shall be cut in the front face of the stone as shown on the plans.

D. Where curb inlets are used to replace a section of existing curbing, the width of the curb inlet shall be the same as the adjoining existing curbing.

PART 3 EXECUTION

3.01 LAYING BRICKWORK AND GRADING RINGS

A. Only clean bricks and grading rings shall be used. Bricks shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.

B. Each brick shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded as directed.

C. Each grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

3.02 PLASTERING AND CURING BRICK MASONRY

A. Outside faces of brick masonry shall be plastered with mortar from 1/4 in. to 3/8 in. thick. If required, the masonry shall be properly moistened prior to application of the mortar. The plaster shall be carefully spread and troweled. After hardening, the plaster shall be carefully checked by tapping for bond and soundness. Unbounded or unsound plaster shall be removed and replaced.

B. Brick masonry and plaster shall be protected from too rapid drying by the use of burlaps kept moist, or by other acceptable means, and shall be protected from the weather and frost, all as required.

3.03 SETTING CASTINGS

A. Curb inlets and frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings or directed. Circular frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

B. Grates shall be left in place in the frames on completion of other work at the manholes.

3.04 CATCH BASINS ADJUSTED TO GRADE

A. Existing catch basin tops shall be adjusted to line and grade as indicated on the drawings or as directed by the Program Manager/Construction Manager.

B. All catch basins adjusted to grade shall be provided with concrete grading rings or brick as specified for new drain manholes.

3.05 REBUILDING OF EXISTING CATCH BASIN

A. Cut suitable openings in existing structures to make connections to drains as indicated on the drawings and as specified or directed. In doing so, confine the cutting to the smallest amount possible consistent with the work to be done.

B. After the drains are installed, carefully fit around, close up, and repair the structures watertight, all as acceptable to the Program Manager/Construction Manager.

C. Prior to starting work, assembled all tools, materials, and construction equipment required to complete the work in the shortest possible time.

END OF SECTION

SECTION 02750

ABANDONMENT OF EXISTING SEWERS AND DRAINS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for abandoning existing combined sewers, sanitary sewers, storm drains and structures as indicated on the Drawings and as specified.

B. Related Sections

1. Section 02149 – Maintaining Existing Flow
2. Section 02224 – Controlled Density Fill
3. Section 03300 – Cast-in-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C32, Standard Specification of Sewer and Manhole Brick (Made from Clay or Shale), AASHTO Designation M91-42, Red Sewer Brick Only Grade SS.
2. C144, Standard Specification for Aggregate for Masonry Mortar.
3. C150, Standard Specification for Portland Cement.
4. C207, Standard Specification for Hydrated Lime for Masonry Purposes.

1.03 SUBMITTALS

A. Shop Drawings

1. In accordance with Specification SECTION 01300 - SUBMITTALS.

B. Samples

1. Provide representative samples of materials if requested by the Program Manager/Construction Manager.

PART 2 PRODUCTS

2.01 PLUGS

A. General

1. Plugs shall meet the following thickness requirements:

Sewer/Drain Diameter	Thickness of Plug	
	Concrete	Brick & Mortar
15-inch and less	12-inch	8-inch
15 to 30-inch	24-inch	16-inch
Greater than 30-inch	36-inch	24-inch

2. For non-circular pipes, the largest cross-sectional dimension shall govern in determining the size of the plug.
3. Bricks with more than one layer of thickness shall be interlocked.
4. Mechanical plugs will not be allowed.

B. Cement

1. Minimum 4,000 psi cement concrete materials in accordance with Section 03300, or brick masonry.

C. Brick

1. Sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Program Manager/Construction Manager.
2. In accordance with ASTM C32, Red Sewer Brick Only Grade SS.
3. In accordance with AASHTO M91-42, Red Sewer Brick Only Grade SS.

D. Mortar for Brickwork

1. Composed of Portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volume of cement and lime.
2. The proportions of cement and lime shall be 1:1/2.
3. Cement shall be Type II Portland cement in accordance with ASTM C150.
4. Hydrated lime shall be Type S conforming to the ASTM C207.
5. Hydrated lime shall be "Mortaseal" manufactured by U.S. Gypsum or
6. "4X Hydrate" manufactured by the New England Lime Company or
7. An acceptable equivalent product.
8. The sand shall conform to ASTM C144.

E. Pipe Fill Material

1. Class II Controlled Density Fill (excavatable fill, very flowable)

PART 3 EXECUTION

3.01 INSTALLATION

A. Plugs

1. Plug existing combined sewers, sanitary sewers and storm drains, as indicated on the Drawings and as specified.
2. Plugs shall withstand the full soil and groundwater pressure.
3. Pipe entering a manhole or catch basin that are to be abandoned shall have a plug installed that is flush with the interior of the structure.
4. Pipes to be abandon that enter the sewer at a manhole, shall be plugged at the manhole.
5. When man entry permits, lines indicated to plugged at the main, should be plugged from inside of the combined sewer.
6. Sewer and drain services 6-inches or 8-inches in diameter shall be plugged with a precast concrete plug. Such plugs shall be made watertight with an application around the plug of an approved watertight compound.

B. Pipe Fill

1. Existing combined sewers, sanitary sewers and storm drains to be abandoned that are greater or equal to 12-inches in diameter shall be abandoned, plugged and filled with Class II Controlled Density Fill (excavatable fill, very flowable). Fill a minimum of 95% of the total inside volume of the pipe.
2. Existing combined sewers, sanitary sewers and storm drains to be abandoned that are less than 12-inches in diameter shall be abandoned and plugged, but not filled.
3. Underdrains shall be filled if indicated on the Drawings
4. Additional excavations required to facilitate filling shall be the responsibility of the Contractor.

C. Manhole and Catch Basin Fill

1. Clean structure of all special waste and debris.
2. Plug pipelines entering structure as specified above.
3. Remove and dispose frame and cover and all concrete and masonry to a minimum depth of four (4) feet below existing ground surface.
4. Bottom of structure to be core drilled, drilled or broken to allow unrestricted migration of groundwater through the structure.
5. Fill remaining structure with compacted sand.

6. Backfill excavation in accordance with Section 02200.

END OF SECTION

SECTION 02763

PIPELINE CLEANING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for cleaning and TV inspection of sewer pipes.

B. Water for Construction

1. The Owner shall supply all water required by the Contractor for the pipeline cleaning. The Contractor must coordinate acceptable supply locations and contact the Owner in advance prior to use of any water for the Project.

C. Related Sections

1. Section 01570 – Traffic Regulations
2. Section 02149 – Maintaining Existing Flow
3. Section 02764 – Television Inspection
4. Section 02767 – Disposal of Materials
5. Section 09907 – Geopolymer Lining System

1.02 REFERENCES

A. National Association of Sewer Service Companies

1. NASSCO Recommended Specifications for Sewer Collection System Rehabilitation.

1.03 CLEANING AND DISPOSAL REQUIREMENTS

A. The Contractor's attention is directed to the requirements set forth by the State of Rhode Island Department of Environmental Management regarding "Special Wastes" and the proper disposal thereof. All waste materials and debris, as designated by the Owner and/or Engineer including but not limited to any pump station, sewers and associated structures, or any portions thereof, including but not limited to sludge, grit sediment, dirt, sand, rock, grease, roots and other liquid, solid or slime-solid material contained therein, shall be considered, "Special Wastes".

B. Remove dirt, grease, rocks, sand, iron tuberculation and other materials and obstructions from the pipeline.

C. Pipeline Cleaning shall be performed by hydraulically propelled or high velocity jet cleaning equipment. Selection of equipment shall be based on such field conditions as access availability and type of debris to be removed.

D. Clean pipeline to restore a minimum of 95 percent of the original carrying capacity of the pipe, and suitably to permit lining of the pipeline.

E. The Contractor is required to test and dispose of any waste material removed from the pipeline in accordance with State and Federal requirements. Testing of waste material will be at the Contractor's expense.

F. The Contractor shall notify the Engineer of the proposed disposal location and requirements of that disposal facility to allow disposal of waste material.

G. The Contractor is required to store any waste material until all testing requirements of the proposed facility have been met and shall submit copies of all test results to the Engineer.

1.04 SUBMITTALS

A. Submit in accordance with Specification Section 01300.

1. Provide detailed plans and descriptions outlining cleaning and television inspection procedures and all provisions and precautions regarding the handling of existing sewage flows.

1.05 QUALITY ASSURANCE

A. Perform general work in accordance with NASSCO recommended specifications for sewer collection system rehabilitation.

1.06 QUALIFICATIONS

A. Company specializing in performing the work of this section with minimum of three (3) years experience.

1.07 TRAFFIC CONTROL

A. In accordance with Specification Section 01570.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.01 CLEANING PROCEDURES

A. Sewer Cleaning

1. The designated pipelines shall be cleaned using hydraulically propelled or high velocity jet cleaning equipment.
2. Selection of the equipment used shall be based on the conditions of the lines at the time the work commences.

3. Equipment and methods selected shall be satisfactory to the Engineer.
4. Equipment selected for cleaning shall be capable of removing dirt, grease, rocks, sand, iron tuberculation and other deleterious materials and obstruction from the pipelines.

B. Material Removal

1. Sludge, dirt, sand rocks, grease and other solid or semi-solid material resulting from the cleaning operation shall be removed at the downstream manhole of the section which could cause line stoppages.

C. Disposal of Materials

1. Solids or semi-solids resulting from the cleaning operations shall be removed from the site and disposed in accordance with Specification Section 02767.

D. Cleaning Precautions

1. During all pipeline cleaning operations, satisfactory precautions shall be taken to protect the pipelines from damage that might be inflicted by the improper use of cleaning equipment.
2. Whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force or any tools which retard the flow of water in the pipeline are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property.
3. The flow of sewage in the sewer lines shall be utilized to provide necessary pressures by hydraulic cleaning devices whenever possible.
4. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily.
5. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant nor shall a hydrant be used for the purpose described unless a vacuum break is provided.

E. Pumping and flow bypassing

1. The Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow of sewage around the pipeline section in which work is to be performed.
2. Handling existing sewage flows and bypass pumping shall be in accordance with Specification Section 02149.

F. Flow Control Precautions

1. Whenever flows in a sewer line are blocked, plugged or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might be inflicted by excessive sewer surcharging.
2. Further, precautions must be taken to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.
3. Coordination with private property owners is required.

3.02 FIELD QUALITY CONTROL

A. After cleaning, the sewer pipes shall be visually inspected by means of closed-circuit television. The inspection shall be recorded on DVD's and printed TV inspection logs in accordance with Specification Section 02764.

B. After videotaping the cleaned pipeline, any pipe not sufficiently cleaned shall be cleaned again to obtain satisfactory results at no additional cost to the Owner.

C. Provide two digital video disks (DVDs), one original and one copy to document conditions following completion of the cleaning process.

END OF SECTION

SECTION 02764

TELEVISION INSPECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for television inspection of pipelines.

B. Related Sections

1. Section 01570 – Traffic Regulations
2. Section 02149 – Maintaining Existing Flow
3. Section 02763 – Pipeline Cleaning
4. Section 09907 – Geopolymer Lining System

1.02 REFERENCES

A. National Association of Sewer Service Companies

1. NASSCO Recommended Specifications for Sewer Collection System Rehabilitation.

1.03 SUBMITTALS

A. In accordance with Specification Section 01300, submit the following:

1. Outline of the procedures proposed to accomplish the work. Include a detailed description of the methods and equipment to be used for each operation. Outline TV inspection procedures and all provisions and precautions regarding the handling of existing sewage flows.

1.04 QUALITY ASSURANCE

A. Perform general work in accordance with NASSCO Recommended Specifications for Sewer Collection System Rehabilitation.

B. Utilize Pipeline Assessment and Certification Program (PACP) certified inspectors and PACP coding methods for all CCTV inspections.

1. Provide evidence of PACP certification for all operators working on the project prior to commencement of the Work.

1.05 QUALIFICATIONS

A. Company specializing in performing the work of this section with minimum five (5) years documented experience.

B. Field Technicians must maintain current certifications for OSHA regulation, 29 CFR 1910 for Confined Space.

PART 2 PRODUCTS

2.01 DELIVERABLES

A. TV Inspection Logs:

1. Printed location records clearly showing the location, in relation to an adjacent manhole of each infiltration point observed during inspection and other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, deposits, areas which exhibit loss of capacity, or other defects and other discernible features.
2. Logs shall be software generated, complete with the following information,
    a. Upstream and downstream manhole identification numbers.
    b. Address location.
    c. Technicians name.
    d. Inspection date/time and weather conditions.
    e. DVD number.
    f. Use of pipe (sanitary, storm, combined).
    g. Type, shape, dimensions and material of pipe.

B. DVD Recordings:

1. Color video and audio record documenting TV inspection of conditions subsequent to cleaning.
2. The purpose of recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed.
3. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor.
4. Title to the tape shall remain with the Contractor; however, the Owner reserves the right to purchase any additional DVD's at the completion of the project.
5. Provide two (2) sets of DVD's complete in the required format.

C. PACP and Hansen/Neztek compliant software for documenting the inspection is to be used.

1. Viewing software to be WinCan, or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Control traffic in accordance with Specification Section 01570.

B. Bypass sewage flow to allow performance of work. Handling existing sewage flows and bypass pumping shall be as specified in Specification Section 02149.

C. Clean sewer lines in accordance with Specification Section 02763.

3.02 TV INSPECTION

A. TV inspect sewer pipes following initial cleaning and following rehabilitation work prior to putting the line back in service.

B. After cleaning, the sewer pipes shall be visually inspected by means of color closed-circuit television. The inspection shall be recorded on DVD and printed TV inspection logs.

C. Equipment:

1. Television Camera to be specifically designed and constructed for such inspection; equipped with a light to allow a clear picture of the entire periphery of the pipe; operative in 100 percent humidity conditions; and equipped with manual or power winch, TV cable, powered rewinds or other devices that do not obstruct the camera view to move the camera through the line.
2. Camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. At areas of interest, the camera shall be capable of rotating its lens 360-degrees to obtain a clearer, more direct viewing angle. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.
3. Camera, television monitor, recording device and all other components of the video system shall be capable of producing picture quality acceptable to the Engineer.
4. TV inspection equipment shall be equipped with a meter device to locate defects by measurement. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be acceptable to the Engineer.
5. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to ensure good communication between members of the crew.

D. If, during the inspection operation, the television camera will not pass through the entire manhole section, set up equipment so that the inspection can be performed from the opposite manhole.

3.03 FIELD QUALITY CONTROL

A. TV Inspection Records

1. Complete records shall be kept of TV inspection performed in each manhole section. The records shall identify the following information:

   a. Identification of the manhole section tested.
   b. Location (footage) of problem.
   c. Defect classifications shall be PACP compliant.

2. Record on DVD all footage inside the sewer pipe. All DVD's and necessary playback equipment shall be readily accessible for review by the Engineer during the project.

3. TV inspection logs shall include the numbering or identification system utilized on the Contract Drawings or the Owners database in the event Drawings are not provided.

END OF SECTION

SECTION 02767

DISPOSAL OF MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for disposal of materials resulting from the cleaning of sewer pipes.

1.02 SUBMITTALS

A. In accordance with Specification Section 01300, submit the following

1. Outline of the procedures proposed to accomplish the work.
2. Include a detailed description of disposal methods and locations of disposal.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.01 DISPOSAL PROCEDURES

A. Material encountered in the cleaning of sewer lines is considered “Special Waste” by the State of Rhode Island, Department of Environmental Management. The materials include sludge, sand, grit, debris, etc.

B. The Contractor is required to test and dispose of any waste material removed from pipeline, manholes, etc. within the project area in accordance with State and Federal requirements. Testing of waste material will be at the Contractor’s expense.

C. The materials being removed from the pipelines and manholes during the cleaning process shall be deposited in such a manner as to not endanger the public, plant personnel or persons performing the work. Such debris deposits may be of such nature, high in biological organic contents, or chemically aggressive that they will require proper disposal in a safe, health risk free, environment. The Contractor shall contact the Owner and Engineer and all agencies having jurisdiction thereof, for approval of debris disposal methods and locations of disposal, prior to disposing of any or all debris removed from pipe cleaning methods. All solids or semi-solids resulting from the cleaning operations shall be removed and satisfactorily disposed of off-site at the Contractor’s expense.

D. Debris must be transported in a watertight vehicle. The Contractor must ensure that no water leaks from the vehicle in any manner during the transportation. The Contractor is solely responsible for any cleanup of debris on route to disposal at a licensed disposal facility. The

Contractor is also responsible for the payment of any fines that are incurred as a result of any incident which occurs during the transportation and/or disposal of the contents of the vehicle.

E. Disposal must be at a licensed facility that is regulated to accept and properly dispose of the debris that is normally expected to be in a wastewater collection system.

END OF SECTION

DIVISION 3

CONCRETE

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SECTION 03252

WATERSTOPS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes requirements for,

1. Flexible PVC waterstops at construction, contraction, and expansion joints in new concrete construction as shown on the Contract Drawings.
2. Hydrophilic rubber waterstops at construction joints between new and existing concrete, or where installation of center bulb-type waterstops is not possible.
3. Preparation of existing concrete surfaces where hydrophilic rubber waterstops are to be installed.

1.02 RELATED SECTIONS

A. Section 03250 – Expansion, Construction and Control Joints

B. Section 03000 – Cast-In-Place Concrete

1.03 REFERENCES

A. Except as noted, work shall conform to the latest edition of the following codes specifications and standards:

1. American Society for Testing and Materials (ASTM)
2. Army Corps of Engineers, “Specifications for Polyvinyl chloride Waterstop”, CRD-C572-74

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Manufacturer’s Data: for all types and sizes of waterstops, including but not limited to:
1. Product data and material specifications
2. Installation instructions
3. Accessories including: crosses, tees, splices, fasteners and adhesives

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

B. Installer Qualifications: Qualified to perform work specified by reason of experience or training provided by the product manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store Products in a location protected from dampness, damage, construction activity, dirt, and direct sunlight in strict accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MATERIALS

A. PVC Waterstop

1. Provide flexible PVC waterstop as detailed on the Contract Drawings.
2. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
3. Performance requirements are as follows:
   a. Minimum Tensile Strength, 2000 psi
   b. Specific Gravity, Approx. 1.4
   c. Shore Durometer Type A Hardness , 65 to 80
4. Type: Center bulb with a number of parallel ribs or protrusions on each side of strip center.
5. Corrugated or tapered type waterstops are not acceptable.
6. Thickness: Constant from bulb edge to the outside stop edge.
7. Minimum Weight per Foot of Waterstop:
   a. 0.90 pound for 3/16 inch by 4 inch.
   b. 1.62 pounds for 3/8 inch by 6 inch.
   c. 2.30 pounds for 3/8 inch by 9 inch.
8. Manufacturers of Products:
   a. Greenstreak, Inc., St. Louis, MO; Style 702 (3/16 inch by 4 inch), Style 732 (3/8 inch by 6 inch) and Style 735 (3/8 inch by 9 inch).
   b. Vinylex Corp., Knoxville, TN; No. RB4-316H (3/16 inch by 4 inch), No. RB6-38H (3/8 inch by 6 inch) and No. RB9-38H (3/8 inch by 9 inch).
   c. Vulcan Metal Products, Birmingham, AL; Type 8069 (3/8 inch by 6 inch) and Type 8070 (3/8 inch by 9 inch).
   d. Or approved equal.

B. Hydrophilic Rubber Waterstop

1. Provide hydrophilic rubber waterstop at construction joints between new and existing concrete and as indicated on the Contract Drawings.
2. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
3. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
4. Performance requirements are as follows:
   a. Minimum Tensile Strength (Chloroprene Rubber) 1300 psi
   b. Minimum Tensile Strength (Modified Chloroprene Rubber) 350 psi
   c. Specific Gravity Approx. 1.4

d. Shore Durometer Type A Hardness 45 to 55

5. Manufacturers of Products
   a. Hydrophilic Waterstop:
      1) Greenstreak, Inc., St. Louis, MO; No. CJ-0725-3K.
      2) Adeka Ultraseal North America, distributed by Unique Techniques, Inc., West Coxsackie, NY; No. MC-2010M.
      3) Or approved equal.
   b. Hydrophilic Sealant:
      1) Adeka Ultraseal North America, distributed by Unique Techniques, Inc., West Coxsackie, NY; No. P-201.
      2) Greenstreak, Inc., St. Louis, MO; No. LV-1.
      3) Or approved equal.

2.02 ACCESSORIES

A. PVC Waterstop

1. Provide factory made waterstop fabrications for all changes in direction, intersections, and transitions leaving only straight butt joint splices for the field.
2. Provide hog rings or grommets spaced at 12 inches on center along the length of the waterstop.
3. Provide Teflon coated thermostatically controlled splicing irons for field butt splices.

B. Hydrophilic Rubber Waterstop

1. Provide manufacturer's recommended adhesives for the appropriate field conditions. Provide adhesives for each surface to be adhered to (wet or dry concrete, either rough or smooth).
2. Provide a one-component sealant for sealing exposed cells.
3. Provide manufacturer's recommended adhesive for all splices.

PART 3 EXECUTION

3.01 INSTALLATION

A. PVC Waterstop

1. Field butt splices shall be heat fused welded using a Teflon coated thermostatically controlled waterstop splicing iron at the manufacturer's recommended temperature. Follow approved manufacturer's installation procedures.
   a. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
   b. Allow at least 10 minutes before the new splice is pulled or strained in any way.
   c. Finished splices shall provide a cross-section that is dense and free of porosity.
2. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel. In no case shall the waterstop be bent over inside the keyways.
3. Place concrete and vibrate to obtain impervious concrete in the vicinity of the waterstop area.
4. Joints in footings and slabs:
   a. Ensure that the space beneath PVC waterstop is completely filled with concrete.

b. During concrete placement, make a visual inspection of the entire waterstop area.
c. Limit concrete placement to elevation of waterstop in first pass, vibrate the concrete under the waterstop, lift the waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.
d. Apply procedure to full height of PVC waterstops. Follow similar procedures for joints in walls.

B. Hydrophilic Rubber Waterstop

1. Cut Coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
2. Apply a continuous bead of manufacturer's recommended hydrophilic sealant before fastening waterstop. The waterstop shall be fastened to the existing concrete surfaces with appropriate fasteners as recommended by the waterstop manufacturer.
3. Splices shall be made using the manufacturer's recommended splicing adhesive. Manufacturer's recommended adhesive sealant shall also be applied to all joints after gluing.
4. Seal watertight any exposed cells with appropriate sealant.
5. A continuous bead of manufacturer's recommended hydrophilic sealant shall be applied along the edge of the waterstop.
6. Follow approved manufacturer's installation procedures.
7. Place concrete and vibrate to obtain impervious concrete in the vicinity of the waterstop area. Care shall be taken to avoid displacing waterstop during concrete placement.

3.02 FIELD QUALITY CONTROL

A. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength that is less than 80 percent of parent section.
2. Misalignment of center bulbs, ribs, and end bulbs greater than 1/16 inch.
3. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
4. Misalignment that reduces waterstop cross section more than 15 percent.
5. Visible porosity in the weld.
6. Bubbles or inadequate bonding.
7. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.
8. Charred or burnt material.
9. Inadequate or incomplete bond between hydrophilic rubber waterstop and concrete surface.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing forms, reinforcing steel, concrete and expansion and/or construction joints

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
2. A615, Specification for deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. C31, Practice for Making and Curing Concrete Test Cylinders in the Field.
4. C33, Specification for Concrete Aggregates.
5. C39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. C42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
7. C94, Specification for ready Mixed Concrete.
8. C143, Test Method for Slump of Hydraulic Cement Concrete.
9. C150, Specification for Portland Cement.
10. C172, Practice for Sampling Freshly Mixed Concrete.
11. C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. C260, Test Method for Air-Entraining Admixtures for Concrete.
13. C494, Specification for Chemical Admixtures for Concrete.
14. C920, Specification for Elastomeric Joint sealants.
15. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
16. D1056, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
17. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

B. American Concrete Institute (ACI):

1. ACI 301, Specification for Structural Concrete for Buildings.
2. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
3. ACI 305, Recommended Practice for Hot Weather Concreting.
4. ACI 306, Recommended Practice for Cold Weather Concreting.
5. ACI 315, Building Code Requirements for Reinforced Concrete.
6. ACI 347, Guide to Formwork for Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.

1.03 SUBMITTALS

A. Submit Shop Drawings in accordance with SECTION 01300 for the following:

1. Reinforcing Steel
   a. Furnish in detail and completeness that all fabrication and placement at the site can be accomplished without the use of contract drawings for reference.
   b. Include number of pieces, sizes, and grade of reinforcing steel, accessories, and any other information required for fabrication and placement.
   c. Show joint layout and design
   d. Check structural and site drawings for anchor bolts, anchors, inserts, conduits, sleeves, and any other items which are required to be embedded in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
2. Concrete mix designs.
3. Grout manufacturer/design mix (if included in this section)
4. Manufacturer's data for ancillary materials such as joint fillers and sealants, epoxy bonding compound.

1.04 QUALITY ASSURANCE

A. Selection of testing laboratory in accordance with SECTION 01410.

B. Sample and Test Concrete as follows:

1. Test Specimens: Make, cure and have tested, a minimum of one set of four test specimens from the concrete of each day's pour and for each fifty cubic yards of concrete cast in accordance with ASTM C172, C31 and C39. One cylinder shall be broken after seven days and three cylinders after twenty-eight day.
2. Slump: A slump test shall be made for each truckload of concrete in accordance with ASTM C143. Slumps greater than design mix limit will be grounds for rejection of the concrete.
3. Air Content: An air content test shall be made from each day's pour of concrete by the pressure method in accordance with ASTM C231. Air contents above or below the limits specified will be grounds for rejection of the concrete.
4. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Program Manager/Construction Manager may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Program Manager/Construction Manager at no additional cost to the Owner. The cost of coring will be deducted from the contract amount. Where the Testing Laboratory has taken core cylinders and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Program Manager/Construction Manager at no additional cost to the Owner.
5. The Contractor shall coordinate the date and location of tests with the Program Manager/Construction Manager before any concrete work is started.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Reinforcing steel.

1. Transport to the site, store, and cover in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete or chip protective epoxy coating.
2. Store on the site at all times, a supply of approved reinforcing steel to ensure that there will be no delay of the work.
3. Identification of steel shall be maintained after bundles are broken.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement.

1. In accordance with ASTM C150, Type II of U.S. manufacture.
2. Only one brand of cement shall be used on the project.

B. Aggregates.

1. Fine aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to fines.
2. Coarse aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to maximum sizes hereinafter specified.

C. Air Entraining Agent.

1. In accordance with ASTM C260.

D. Water Reducing Agent.

1. In accordance with ASTM C494 Type A.

E. Microsilica Admixture.

1. Packaged in easily dispersing form.

F. Water.

1. Clean and potable,
2. Free of impurities detrimental to concrete.

G. Reinforcing Bars.

1. New, deformed billet steel bars, in accordance with ASTM A615, Grade 60.

H. Welded Wire Fabric

1. In accordance with ASTM A185.

I. Accessories.

1. Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place.
2. All accessories shall be dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards.

J. Tie wire.

1. 16 gauge or heavier black annealed wire.

K. Form Ties and Spreaders.

1. Standard metal form clamp assemble and plastic cone, of type acting as spreaders and leaving no metal within 1 inch of concrete face.
2. Provide form tie with water stop for all walls to be in contact with earth or liquid.
3. Inner tie rod shall be left in concrete when forms are removed.
4. No wire ties or wood spreaders will be permitted. Use ½" x 1" C.T. plastic cones for sinkages.

L. Form Coatings.

1. Non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface.
2. "Nox-Crete Form Coating" as manufactured by Nox-Crete Company, or approved equal.
3. Coatings containing mineral oils or the non-drying ingredients will not be permitted.

M. Grout.

1. High-strength, non-shrink grout with saltwater resistance.
2. Five Star Special Grout 120 or equivalent.

2.02 CONCRETE STRENGTHS AND PROPORTIONS

A. Cast-in-place concrete shall have the minimum compressive strength at 28 days as indicated on the Drawings.

B. The exact proportions for the mix, including amounts admixture (if any), and water, shall be determined by the concrete supplier.

C. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed not he work, but without permitting the materials to segregate or excess free water to collect on the surface.

D. Air-Entrainment: The air content in all concrete shall be maintained at 5 to 7 percent.

2.03 PREMOLDED JOINT FILLER

A. Bituminous Type.

1. In accordance with ASTM D994 or D1751.

B. Sponge Rubber Type.

1. Neoprene, closed-cell, expanded in accordance with ASTM D1056, Type 2C5, with a compression deflection, 25 percent deflection (limits), 17 to 24 psi (119 to 168 kPa) minimum.

2.04 POURABLE JOINT FILLERS

A. Filler for Nonpotable Water Structures

1. Specific Gravity: Greater than 1.0 for cured, in-place filler.
2. Vertical and Sloped Joints: Furnish gun grade material that will remain as placed in joints and will not run down slope.
3. Suitable for continuous immersion and exposure to liquid being contained in the structure.

2.05 JOINT SEALANTS

A. In slabs.

1. In accordance with ASTM C920 for poured 2-component polyurethane sealant.
2. Sikaflex-2c, as manufactured by Sika Corporation or approved equivalent.

B. In walls.

1. Type II, Class A, compound conforming to Interim Federal Specification TT-S-00227E (3) (COM-NBS) for Sealing Compound; Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
2. Sikaflex-1a, as manufactured by Sika Corporation or approved equivalent.

2.06 EPOXY BONDING COMPOUND

A. The epoxy bonding compound shall be a three-component, solvent-free, moisture-tolerant, epoxy modified, cementitious product specifically formulated as a bonding agent and anti-corrosion coating. The product shall have suitable contact time, fluidity, and application temperature for this type of application.

PART 3 EXECUTION

3.01 FORMWORK

A. Falsework for Forms

1. Build and maintain necessary false work for the forms.

B. Construction of Forms

1. General
   a. Construct in accordance with ACI 347.
   b. Construct of sound material, to the correct shape and dimensions, mortar tight, of sufficient strength, and so braced and tied together that the movement of men, equipment, materials, or placing and vibrating the concrete will not throw them out of line or position.
2. Embedded Items
   a. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   b. Do not embed wood, other than necessary nailing blocks, in concrete.
   c. Extended complete cooperation to suppliers of embedded items in their installation.
   d. Secure information for embedded items from other trades as required.

e. Securely anchored embedded items in correct location and alignment prior to placing concrete.

3. Openings for Items Passing Through Concrete
   a. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   b. Coordination work of this nature in order that there will be no unnecessary cutting and patching of concrete.
   c. Cutting and repairing of concrete as a result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

C. Removing Forms and False work

1. Forms shall not be removed for at least 72 hours after concrete has been placed.
2. Forms shall not be removed until the concrete has attained sufficient strength to insure stability.

3.02 REINFORCING STEEL

A. General

1. Place reinforcing steel in accordance with the drawings and approved shop drawings and the applicable requirements of the CRSI, Manual of Practice.
2. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and the placement of concrete.

B. Reinforcing Steel Supports

1. Support bars on approved plastic or dielectric-coated metal chairs or spacers, accurately placed and securely fastened to forms or steel reinforcement in place.
2. Supply additional bars, whether specifically shown on the drawings or not, where necessary to securely fasten reinforcement in place.
3. Support legs of accessories in forms without embedding in form surface.
4. Spacing of chairs and accessories shall conform to CRSI, Manual of Standard Practice. Accurately space hoops and stirrups and wire to the reinforcement.
5. Permit no lose wood inside forms.
6. Lifting of welded wire fabric into proper position while concrete is being poured rather than supporting fabric on chairs will not be permitted.

C. Placing and Tying

1. Set in place, space, and rigidly and securely tie or wire with tie wire at all splices and at all crossing points and intersections in the positions shown, or as directed.
2. Rebending of bars on the job to accommodate the job to accommodate existing conditions will not be permitted without the written approval of the Program Manager/Construction Manager
3. Points ends of wire ties away from forms.

D. Spacing

1. Minimum center to center distance between parallel bars shall be in accordance with the details on the drawings, or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1½ inches or less than 1½ times the maximum size aggregate.

E. Splices

1. Maximum 50% of steel spliced occurring within lap length.
2. Top bars shall be 1.3 times values given in 3.01.D.5.c.
3. Splice lengths.
   a. #6 bars and smaller: 50-bar diameter
   b. #7 bars and larger: 60-bar diameter

F. Concrete Covering

1. In accordance with ACI 315, except where shown otherwise on drawings.

3.03 CONCRETE

A. Mixing of Concrete

1. All concrete shall be ready-mixed concrete, and shall be mixed and delivered in accordance with ASTM C 94. The batch plant of the concrete producer shall be certified for compliance with the standards established by the National Ready-Mixed Concrete Association.
2. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept to a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.
3. Concrete shall be placed within 90 minutes after cement has been mixed with aggregate or 45 minutes after addition of water and admixtures.
4. No admixtures, except those mentioned in paragraph 2.1 shall be used. Calcium chloride will not be permitted.
5. Truck delivery slips of all concrete delivered to the job shall indicate the quantity and quality of concrete, additives, date and time of batching and delivery, and the location of placement. Delivery slips shall be forwarded to the Program Manager/Construction Manager at the end of each pour.

B. Cold Weather Concreting.

1. In accordance with ACI 306.
2. Concrete shall not be mixed or placed when the temperature is below 40 degrees F, or when conditions indicate that the temperature will fall below 40 degrees F within 72 hours unless precautions are taken to protect the concrete.
3. Concrete temperature shall be maintained, when deposited, at not less than 60 degrees F. Reinforcement, forms, and ground which concrete will contact must be completely free of frost.
4. Concrete and formwork must be kept at a temperature of not less than 50 degrees F. for not less than 96 hours after placing.
5. Calcium chloride shall not be used.

C. Hot Weather Concreting.

1. In accordance with ACI 305.
2. The maximum temperature of the concrete, when deposited, shall be 85 degrees F. If the weather causes the placing temperature to exceed 85 degrees F., the mix shall be cooled by methods approved by the Program Manager/Construction Manager.
3. No concrete shall be deposited when the air temperature is greater than 90 degrees F.

D. Conveying and Placing Concrete.

1. In accordance with ACI 304.
2. Notification: Before placing concrete, forms shall be thoroughly inspected. All chips, dirt, etc., shall be removed, all temporary bracing and cleats taken out, all openings for pipes, etc., properly boxed, all forms properly secured in their correct position and made tight, all reinforcement, anchors, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcement, and which is set and dry, shall be cleaned off, and the forms and steel washed off before proceeding. Remove all foreign matter from forms and excavations.
3. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Program Manager/Construction Manager. Any flow of water into an excavation shall be diverted through proper side drains into a sump, or shall be removed by other approved methods which will avoid washing away the freshly deposited concrete.
4. Soil on which concrete will be poured shall be thoroughly wetted (except in freezing weather).
5. Anchors and Embedded Items: Anchors, bolts, sleeves, inserts, wood blocking, and any other items to be embedded in concrete shall be accurately secured in position before the concrete is placed. Aluminum shall not be embedded in concrete.

E. Handling and Depositing

a. Before any concrete is placed, notify all whose work is in any way connected with or influenced by the concrete work, and give them reasonable time to complete all portions of their work that must be completed before concrete is deposited.
b. Immediately before concrete is placed, inspect all forms to ensure that they are in proper position, sufficiently rigid, thoroughly clean, properly oiled and free from foreign materials, and that all reinforcement is in proper position.
c. Concreting, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.
d. Concrete shall be conveyed as rapidly as practicable from the mixer to the place of final deposit by methods that prevent the separation or loss of ingredients. It shall be deposited, as nearly as practicable, in its final position to avoid rehandling or flowing.
e. Concrete shall not be dropped freely where reinforcement will cause segregation, nor shall it be dropped freely more than six (6) feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.
f. Concrete that has partially hardened shall not be deposited in the work.

F. Pumping

a. Concrete may be placed by pumping if first approved in writing by the Program Manager/Construction Manager for the location proposed.
b. Equipment for pumping shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials.
c. The concrete mix shall be designed to the same requirements as herein before specified, and may be richer in lubricating components in order to allow proper pumping.
d. Concrete shall not be pumped through aluminum pipes.

G. Vibrating and Compacting

a. All concrete shall be thoroughly consolidated and compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded items, and into the corners of the forms. All concrete against forms shall be thoroughly spaded. Internal vibrators shall be used under experienced supervision, and shall be kept out of contact with reinforcement and wood forms. Vibrators shall not be used in a manner that forces mortar between individual form members.
b. Vibrators shall be flexible electric type or approved compressed air type, adequately powered and capable of transmitting to the concrete not less than seven thousand (7,000) impulses per minute. Vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place without separation of the ingredients. A sufficient number of vibrators shall be employed so that complete compaction is secured throughout the entire volume of each layer of concrete. At least one (1) vibrator shall be kept in readiness as a spare for emergency use. Vibrators shall be such that the concrete becomes uniformly plastic with their use.
c. Vibration shall be close to the forms but shall not be continued at one spot to the extent that large areas of grout are formed or the heavier aggregates are caused to settle. Care shall be taken to not disturb concrete that has its initial set.
d. Where conditions make compacting difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand as used in the concrete shall first be deposited in the forms, to a depth of at least on inch.
e. The responsibility for providing fully filled out, smooth, clean, and properly aligned surfaces free from objectionable pockets shall rest entirely with the Contractor.

3.04 CONSTRUCTION JOINTS

A. Construction joints shall be located a maximum of 40 feet apart. If, for any reason, the contractor feels a change is necessary, he shall prepare a placing plan and submit it to the Program Manager/Construction Manager for approval.

B. Where a joint is to be made, the surface of the concrete shall be sandblasted or thoroughly picked, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted, but not saturated, and slushed with a coat of grout immediately before the placing of new concrete.

C. Approved keys shall be used at all joints, unless detailed otherwise.

D. Forms shall be retightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

E. Bonding Concrete at Construction Joints

1. To new concrete construction joints:
   a. Thoroughly clean and saturate joint with water.
   b. Cover horizontal wall surfaces as specified in this Section, and immediately place concrete.
   c. Limit concrete lift placed immediately on top of bonding compound to 12 inches thick.
   d. Thoroughly vibrate to mix and consolidate bonding compound and concrete together.

3.05 BONDING NEW CONCRETE TO OLD CONCRETE:

1. Mechanically roughen existing concrete surfaces to a clean, rough surface using appropriate mechanical means to remove the existing concrete surface, and provide a minimum roughness profile of ¼-inch.
2. Saturate surface with water for 24 hours, cover with epoxy bonding compound and place concrete as specified for new concrete.

3.06 EXPANSION JOINTS

1. Expansion joints shall be located as shown on contract drawings.
2. The joint shall include a joint filler, a bond breaker and joint sealant and installed as indicated on contract drawings.

3.07 JOINT SEALANTS.

1. Prepare surface in accordance with manufacturers directions.
2. Apply primer as recommended by sealant manufacturer.
3. Install sealant with the proper tools and methods as directed by the sealant manufacturer.

3.08 PATCHING

1. Immediately after stripping forms, patch minor defects, form-tie holes, honeycombed areas, etc., before concrete is thoroughly dry.
2. Repair gravel pockets by cutting out to solid surface, form key, and thoroughly wet before placing patching mortar consisting of 1 part cement to 2 parts fine sand; compact into place and neatly finish. Honeycombed areas or gravel pockets which, in the Program Manager/Construction Manager's opinion are too large and unsatisfactory for mortar patching as described above, shall be cut out to solid surface, keyed, and packed solids with matching concrete to produce firm bond and surface.
3. The Contractor shall do all the cutting as required by himself or other trades. All such work shall be of the minimum size required. No excessive cutting will be permitted, or shall any structural members or reinforcement be cut.
4. The Contractor shall do all patching after work by other trades has been installed, where required, using Portland Cement Mortar 1:2 mix.

3.09 PROTECTION AND CURING

1. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.
2. Keep concrete in a thoroughly moist condition from the time it is placed until it has cured, for at least (7) days.
3. Carefully protect exposed concrete corners from damage.
4. Allow no slabs to become dry at any time until curing operations are complete. In general, slabs shall be cured with non-staining curing paper, hosing or fog spray; vertical surfaces shall be curing with Burlene or fog spray or an approved curing compound.
5. Protect fresh concrete from drying winds, rain, damage, or spoiling. Curing paper shall be lapped 4 inches minimum at joints and sealed with waterproof tape.

3.10 CONCRETE FINISHES

1. Unexposed Surfaces: All unexposed surfaces shall have any form finish, at the Contractor's option.

2. Wearing Surface Finish: Float the surface by hand using a wooden or magnesium float. Finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.
3. Addition of Material: The addition of cement, sand, water, or mortar to slab surfaces while finishing concrete is strictly prohibited.

3.11 DEFECTIVE WORK

1. The following concrete work shall be considered defective and may be ordered by the Program Manager/Construction Manager to be removed and replaced at Contractor's expense:
   a. Incorrectly formed.
   b. Not plumb or level.
   c. Not specified strength.
   d. Containing rock pockets, voids, honeycomb, or cold joints.
   e. Containing wood or foreign matter.
   f. Otherwise not in accordance with the intent of the Drawings and Specifications.

END OF SECTION

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DIVISION 4

MASONRY

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SECTION 04100

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements to furnish, prepare, and protect as a perishable material, mortar and grout, complete with specified admixtures for use in the installation of reinforced concrete pipe and structures.

B. Related Sections

1. Section 02607 - Precast Concrete Manhole and Structures
2. Section 04210 – Brick Masonry for Sewer Repair

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C144, Specification for Aggregate for Masonry Mortar.
2. C150, Specification for Portland Cement.
3. C207, Specification for Hydrated Lime for Masonry Purposes.
4. C270, Specification for Mortar for Unit Masonry.
5. C404, Specification for Aggregates for Masonry Grout.
6. C476, Specification for Grout for Masonry.
7. C780, Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

1.03 SUBMITTALS

A. In accordance with Section 01300.

B. Product Data

1. Submit manufacturer’s product data for each product, including certification that each product complies with the specified requirements.

C. Samples

1. Before the start of work samples of sand shall be submitted to the Program Manager/Construction Manager for approval.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store cementitious materials off the ground, under cover and in dry location. Store in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing water marks or other evidence of damage, shall not be used and shall be removed from the site.

B. All perishable materials included in this Section shall be delivered, stored and handled so as to prevent deterioration, intrusion of foreign matter or moisture, or damage of any nature.

PART 2 PRODUCTS

2.01 MANUFACTURES

A. Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

2.02 COMPONENTS

A. Portland Cement

1. ASTM C150, Type II. The same brand and color of cement shall be used throughout the job to ensure uniformity of color.

B. Hydrated Lime

1. ASTM Designation C207, Type S.

C. Aggregate for Mortar

1. ASTM Designation C144
2. Clean, durable particles, free from injurious amounts of organic matter.

D. Aggregate for Grout

1. ASTM Designation C404

E. Water

1. Clean and Potable

F. Mortar Color

1. Chemically inert, non-fading color, manufactured from alkali fast mineral oxides, finely ground and specifically prepared for use in cement and lime mortars. They shall be added to the mixture where so specified and used in accordance with the manufacturer's recommendations. Colored mortar shall be used on all new building face brick and, as standard of color only, shall be Davis Colors, 7011 Muirkirk Rd., Beltsville, MD 20705; "Chromix" L.M. Schofield Company, 6533 Bandini Blvd., Los Angeles, CA 90040; Solomon Grind-Chem Service, Springfield, Ill. 62705, or equal. Color shall match the existing mortar color.
2. Color of mortar joints on both new and existing masonry work is to be the same. Color shall be selected by the Program Manager/Construction Manager from the manufacturer’s full range of standard colors.

2.03 MORTAR AND GROUT MIXES

A. General

1. No air-entraining admixtures or cementitious materials containing air-entraining admixtures shall be used in the mortar. No anti-freeze liquids, salts, or other substances

shall be used in the mortar or grout to lower the freezing point. Calcium chloride or admixtures containing calcium chloride shall not be used in mortar or grout. Integral water-proofing compounds, accelerators, or other admixtures shall not be used in mortar or grout without approval in writing by the Program Manager/Construction Manager.

Grout

1. In accordance with ASTM Designation C476, for grout for use in construction of reinforced and nonreinforced masonry, and shall be mixed 2 1/2 cubic feet of sand to one bag of cement, adding only enough water to make a flowable consistency. Neat grout shall be composed of cement and water only. Non-staining cement shall be used for non-staining grout.
2. Use grout of the appropriate consistency (fine or course) as follows:
   a. Fine grout in spaces less than 4 inches in any horizontal dimension.
   b. Course grout in spaces greater than 4 inches in any horizontal dimension.

C. Mortar

1. In accordance with ASTM C270. (Proportional Specification)
2. The mortar mixtures hereinafter tabulated are standard mixtures for which measurement shall be by volume. For the purposes of these Specifications, the weight of one cubic foot of the respective materials used as ingredients in the mortar shall be as follows:

Materials	Weight, lb per cu ft (kg/m^3)
Portland Cement	94(1504)
Hydrated Lime	40(640)
Sand, damp and loose	80(1280) dry sand

3. The Contractor shall use mortar Type S1 for all masonry work. Quantities of materials in parts by volume are given below:

Mortar Type	Portland Cement	Hydrated Lime	Sand, Measured in a Damp, Loose Condition
S1	1	½	No less than 2 1/4 and not more than 3 times the sum of volumes of cement and lime used.

4. Mortar ingredients shall be accurately measured by volume in boxes especially constructed for the purpose by the Contractor, or by other method approved in writing by the Program Manager/Construction Manager. Measurement by shovel will not be allowed.
5. Mortar shall be machine mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. The mixing time shall not be less than 5 minutes, approximately two minutes of which shall be for mixing the dry materials and not less than three minutes for continuing the mixing after the water has been added. Where hydrated lime is used for mortar requiring a lime content, the Contractor will have the option of using the dry-mix method or first converting the hydrated lime into a lime putty as specified below. Where the dry-mix method is employed, the materials for each batch shall be well turned over together until the even color of the mixed, dry materials indicates that cementitious material has been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.
6. All mortar shall be freshly mixed and the quantity of each batch shall not be in excess of the amount that will be used before the same has started to set. Mortar that has begun to set shall not be used. Retempering will not be permitted. Mixer drums shall be entirely

emptied of a batch before charging with a succeeding batch. Mortar boxes shall be cleaned out at the end of each day's work, and all tools shall be kept clean.

PART 3 EXECUTION

3.01 MIXING

A. Cementitious materials and aggregate shall be mixed between 3 and 5 minutes in a mechanical batch mixer with the maximum amount of water to produce a workable consistency.

3.02 PLACING MORTAR

A. In accordance with the requirements of Section 04210.

3.03 TESTING

A. Construction-site-prepared mortar shall be tested in accordance with ASTM C780

B. Samples tested during the progress of the work may be accepted on the basis of the 7 day test. The right is reserved to rescind such acceptance if the mortar fails on the 28 day test.

C. Costs for testing shall be in accordance with Section 01410.

END OF SECTION

SECTION 04210

BRICK MASONRY FOR SEWER REPAIR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Brick masonry work in utility construction for permanent or temporary installation of below ground structures.

B. Brick masonry in repair and rehabilitation of utility lines and associated structures.

1.02 RELATED SECTIONS

A. Section 02607 - Precast Concrete Manholes

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C32 - Specification for Sewer and Manhole Brick (Made from Clay or Shale).
2. C55 - Standard Specification for Concrete Building Brick.
3. C62 - Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
4. C67 - Methods of Sampling and Testing Brick and Structural Clay Tile.
5. C91 - Specification for Masonry Cement.
6. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
7. C140 - Standard Method of Sampling and Testing Concrete Masonry Units.
8. C270 - Standard Specification for Mortar for Unit Masonry.

1.04 SUBMITTALS

A. Submit in accordance with requirements of Section 01300.

1. Submit certification from the manufacturer that brick units meet applicable requirements of reference standards.
2. As an alternate to providing certification, submit test results that show brick units meet applicable requirements of reference standards, when tested by an approved independent testing laboratory. Test result submittals shall be at no cost to the City.

1.05 HANDLING AND STORAGE

A. Handle and store brick to prevent damage.

B. Store brick and mortar mix off the ground and in a dry place. Cover mortar mix to protect from weather.

PART 2 PRODUCTS

2.01 CLAY AND SHALE BRICK MASONRY UNITS

A. Manholes and Structures: Use brick units made from clay or shale conforming to requirements of ASTM C 32, Grade MM, either cored or solid. Units shall have the following physical properties:

1. Compressive Strength: 2200 psi minimum for individual brick; 2500 psi average for five bricks.
2. Size: 2-1/4" by 7-5/8" by 3-5/8".
3. Test Procedure: ASTM C 67.

B. Sewer Brick: Use brick units made from clay or shale conforming to requirements of ASTM C 32, Grade SM, either cored or solid. Units shall have the following physical properties:

1. Compressive Strength: 3750 psi minimum for individual brick; 5000 psi average for 5 bricks.
2. Size: 2-1/4" by 7-5/8" by 3-5/8".
3. Test Procedure: ASTM C 67.

2.02 CONCRETE BRICK MASONRY UNITS

A. Manholes and Structures: Conform to requirements of ASTM C 55, grade S-1.

B. Dimensions: 2-1/4" by 7-5/8" by 3-5/8".

2.03 MORTAR

A. Provided mortar conforming to the requirements of Section 02607.

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure that foundations and other surfaces to support brickwork are at proper grades and elevations. Correct improperly prepared surfaces. Work surfaces and masonry shall be free of dirt, grease, oil, or other harmful materials before starting brick masonry work.

3.02 WEATHER REQUIREMENTS

A. Lay no masonry when temperature of outside air is below 50 F, unless satisfactory means are provided to heat materials and protect work from cold and frost.

B. Maintain mortar at 50 F or above and ensure that mortar will harden without freezing.

3.03 CONSTRUCTION

A. Brick Placement

1. Use sewer brick where exposed to flow. Where not exposed to flow, use manhole brick.
2. Lay sewer brick with the 2-1/4" by 7-5/8" side exposed to flow.
3. Lay manhole bricks so that in every fifth course the long axis of bricks are perpendicular to the long axis of the four preceding courses.
4. Lay curved courses and courses in different planes, using bonded and keyed construction.
5. Lay brick plumb and true with courses level and uniformly spaced. Adjust the bond of face brick so that no course will terminate with a piece less than one-half length of brick.
6. Dampen brick prior to placement.
7. Where fresh masonry joins partially set or totally set masonry, clean surfaces of set masonry. Remove loose mortar and brick. Wet brick to obtain the best possible bond.
8. Immediately remove mortar droppings and splashings as work progresses to facilitate final cleaning.

B. Joints

1. Completely fill joints in brick and other materials with mortar as each course is laid.
2. Make joints in exposed brickwork a uniform 3/8-inch wide, unless otherwise shown on Drawings.
3. When mortar is "thumbprint" hard, tool exposed joints with a round or other suitable jointer that is slightly larger than width of the mortar joint. In tooling, make sure that cracks and crevices are closed.
4. Point holes in exposed masonry. Cut out defective joints and repoint.

3.04 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01410.

B. A minimum of one set of mortar samples shall be molded for each day's placement as directed by the Program Manager/Construction Manager. Mold three 2-inch cube specimens. One cube will be tested for compressive strength at 7 days and 2 cubes will be tested for compressive strength at 28 days in accordance with ASTM C 109.

C. Each load of bricks delivered to the jobsite shall be tested.

1. Test clay bricks in accordance with ASTM C 167.
2. Test concrete bricks in accordance with ASTM C 140.

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DIVISION 9

FINISHES

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SECTION 09907

GEOPOLYMER LINING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This specification covers work, materials and equipment required for the preparation and installation of a Geopolymer Lining System providing a minimum 50-year service life for internal protection of new reinforced concrete consolidation conduit and reinforced concrete combined sewer overflow pipe and associated strucutres.

B. The protective lining works shall include activities associated with the protective lining system, not limited to the following:
   1. Design of approved continuous protection liners to the internal surface of the host infrastructure (pipe, manholes, structures, etc.),
   2. Pre-construction inspection and surface preparation of host infrastructure prior to application of protective lining system,
   3. Installation of approved continuous protection liners to the internal surface of the host infrastructure. ,
   4. Quality Control Measures,
   5. Post-construction inspection, repairs and testing.

C. RRELATED SECTIONS
   1. Section 01300 – Submittals
   2. Section 02149 – Maintaining Existing Flow
   3. Section 02763 – Pipeline Cleaning
   4. Section 02764 – Television Inspection

1.02 REFERENCES

A. Unless revised herein, the Licensed Applicator shall follow the latest revision of the practices and standards of the following American Society for Testing and Materials (ASTM) and American Concrete Institute (ACI) Standards, which are made part of this specification:

   American Society for Testing and Materials (ASTM):
   1. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
   2. ASTM C 39 / C 109 – Compressive Strength Hydraulic Cement Mortars
   3. ASTM C 78 – Flexural Strength of Concrete
   4. ASTM C 138 / C 642 – Standard Test Method for Density
   5. ASTM C 267 – Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes
   6. ASTM C 469 – Static Modulus of Elasticity & Poisson’s Ratio of Concrete Compression
   7. ASTM C 496 – Splitting Tensile Strength of Cylindrical Concrete Specimens
   8. ASTM C 666 – Freeze Thaw Durability
   9. ASTM C 807 – Set Time of Hydraulic Cement Mortar

10. ASTM C 882 – Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
11. ASTM C 1090 – Shrinkage Test
12. ASTM C 1138 - Standard Test Method for Abrasion Resistance of Concrete (Underwater Method)
13. ASTM C 1202 – Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
14. ASTM F 2414 – Practice for Sealing Sewer Manhole Using Chemical Grouting
15. ASTM F 2551 – Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes

American Concrete Institute (ACI):
1. ACI Certified Concrete Field Testing Technician, Level 1

1.03 SUBMITTALS

A. The following items shall be submitted:
   1. Manufacturer-certified copies of all test reports on each product used, including:
      1. ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications. Test reports shall be performed at the Licensed Applicator's expense and shall be carried out by an approved independent third-party testing laboratory or by a reputable independent testing body. As a minimum, the test reports should include all those listed in **Table 2** of this Section.
      2. XRF test results indicating the product confirms to the requirements as found in **Table 1** of this Section. Testing to be performed as detailed in **Paragraph 1.08**.
      3. XRD test results indicating the product confirms to the requirements as found in **Table 1** of this Section. Testing to be performed as detailed in **Paragraph 1.08**.
   2. Detailed Minimum Liner Thickness Calculations as required and as discussed further in **Paragraph 2.05** of this Section, along with proposed plan for ensuring that the installed Geopolymer Liner meets the minimum thickness requirements.
      a. Licensed Applicator Qualifications
         1. Manufacturer Certification that Licensed Applicator (as defined in **Paragraph 1.05/B** of this Section) has been trained and approved in the handling, mixing and application of the products to be used.
         2. Manufacturer Certification that the equipment to be used for applying the products has been manufactured or approved by the Manufacturer and Licensed Applicator personnel have been trained and certified for proper use of the equipment by the Manufacturer.
         3. Proof of any required permits or licenses necessary for the project.
   3. Pre-construction CCTV Video
   4. Post-construciton CCTV Video

1.04 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality Geopolymer Liner products with minimum 10-years' experience in the manufacture and distribution of a geopolymer product. Geopolymer product shall have a track record of use within sanitary sewer and/or storm infrastructure of at least 10-years.

B. Licensed Applicator: Company pre-approved by the Product Manufacturer and who meets the following conditions:
   1. Horizontal Infrastructure:

a. At least 5-years' experience specializing in the application of spray on lining systems including the installation of at least 35,000 LF in horizontal infrastructure using the specific material(s) being proposed for the subject project, OR
b. Provide supplemental installation expertise in the form of a product expert, provided by the Product Manufacturer, who meets the Superintendent requirements found in **Item C**, below.
    1. In addition, product expert provided by the Product Manufacturer must be additionally insured with a liability umbrella up to $5 million dollars.

2. Vertical Infrastructure:
    a. At least 3-years' experience specializing in the application of spray on lining systems including the installation of at least 10,000 VF in vertical infrastructure using Geopolymer, Cementitious or Mortar Liner products in vertical infrastructure applications similar to those being proposed for the subject project, OR
    b. Provide supplemental installation expertise in the form of a product expert, provided by the Manufacturer, who meets the Superintendent requirements found in **Item C**, below.
        1. In addition, product expert provided by the Product Manufacturer must be additionally insured with a liability umbrella up to $5 million dollars.

C. Manufacturer Certified Superintendent: Individual specialized in the application of Geopolymer Liner products, pre-approved by the Product Manufacturer for the application of spray on lining systems, who, meets the following minimum requirements:
    1. 5-years' experience in the industry actively involved in field services related to the lining of pipes, manholes or other sanitary sewer and/or storm infrastructure,
    2. For Horizontal Infrastructure, installation of 5,000 LF using the specific Geopolymer Liner product proposed OR installation of 15,000 LF of Geopolymer, Cementitious or Mortar Liner products in horizontal infrastructure applications similar to those being proposed for the subject project.
    3. For Vertical Infrastructure, Superintendent shall be certified by the Product Manufacturer.

D. Single Source Responsibility: Geopolymer Liner and all products used with the Geopolymer Lining System, to include but not limited to Infiltration Control, shall be approved by and/or supplied through the Product Manufacturer. Use only products approved by Product Manufacturer and used only within recommended limits.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in original containers with seals unbroken and labels intact and free of moisture.

B. Receipt Process: Materials must be inspected by Licensed Applicator upon receipt and the Bill of Lading reviewed to confirm it properly documents amount(s) and type(s) of material(s) received, date and time of delivery as well as the shipping company delivering the material. Completed/signed Bill of Lading and material batch numbers shall be logged by the Licensed Applicator upon receipt of the material(s) and stored in project files for possible future reference.

C. Storage: Geopolymer Lining System products are to be kept dry, protected from weather and stored under cover within the temperature ranges recommended by the Manufacturer. Products are to be stored and handled according to their SDSs or appropriate classification. Damaged or unsuitable products shall be promptly removed from the job site and shall be replaced with suitable materials. Do not store kerosene, gasoline or other flammable liquids in this space. Remove oily rags at the end of each day's work. Regardless of storage location,

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Licensed Applicator shall conform with all local, state and federal regulations including those set forth by OSHA and the EPA and any other applicable authorities. Confined space entry requirements shall be followed.

B. Monitor and maintain the temperature inside the host infrastructure prior to, during and immediately following installation. Temperature conditions shall be maintained per Manufacturers' recommendations.

C. Provide continuous ventilation and if necessary cooling and heating facilities to maintain surface and ambient temperatures before, during, and following application of finishes, within specified temperature range and for duration as directed by Manufacturer.

D. Protection: Provide sufficient shielding to fully protect adjacent finished work.

1.07 QUALITY CONTROL

A. Confirmation of a Geopolymer
   1. Material shall be confirmed as a Geopolymer as determined by XRF and XRD testing. Testing shall be carried out as detailed here. Testing shall be completed on the proposed Geopolymer Liner material and results submitted at the following stages:
      a. Submittal documentation.
      b. During application, XRF and XRD field testing shall be carried out as follows:
         1. Sieve the unmodified/unground Geopolymer Liner material with #200 mesh, removing the fibers and aggregate.
         2. XRF and XRD testing to be run on the precursor that remains.
      c. Representative testing information. Based upon the size of the project, as determined by the amount of Geopolymer Liner material that is to be used, field testing shall be carried out based upon the following:
         1. For projects utilizing less than 100,000 lbs. | 45,000 kg of Geopolymer Liner material, no testing of the installed product is required.
         2. For projects utilizing 100,000 lbs | 45,000 kg of Geopolymer Liner material to equal to or less than ***250,000*** lbs. | 113,000 kg of Geopolymer Liner material, one randomly sampled batch of material. Random sample shall be as directed by Owner/Engineer.
         3. For projects utilizing more than ***250,000*** lbs. | 113,000 kg of Geopolymer Liner material, first, last and one randomly sampled batch throughout the project life. Random sample shall be as directed by Owner/Engineer.

B. Quality Control, Sampling and Testing

1. During application, Licensed Applicator shall regularly perform Geopolymer Liner thickness readings with a method approved by Manufacturer.
2. Sample and make nine (9) three (3) by six (6) inch | 75 x 150 mm test cylinders (for Vertical or Horizontal Infrastructure) or nine (9) two (2) by two (2) by two (2) inch | 50x50x50mm cubes (for Vertical Infrastructure) per ASTM C 31. Label each sample with the date, location sample was taken, project, and product batch numbers. The product batch numbers are located on each Geopolymer material bag. Samples should be prepared by the Licensed Applicator or independent third-party laboratory (for Vertical Infrastructure) or by independent third-party laboratory under the guidance of the Licensed Applicator (for Horizontal Infrastructure). Prepare samples to test compressive strength at intervals of the lesser of each project or 42,000 lbs. | 19,000 kg of material (for Vertical Infrastructure) or every 42,000 lbs. | 19,000 kg of material (for Horizontal Infrastructure). The samples must be undisturbed for a period of at least 24 hours before they can be transported. The independent third-party laboratory shall transport the samples to their lab to be tested/analyzed in accordance with ASTM C 39 (for Vertical or Horizontal Infrastructure), or ASTM C 109 (for Vertical Infrastructure), or as specified by contract documents. Test the Geopolymer Liner material for compressive strength at 7 days (3 cylinders) and 28 days (3 cylinders) and leave remaining (3 cylinders) for retainage to be tested/analyzed as directed by Licensed Applicator.
    a. Performance and Material Testing – Vertical Infrastructure (Manholes, Boxes, Structures, etc.)
        1. Performance testing as directed in ASTM F 2551.
        2. Submit the following information to the Owner/Engineer: Product data, including Manufacturer and brand name along with independent third-party laboratory test results to verify 28-day compressive strength in accordance with ASTM C 39, ASTM C 109 or as specified by contract documents. The project superintendent will require that samples of applied material be collected and tested as discussed in **Paragraph 1.08/B/2** of this Section. Samples may be obtained from the pump, immediately before the discharge into the hose, from a section of hose, or at the spin caster/nozzle, if feasible. The sample location should be identified in laboratory reporting. The material thickness may be determined by using depth gauges during the spraying process. Permanent depth gauges may either be attached to the host infrastructure prior to Geopolymer Liner application or a handheld depth gauge may be used by the installer during installation. Photos shall be taken of the infrastructure prior to and following final installation and submitted to the Owner/Engineer with final application for payment.
    b. Performance and Material Testing – Horizontal Infrastructure (Pipes, Culverts, Tunnels, etc.)
        1. Submit the following information to the Owner/Engineer: Product data, including Manufacturer and brand name along with independent third-party laboratory test results to verify 28-day compressive strength in accordance with ASTM C 39. The project superintendent will require that samples of the applied material will be collected and tested as discussed in **Paragraph 1.08/B/2** of this Section. Samples may be obtained from the pump immediately before discharge into the hose, from a section of hose, or at the spin caster/nozzle, if feasible. The sample location should be identified in laboratory reporting. The material thickness may be determined by using depth gauges during the spraying process. Permanent depth gauges may either be attached to the host infrastructure prior to Geopolymer Liner

application or a handheld depth gauge may be used by the installer during installation. The depth measurements should be made in at least three locations within the infrastructure being lined to include both ends and the middle of the infrastructure. A digital video showing the prepared pipe with depth gauges installed and digital video of the completed lining will be submitted to the Owner/Engineer with final application for payment.

C. Daily Activity Logs
   1. Logs will be maintained onsite or electronically and will be available for viewing but will not be submitted.
   2. Horizontal and Vertical Infrastructure
      a. A Daily Activity Log will be kept detailing the daily activities on a project site. Information to be recorded may include such information as dates and times work was completed, personnel present or absent from the job site and hours worked, reference to material deliveries Bill of Lading, record of materials used, and surface preparations made, special conditions encountered and additional information as deemed appropriate by the Superintendent.

D. Daily Application Logs
   1. Logs will be maintained onsite or electronically and will be available for viewing but will not be submitted.
   2. Horizontal Infrastructure
      a. A Daily Application Log will be filled out completely anytime a work crew is on site and Geopolymer Liner material is being applied.
      b. Important spray data including the Job location, name and identification number, identifying asset information for infrastructure being lined, the Geopolymer Liner materials used (Bag and Batch No.), water addition rate, times Geopolymer Liner material was applied, Length of Hose, equipment motor speed and pressure observed, retrieval device speed, application method and under which atmospheric conditions to include the ambient air temperature, the dry powder temperature, the mixing water temperature, the wet product temperature and the temperature inside the infrastructure prior to, during and following lining are all recorded on the Daily Application Log.
      c. The operating conditions are also to be recorded. These measurements include the water addition rate taken at the water metering device, the retrieval speed of the retraction system and the pump motor speed recorded at the pump.
   3. Vertical Infrastructure
      a. A Daily Application Log will be filled out completely anytime a work crew is on site and Geopolymer Liner material is being applied. This log includes listing the surface preparations made, the repair materials used, and weather conditions observed during application.

1.08 WARRANTY

A. Manufacturer shall warrant all work against defects in materials and Licensed Applicator shall warrant all work against defects in workmanship for a period of one (1) year, from the date of acceptance of the lining work. Manufacturer / Licensed Applicator shall repair defects in materials or workmanship, as applicable, which may develop during said one (1) year period, at Licensed Applicators expense and without cost to the Owner.

B. GeoKrete Geopolymer Liner as manufactured, sold and distributed by Quadex, LLC adheres to the following warrantied Material Properties:
   1. XRF / XRD
      a. Chemical and phase compositions in the ranges stated in **Table 1**.
   2. Compressive Strength, which exceeds the values used in the design calculations, as sampled by ASTM C 31 and as tested by ASTM C 39, results as follow:
      a. 28 Day Minimum Average Compressive Strength..... 8,000 psi | 55.15 MPa
      b. Allowance should be given for consideration of 56 Day results in the rare case that 28 Day strength is not achieved.

   Compressive Strength testing is called for as it is typically the primary factor for determining thickness in the design calculations. Should other physical characteristic values be used as primary factors within the design calculation, additional testing of that specific parameter will be required at the same frequency and quantity to clearly show that design strength assumptions were met or exceeded in the field.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Existing infrastructure may consist of RCP, brick, stone, corrugated metal, HDPE and others as allowed by Manufacturer.

2.02 ACCEPTABLE MATERIALS

A. When more than one product is used in composite with other(s), all materials shall be supplied by the same Manufacturer.

B. Approved Geopolymer Lining System materials as manufactured/supplied by Quadex include:
   1. Geopolymer Liner – GeoKrete
   2. Infiltration Control (Mild to Moderate) - Quad-Plug
   3. Infiltration Control (Heavy) – I&I Guard – PRF or alternative Chemical Grout as approved by Product Manufacturer
   4. Manhole Chimney Treatment – Chimney Guard

2.03 GEOPOLYMER – CHARACTERIZATION TECHNIQUES

A. Provide oxide composition and phase composition testing results, using X-Ray Fluorescence (XRF) and X-Ray Diffraction (XRD), respectively.
   1. Prior to testing, the aggregate and reinforcing fibers shall be removed from the product using a #200 mesh, the resulting material that passes through the mesh is referred to as the Geopolymer precursor powder. The material run through the mesh shall be unmodified and unground/undissolved accurately representing the Geopolymer Liner material as it will be provided out of the product packaging in the field.
   2. Results shall meet the requirements of **Table 1**

Table 1

Oxide Content of Geopolymer Powder	**Acceptable Values**
Oxides	**(% wt)**

	Total SiO_2	40 – 55 %
	Amorphous SiO_2 (Geopolymer precursor*)	25 – 50 %
	Total Al_2O_3	13 – 30 %
	Amorphous Al_2O_3 (Geopolymer precursor*)	10 – 20 %
	Total amorphous*	>50 %
	Total of OPC crystalline phases* (% Portland Cement, i.e.: C_3S, C_2S, C_3A, C_4AF)	<28 %
	Total CaO	<25 %
	Total Na_2O	0.35 – 15.0 %
Oxide Ratios		**(ratio)**
	Amorphous SiO_2 / Amorphous Al_2O_3 (Ratio*)	>2.0
	Total Na_2O / Amorphous Al_2O_3 (Ratio*)	0.05 – 1.2

* Requires XRD Testing to be included along with XRF to ensure that the appropriate ratio of reactive/amorphous SiO_2 and Al_2O_3 are available in the geopolymer precursor to facilitate the polycondensation reaction of the product and ensure cure is not taking place primarily through hydration as with a cementitious product. Failure to perform XRD Testing may leave you with a cementitious product.

2.04 GEOPOLYMER – PHYSICAL PROPERTIES

A. The Geopolymer Liner material may be Centrifugally Cast, Manually Sprayed or Hand Troweled.

B. The Geopolymer Liner material shall be a factory blended, one-component (just add water), eco-friendly, micro-fiber reinforced ultra-dense geopolymer mortar synthesized from reactive SiO_2 and Al_2O from industrial byproducts, enhanced with monocrystalline quartz aggregate.

C. The Geopolymer Liner shall be formulated to produce a liner with improved compressive and flexural strength, high adhesion to damp surfaces, lower permeability and increased resistance to aggressive chemical attack.

D. The fiber reinforced formula shall be developed to: improve chemical resistance, improve hydraulic abrasion resistance, provide dimensional stability and protect against penetration by substances such as fats, oils, grease, gases and chloride ions.

E. The finished infrastructure must be such that once the Geopolymer Liner sets, the total liner thickness will be homogeneous and monolithic.

The Geopolymer Liner material shall conform to the minimum requirements as presented in **Table 2**.

Table 2

Physical Properties	ASTM Reference	Requirements
Set Time	ASTM C 807	Min. Initial 60 mins Max. Final 240 mins
Compressive Strength	ASTM C 39 / C 109	Min. 8,000 psi | 55.15 MPa @ 28 days

Flexural Strength	ASTM C 78 / C 293	Min. 800 psi | 5.51 MPa @ 28 days
Density	ASTM C 138 / C 642	Dry 90–110 lb/ft^3 | 1,441–1,762 kg/m^3 Wet 135–145 lb/ft^3 | 2,162–2,323 kg/m^3
Chemical Resistance, Sulfuric Acid PH 1.0	ASTM C 267	Max 1.0% mass loss @ 12 weeks
Modulus of Elasticity	ASTM C 469	Min. 5x10^6 psi | 34.47 GPa @ 28 days
Split Tensile Strength	ASTM C 496	Min. 900 psi | 6.2 MPa @ 28 days
Freeze Thaw Durability	ASTM C 666	Max 0.1% Loss @ 300 cycles
Bond Strength to Concrete	ASTM C 882	Min. 3,000 psi | 20.68 MPa @ 28 days
Shrinkage Test	ASTM C 1090	Max 0.02% @ 28 days
Abrasion Resistance	ASTM C 1138	Max 1.5% Weight Loss @ 6 cycles on 28 day sample
Rapid Chloride Ion Permeability	ASTM C 1202	Very Low @ 28 days

2.05 GEOPOLYMER – LINER THICKNESS DESIGN

A. General Liner Thickness Guidelines - The design thickness of the centrifugally cast, manually sprayed or hand troweled liner shall be determined by a Qualified Engineer retained by the Manufacturer.

B. Signed and sealed designs shall be prepared and submitted by a Qualified Engineer, licensed in either the state of liner application or in the state in which the headquarters of the liner Manufacturer is located.

C. The thickness calculations shall be site specific and involve a careful consideration of loading conditions that are applicable to those for the construction phase and long-term service of the infrastructure in question.

D. The Licensed Applicator/Contractor shall submit Manufacturer's minimum recommended thicknesses or liner thickness calculations to the Owner/Engineer for review. Thickness or calculations shall substantiate sufficient liner thickness to achieve desired 50-year service life.
   1. Regardless of design, installation thickness of 1.0-inch | 25.4mm minimum shall be achieved unless approved in writing from liner manufacturer prior to Bid.

E. The Licensed Applicator/Contractor shall submit their proposal based upon the appropriate length, size, design life and host infrastructure parameters designated in the Project Plans and Specifications.

F. The Design Parameters shall be as presented in **Table 3**:

Table 3

Design Parameter	**Below to be filled in by Owner/Engineer**
Shape / Size	48-inch and 42-inch
Pipe Material	Reinforced Concrete Pipe

Length	Total:1,888 feet (48”), 450 feet (42”) Reach Ranges: 670 feet to 61 feet
Bury Depth	Range (5 feet to 32 feet)
Level of Deterioration	New
Ovality	Circular
Live Loading Conditions	
Soil Density	
Ground Water Elevation	Range (El 18 to El 8

2.06 INFILTRATION CONTROL

A. Heavy Infiltration
   1. Injection grouting material shall be used to address heavy infiltration following Manufacturer’s instructions.
   2. Heavy infiltration means infiltration that meets the definition of a “runner” or “gusher”, as defined by NASSCO’s Pipeline Assessment Certification Program.

B. Mild to Moderate Infiltration
   1. All fast setting materials furnished shall be formulated to be applied in dry powder form, with no prior mixing of water, directly to active leaks under hydrostatic pressure in pipes, manholes or related structures. Materials shall consist of rapid setting cements, siliceous aggregates, and various accelerating agents.

2.07 GEOPOLYMER LINER APPLICATION EQUIPMENT

A. Horizontal Infrastructure
   1. The following outlines the equipment that is to be used on application to Horizontal Infrastructure. Such equipment may also be used on Vertical Infrastructure at the installer’s discretion.
   2. Major equipment components consist of a generator, an air compressor, a high-pressure washer, a high shear mixer, a high output pump, a spray nozzle or gyroscopic high-speed spin cast delivery assembly with an electronic retraction system capable of +/- 5% repeatability, and high-pressure hoses and couplings.
   3. Application equipment shall include a high shear mixer and high output swing tube pump with appropriate sensors and monitors to gauge material ratios and material consistencies.
   4. Application equipment shall have visible display for the rate of water addition.
   5. Application equipment shall measure the back pressure on the discharge side of the pump.
   6. Optional spinner head shall be attached to a gyroscopic mechanism to layer the materials.

B. Vertical Infrastructure
   1. Manufacturer approved equipment shall be used in the application of the specified Geopolymer Liner. The following outlines the equipment that is to be used on application to Vertical Infrastructure.
   2. Major equipment components consist of a generator, an air compressor, a pressure washer, a mortar mixer, a material pump, a spray nozzle or spinner head and material hose all to be trailer or skid/truck mounted and contained within a single platform.
   3. Application equipment shall include a vertical shaft, horizontal blade mixer with at least a 45-gallon capacity and three stage progressive cavity material pump.

4. Application equipment shall have a water metering system to monitor the rate of water addition.
5. Application equipment shall include sufficiently sized water transfer pump so as to provide continuous delivery of water to all components.
6. Application equipment shall include either a manual spray nozzle, or a spinner head. Spinner head shall be attached to an electric winch mounted on a tripod allowing for control of vertical movement at a consistent rate.

2.08 EQUIPMENT MAINTENANCE

A. All equipment shall be in clean and good working conditions.

B. Maintenance and service shall be performed on the equipment at Manufacturers' recommended intervals.

C. Spare parts or extra equipment should be kept on site to ensure rapid redeployment in the event of equipment failure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Licensed Applicator shall verify that surfaces and substrate conditions are ready to receive work. Generally, this can be described as a substrate that is free of dirt, grease, oils and foreign materials as removed by 3,500 psi | 241 bar pressure wash throughout which all active infiltration has been stopped or controlled so as to allow for lining. For lining of new infrastructure 5,000 psi | 345 bar or greater pressure wash will be required.

B. Licensed Applicator shall examine surfaces scheduled to be lined prior to commencement of work. Report to Owner/Engineer any condition that may potentially affect proper application.

C. Appropriate actions shall be taken to comply with regulatory and other applicable agencies with regard to environment, health and safety.

D. Any active flows shall be dammed, plugged or bypassed as required to ensure that the conveyed flow is maintained away from the surfaces to be lined. Flows should be totally plugged and/or diverted when lining the invert and during required dry/cure periods. All extraneous flows into the host infrastructure at or above the area lined shall be plugged and/or diverted until the Geopolymer Liner has cured per Manufacturer recommendations.

E. Installation of the Geopolymer liner shall not commence until the host infrastructure has been properly cleaned and repaired .

F. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the infrastructure being lined unless otherwise instructed by the material Manufacturer.

3.02 BYPASS PUMPING

A. Maintain sanitary sewer service during the installation process, as required for acceptable completion of the work and / or to avoid damages due to sewer spills or overflows.

B. Install and operate bypass pumping equipment to maintain sewage flow around, and in some cases through, the host infrastructure being rehabilitated, and to prevent backup or overflow in compliance with Owner/Engineer requirements.

C. Coordinate with Owner/Engineer regarding potential upstream diversion strategies which could potentially reduce influent flow from upstream system.

D. Install all bypass and isolation material and equipment so as to not affect flow in upstream or downstream structures. The pump and bypass lines shall be of adequate capacity and size to at minimum handle the anticipated daily peak flow, as provided by Owner/Engineer at time of advertisement. Where required by Owner/Engineer, in project documents, bypass may be sized to address anticipated peak wet weather flows. Bypassing of sanitary sewer into the storm system will not be permitted. For all bypass pumping, pump noise shall be kept to a minimum.

3.03 SURFACE PREPARATION AND LIGHT CLEANING

A. Excessive debris, sediment, root intrusion or other foreign materials which may impact the effectiveness of the surface preparation process shall be removed prior to the commencement thereof.

B. Oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants which may affect the performance and adhesion of the coating to the substrate shall be addressed per Manufacturers' recommendations.

C. Choice of surface preparation method(s) should be based upon the condition of the structure and concrete or masonry surface, potential contaminants present, access to perform work, and the required cleanliness and profile of the prepared surface to receive the repair and/or lining product.

D. Surface preparation method, or combination of methods, that may be used include high-pressure water cleaning (minimum 3,500 psi | 241 bar), water jetting, abrasive blasting, grinding or scarifying. When grease or oil are present within the host infrastructure, steam, heated water (up to 200°F | 93.3°C) or a detergent approved by Owner/downstream treatment facility owner/operator may be added to the water may be used integrally with the high-pressure water cleaning and other methods as referenced in industry accepted standards such as:
   1. ASTM-F-2551 Standard Practice for Installing a Protective Cementitious Liner System in Sanitary Sewer Manholes.

E. Loose debris materials resulting from the cleaning of the structure shall be removed prior to application of the Geopolymer Liner material.

F. Loose or defective brick, concrete, grout, ledges, and all steps shall be removed to provide an even surface prior to application of Geopolymer Liner material.

3.04 PRE-CONSTRUCTION INSPECTIONS

A. Prior to work, the Licensed Applicator's will provide pre-construction videos of the complete limits of the infrastructure to be rehabilitated as well as the project site utilizing color video inspection equipment.

3.05 SEALING ACTIVE LEAKS

A. The work consists of hand applying a dry quick-setting cementitious mix or, for heavy leaks, chemical grout formulated to instantly stop running water or seepage in all types of concrete, metal and masonry pipes, manholes and structures.
   1. The area to be repaired must be clean and free of debris to the extent the repair material will bond to the surface of the affected area.
   2. For quick-setting mortar, with gloved hand, place a generous amount of the dry quick-setting cementitious material to the active leak, with a smooth fast motion, maintaining external pressure for 60 seconds, repeat until leak is stopped.
   3. Proper application should not require any special mixing of product or special curing requirements after application.

B. Materials, additives, mixture ratios, and procedures utilized for the grouting process shall be in accordance with Manufacturer's recommendations and shall be appropriate for the application.

3.06 MIXING OF THE GEOPOLYMER LINER MATERIAL

A. Licensed Applicator shall add the Geopolymer Liner material to the batch water following the Manufacturers' water/material ratio precisely.

B. The lining material shall be mixed in a high shear mixer, or similar, to ensure thorough and uniform mix of water with the material prior to pumping.

C. The mixing operations must be performed so that the minimum of dust is released into the surrounding environment.

D. The batch style mixing, precise metering of water and pump rate eliminates wet/dry and thick/thin variations resulting in a uniform structure liner regardless of the pumping distance.

E. Multiple application nozzles should be onsite at all times to address any application issues or failure of the nozzle.

3.07 APPLICATION OF GEOPOLYMER LINER MATERIAL

A. The work consists of spray applying and/or centrifugally spin-casting the specified Geopolymer Liner material to the inside of an existing structure.

B. Application on all pre-cast/poured-in-place manholes shall occur after preparing surfaces. Material shall be applied to the bench and invert area in such a manner as to provide for proper drainage without ponding and to compensate for abrasion. Material must be applied only when surfaces are damp, saturated surface-dry (SSD), but with no visible active infiltration.

C. Hand Troweled Application
   1. In locations where equipment access is limited, or work scope is such that mobilization of equipment is not justifiable, material may be hand troweled into place.
   2. Proper mixing should be achieved with a portable mixing unit of sufficient strength to thoroughly mix product to Manufacturers recommended consistency.

3. Application of material shall be performed in a manner such that material is applied evenly and consistently throughout the entirety of the structure.
4. Material shall be applied to a specified uniform minimum thickness no less than 1-inch | 25.4mm, unless otherwise approved in writing by Manufacturer prior to bid.
5. Material shall be applied to the bench/invert area in such a manner as to provide for proper drainage without ponding and accounting for anticipated abrasion.
6. Troweling of materials shall begin immediately following the mixing of the product. Initial troweling shall be in a motion, to compress the material into any voids within the structure walls. Precautions should be taken not to over trowel.
7. In vertical installation applications, once troweling has been completed, the applied liner should be brushed or sponged to remove trowel marks and to break up the latent surface brought about by troweling. Brushing/sponging should be in the horizontal plane and as with troweling do not over work the lining material. In horizontal applications, brushing/sponging should be performed if specifically required in the project plans and/or specifications.

D. Hand Spray Application
   1. Material hose shall be coupled to a low-velocity spray application nozzle. Pumping of the material shall commence and the mortar shall be atomized by the introduction of air at the nozzle, creating a low-velocity spray pattern for material application.
   2. Spraying shall be performed in a manner such that material is applied evenly and consistently throughout the entirety of the structure.
   3. Material shall be applied to a specified uniform minimum thickness no less than 1-inch | 25.4mm, unless otherwise approved in writing by Manufacturer prior to bid.
   4. Material shall be applied to the bench/invert area in such a manner as to provide for proper drainage without ponding and accounting for anticipated abrasion.
   5. Troweling of materials shall begin immediately following the spray application. Initial troweling shall be in a motion, to compress the material into any voids within the structure walls. Precautions should be taken not to over trowel.
   6. In vertical installation applications, once troweling has been completed, the applied liner should be brushed or sponged to remove trowel marks and to break up the latent surface brought about by troweling. Brushing/sponging should be in the horizontal plane and as with troweling do not over work the lining material. In horizontal applications, applied material should be troweled smooth. Brushing/sponging should be performed if specifically required in the project plans and/or specifications.

E. Centrifugal Application - Spin-cast unit shall be approved by the material Manufacturer. Mechanical insertion/extraction equipment and retraction speeds shall be calibrated to the structure diameter to ensure uniform application to specified thickness. Material hose shall be coupled to the spin-cast unit. The spin-cast unit shall then be positioned within the center of the horizontal or vertical structure or as appropriate for uniform application and coverage.
   1. Vertical Structures/Manholes
      a. Initially locate the spinner at either the top of the manhole chimney or the lowest point corresponding to the junction of the manhole bench and walls.
      b. The spin-cast unit shall then be initialized and pumping of the material shall commence.
      c. As the mortar begins to be centrifugally cast evenly around the interior of the structure, the rotating applicator head may be cycled up and down in multiple passes. When installing in rough, non-uniform vertical structures, a controlled

retrieval speed conducive to providing a uniform material thickness on the structure walls shall be maintained.

2. Horizontal Structures/Pipes
   a. The Geopolymer Liner material delivery hose shall be coupled to a medium-velocity spray application nozzle.
   b. Pumping of the material shall commence and the material shall be spin-cast onto the pipe surface.
   c. A gyroscopic head that has a speed adjustment for making multiple position changes per minute is required. The gyroscopic head allows the spin cast mechanism and the associated selected nozzle to make multiple passes on the pipe wall in a single pass of the sled assembly.
   d. Spraying of a pipe shall be performed in a manner such that material is applied evenly and consistently throughout the entirety of the structure/pipe.
   e. Geopolymer Liner shall be applied to a specified uniform minimum thickness no less than 1-inch | 25.4mm, unless otherwise approved in writing by Manufacturer prior to bid..
   f. The Geopolymer Liner delivery hose shall be coupled to a gyroscopic applicator device. The gyroscopic applicator shall then be positioned within the center, or as required to achieve uniform coverage as dictated by the diameter, size and shape of the pipe.
   g. As the material begins to be gyroscopically cast evenly around the interior of the cavity, the rotating applicator head shall produce a uniform material thickness to the repair surface.
   h. Controlled multiple passes shall then be made, if necessary, until the specified minimum finished thickness is attained. If the procedure is interrupted for any reason, the operator shall arrest the longitudinal transition of the applicator head until flows are recommenced.
   i. Material thickness may be verified at any point with an approved depth gauge. If additional material is required at any level, the gyroscopic applicator head shall be placed at the location and application shall recommence until that area meets the required thickness.
   j. The lining material shall be applied to a damp surface, with no free water.
   k. The medium-velocity spray nozzle and the gyroscopic spin casting head may be used in conjunction to facilitate uniform application of the material to irregularities in the contour of the pipe walls.
   l. Proper steps shall be taken to ensure the material is cured in a moist and moderate climate as directed by the Manufacturer. General underground conditions are usually adequate to meet this curing requirement.

3.08 CURING OF THE GEOPOLYMER LINER MATERIAL

A. The Manufacturer’s recommended cure schedule must be strictly adhered to at all times.

B. SPECIAL NOTE: The use of curing compounds is not recommended for Geopolymer Liner material.

3.09 TERMINATION AND SEALING AT MANHOLES, JUNCTIONS, BENDS, INLETS, OUTLETS, SHAFTS AND OTHER STRUCTURES

A. Termination of the Geopolymer Liner at the end of a pipe or manhole shall be completed by hand applying the liner to the outer surface of the pipe or into the interior of the manhole.

B. Unless specifically directed otherwise in the project plans/specification, all starter/intermediate/terminal manholes/junctions/bends/other structures which are directly impacted by rehabilitation activities will also receive an application of Geopolymer Liner.

C. Unless specifically directed otherwise in the project plans/specifications, all manholes which have been lined with Geopolymer Liner material will receive an application of Chimney Guard chimney treatment. Material is to be installed from the bottom of the cover extending down the shaft a minimum of 12-inches | 300mm and maximum of 18-inches | 450mm as measured vertically into the MH shaft. The surface is to be prepared as follows:
   1. Steel is to be prepared by grinding meeting SSPC-SP 11 followed by cleaning meeting SSPC-SP 1 as a final preparation, resulting in a final minimum surface profile of 1 mil.
   2. Freshly installed mortars, which have been brush finished, are to be prepared by pressure washing at 3,500 psi | 241 bar sufficiently to remove loose dust and debris, following chimney treatment manufacture instructions for durations between product installations.
   3. If installing to a previously mortar lined MH, prepare surface by 5,000 psi | 345 bar pressure wash sufficient to both score the surface and remove loose dust and debris.
   4. If installing to a previously polymeric lined MH, prepare surface by abrading the material with 80-100 grit sandpaper followed by cleaning meeting SSPC-SP 1 as a final preparation to a surface profile of 3mils.
   5. If installing to a new precast or cast-in-place MH, abrasive blast or 7,000 psi | 483 bar pressure wash to a finish between ICRI-CSP 3 to ICRI-CSP 5.

3.10 END OF SHIFT EQUIPMENT CLEAN UP PROCEDURES

A. All equipment and materials used during the days/shifts operations shall be properly cleaned/covered and stored.

B. All hoses, fittings, pumps, mixers, spray head equipment, retraction equipment will be cleaned both inside and out.

C. All mixed Geopolymer and support materials not used in application shall be captured and disposed of properly.

3.11 FINAL INSPECTION

A. A visual inspection should be made by the Inspector and Licensed Applicator periodically throughout the progression of construction, prior to the completion of a lining stage. Any deficiencies in the finished lining shall be marked and repaired by the Licensed Applicator according to the procedures set forth herein.

B. While infrequent, small points of infiltration and/or surface cracking may occur in newly lined infrastructure. As with other trenchless repair technologies, repair methods are

available to address the areas of concern and restore the infrastructure to its intended condition. To address the observed conditions, the following activities are to be performed:

1. Points of Infiltration – The area will be cleaned and treated with either a topical application of patching material or in more severe cases will be drilled and chemical grout will be injected to permanently stop infiltration.
2. Surface Cracks – The area around the crack will be cleaned and the crack opened using a small wire brush. The crack will then be rinsed and filled with GeoKrete, Manufacturer approved additive or a mixture of the two. The treated area will be blended to match the surrounding surface creating a permanent solution.

C. At the completion of a lining stage of the infrastructure and once all repairs have been made and accepted, the inspector should indicate acceptance of the work and general conformance with the plans and specifications by signing a Project Sign-off Form provided by the Licensed Applicator/Contractor. Once signed, the Licensed Applicator should document a final inspection video (1 copy) of the completed line segments. This inspection shall be performed by a color video inspection system.

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DIVISION 16

ELECTRICAL

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SECTION 16000

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes all labor, materials, tools, equipment, and accessory items and performing all operations necessary to furnish and install the complete electrical work in accordance with this section of these specifications, the drawings and the standards of the applicable codes listed herein.

B. The work shall include, but not be limited to, furnishing and installation of equipment and items listed below and installation only of items furnished under other sections of these specifications.

1. Complete electrical service as hereinafter specified.

2. Conduit, wire and electrical connections are required on certain items specified in sections of these specifications other than the electrical section. This Contractor shall examine all sections of these specifications to determine the complete scope of the electrical work.

3. Raceways and fittings

4. Wires and cables

5. Miscellaneous equipment

6. Panelboards

7. Grounding systems

8. Underground system

9. Security Alarm system

C. Mount and wire operator's stations, and power conversion equipment for all variable speed drive systems furnished under other Divisions of these Specifications.

D. Install and make all field connections to variable frequency drives, process instrument panels and other control panels furnished under other Divisions of these Specifications.

E. Mount and wire process instruments and control cabinets furnished under other Divisions of these Specifications. Furnish and install all conduit, wire and interconnections between process instrumentation primary elements, transmitters, local indicators and receivers. Mount and wire all lightning and surge protection equipment at process instrumentation transmitters and receivers.

F. Documents Applicable to the Work of this Section

1. Division 0 of the Contract Documents (Contract Forms and Requirements).

2. Division 1 of the Technical Specifications.

3. Technical Specifications: Section 16000 - Basic Electrical Requirements, and the following sub-sections:

a. Section 16060 – GROUNDING SYSTEM
b. Section 16080 – UNDERGROUND SYSTEMS
c. Section 16085 – MISCELLANEOUS EQUIPMENT
d. Section 16120 – WIRE AND CABLES
e. Section 16130 – RACEWAYS AND FITTINGS
f. Section 16442 – PANELBOARDS
g. Section 16720 – SECURITY ALARM SYSTEMS

G. Drawings: Work specifically required under this Section includes all Electrical work shown on or required by Contract Drawings GE-1, GE-2, E-1, E-2, & E-3.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300

1. Panelboards
2. Miscellaneous equipment
3. Security Alarm System

B. The manufacturer's data sheets with product designation or catalog numbers shall be submitted for the following material:

1. Wire
2. Conduit
3. Receptacles
4. Boxes and fittings

C. Submit all other data as specified herein.

D. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section 16000.

E. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

F. Prior to submitting shop drawings for lighting fixtures, verify the type of ceiling suspension systems being installed. Notify Engineer of any discrepancies between fixture type specified and suspension system. Additional cost rising from failure to notify the Engineer will be the responsibility of the Contractor.

G. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.

H. Record Drawings - Prepare as specified in Part 1 of this Section.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600 and as specified herein.

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 stored for more than two weeks, the equipment shall receive all maintenance considerations required by the manufacturer for the proper storage of equipment. Proper storage in this context shall include the provision of heaters and dehumidifiers to keep the equipment dry at all times. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the Owner. 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.

1.04 DESIGN CRITERIA

A. Service Characteristics:

Primary Utility Voltage: 13.8KV

Secondary Voltage: 120/240V, 1-Phase

All equipment and wiring shall be suitable for the applied voltage.

B. Service and Metering

1. The power company serving this project is National Grid.

2. A new service that will be obtained at 120/240Volts, 1-phase, 3-wire from an existing utility pole.

3. Furnish and install the secondary service conduit, wire and connectors.

4. The power company will provide the meter, the contractor shall provide the meter socket in accordance to the utility company requirements.

5. All work and material for the electrical service shall be in accordance with the requirements of each utility company.

6. Make all arrangements with the power utility company for obtaining the service and furnish all labor and material for the service. Submit any utility fee invoice(s) associated with the service replacement to the Owner. The Owner shall make direct payment(s) for the fee(s) to National Grid.

C. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. The Contractor shall arrange for all necessary permits, pay all fees and

arrange for all required inspections by local authorities. In general, all work shall comply with the requirements of the National Electrical Code, all state codes and the codes and ordinances of the city or town in which the work is to be done.

D. Tests and Settings

1. Test all systems furnished under DIVISION 16 - ELECTRICAL and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the system.

2. Make all circuit breaker and motor circuit protector settings based on the connected equipment manufacture's recommendations.

3. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. A certified test report shall be submitted stating that the equipment meets and operates in accordance with manufacturer's and job specifications, and that equipment and installation conforms to all applicable standards and specifications.

   a. Testing of protective relays, static devices, transfer switches, circuit breakers and motor circuit protectors for calibration and proper operation and settings.

   b. Over potential, high potential, insulation resistance and shield continuity tests for cables.

   c. Mechanical inspection of circuit breakers.

4. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.

5. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Contractor shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

1.05 RELATED WORK NOT INCLUDED

A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is included under DIVISION 2 - SITE WORK of these Specifications.

B. Concrete work, including concrete electrical duct encasement, is included under DIVISION 3 - CONCRETE of these Specifications.

1.06 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions etc. When located in formed concrete walls locate all necessary slots for electrical work and form before concrete is poured.

B. Provide waterproof sealing for the penetrations through exterior walls, etc.

C. Provide fireproof sealing for penetrations through fireproof walls, etc.

D. Foam type fire and water proofing is not allowed.

1.07 CUTTING AND PATCHING

A. All openings required by the work of these Sections shall be planned for in advance. Any cutting and patching required by the lack of such planning shall be done by the General Contractor at the expense of this Contractor. It will be the responsibility of this Contractor to keep the General Contractor informed of all required openings.

1.08 CORING

A. Provide all coring for conduits penetrating floors, walls, partitions etc.

B. Provide waterproof sealing for the penetrations through exterior walls, etc.

C. Provide fireproof sealing for penetrations through fireproof walls, etc.

D. Foam type fire and water proofing is not allowed.

1.09 ELECTRICAL HAZZARDOUS CLASSIFCATION AND NEMA RATINGS FOR ELECTRICAL INSTALATION AND ENCLOSURES

A. Unclassified, NEMA Type 3R for Electrical Enclosure interior.

B. Unclassified, NEMA Type 4X for exterior work.

C. Class 1, Division I, NEMA Type 7 for within the Diversion Structure.

1.10 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact routing of conduit runs or terminations. Contractor shall determine exact location of conduit terminations by examinations of approved shop drawings. The Contractor shall not reduce the size or number of conduit runs indicated on the drawings.

B. The final routing of raceways shall be determined by structural conditions, interferences with other trades and by terminal locations on apparatus. The Engineer reserves the right of a reasonable amount of shifting at no extra cost up until time of roughing in the work.

C. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the drawings in locations which are found to be inaccessible, advise the Engineer of the situation before work is advanced to the point where extra costs will be involved.

D. Each three-phase circuit shall be run in a separate conduit unless otherwise shown on the drawings.

E. Unless otherwise approved by the Engineer conduits shown exposed shall be installed exposed; conduits shown concealed shall be installed concealed.

F. Where circuits are shown as “home-runs” all necessary fittings and boxes shall be provided for a complete raceway installation.

G. Each branch circuit shall have its own neutral, dedicated to that circuit. A common neutral for more than one single phase circuit is not allowed.

H. Any work installed contrary to drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

I. The locations of equipment, fixtures, outlets, and similar devices shown on the drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

J. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between back surface and equipment.

K. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical system shown. Additional circuits shall be wherever needed to conform to the specific requirements of the equipment.

L. All connections to equipment shall be made as required, and in accordance with the approved shop and setting drawings.

M. Schematic diagrams shown on the drawings indicate the required functions only. Standard circuits of the particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic drawings shown. Additional wiring or conduit required for such deviations shall be furnished at Contractor's expense. Contractor must ensure that all components necessary to accomplish the required function are provided.

1.11 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the structure.

B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitable, to insure that the tilting does not impair the functional integrity of the equipment.

1.12 TEMPORARY POWER AND LIGHTING

A. The Electrical Subcontractor shall furnish and install feeders of sufficient size from the utility company for the electric light and power requirements for the project while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot in the work area. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, and stairwells. Minimum sized lamp used shall be 1500 lumens.

Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified lumens shall be increased to provide these increased intensities.

B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.

C. All temporary electrical work shall meet the requirements of the National Electrical Code Article 305 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws.

D. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.

E. The General Contractor will pay for the cost of electric energy consumed by himself and by all of his Subcontractors, unless otherwise indicated.

F. Provide all temporary lighting and power required above during the normal working hours of the project or a total of ten (10) hours per normal working day; Saturdays, Sundays and legal holidays are excluded. The ten hours per day shall include manning the temporary power and lighting 2 hour before and 2 hour after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the local authorities having jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical Subcontractor will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

1.13 RECORD DRAWINGS

A. Record drawings shall be provided under this Section in accordance with Section 01700 and as specified herein.

B. As work progresses and for the duration of the Contract, maintain a complete and separate set of prints of Contract Drawings at the job site at all times. On a daily basis, record work completed and all changes from original Contract Drawings clearly and accurately, including work installed as a modification or addition to the original design such as change orders, instructions issued by the Engineer, or conditions encountered in the field.

C. Drawings shall show record condition of details, sections, and riser diagrams, and control changes. Schedules shall show actual manufacturer and make and model numbers of final equipment installation. Remove all superceded data to show the completed work. Accurately indicate the location, size, type, and elevation of new utilities and their relationship to other utilities.

D. The Record Drawings will be used as a guide for determining the progress of the Work installed. They shall be inspected on a regular basis and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.

E. At completion of Work prepare a complete set of Record Drawings showing all systems as actually installed. The Contract Drawing electronic CAD files will be made available for this Contractor's copying, at his expense, into reproducibles to serve as backgrounds for the Record Drawings. Provide all drawings necessary to show the required as-built information. Submit three sets of prints

to the Engineer for comments as to compliance with this Section. Make all modifications so noted by the Engineer.

F. Certify the accuracy of the record drawings. Record Drawings shall become the property of the Owner.

G. When required by jurisdiction, submit the record set for approval by the Authority Having Jurisdiction in a form acceptable to the jurisdiction.

1.14 COMPONENT INTERCONNECTIONS

A. Components of equipment furnished under this Specification will not be furnished as integrated systems.

B. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection. Furnish two copies of interconnection wiring diagrams and tables to the Owner as part of the record drawings.

C. Furnish and install all component interconnections.

1.15 MANUFACTURER'S SERVICES

A. Provide manufacturer's services for testing, training and start-up of the following equipment:

1. Security Alarm System.

1.16 MATERIALS

A. Materials and equipment used shall be Underwriters Laboratories, Inc. listed wherever standards have been established by that agency. Written approval by the Engineer and local inspecting authority is required wherever UL Listed approval is not available.

B. Manufacturer of Principal Equipment

1. All lighting and power panelboards shall be made by one manufacturer.

2. All conduit of a given type shall be made by one manufacturer.

3. All wire and cables of a given type shall be made by one manufacturer.

4. All three phase magnetic motor starters furnished shall be made by one manufacturer.

1.17 WARRANTY

A. Provide warranty and guarantee on all equipment furnished and work performed for a period of one (1) year from the date of substantial completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF BASIC ELECTRICAL REQUIREMENTS

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SECTION 16060

GROUNDING SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Conduit
2. Wire
3. Ground rods
4. Ground bus bars

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

PART 2 PRODUCTS

2.01 CONDUIT

A. Conduit shall be as specified under Section 16130 (Raceways and Fittings).

2.02 WIRE

A. Wire shall be as specified under Section 16120 (Wire and Cables).

2.03 GROUND RODS

A. Ground rods shall be copper clad steel 3/4 inch in diameter and 10 feet in length unless otherwise shown on the drawings. Rods shall one 10 foot length rod. Ground rods shall be Copperweld, equal by A.B. Chance Co., or equal.

2.04 GROUNDING BUS BARS

A. Provide a grounding bus bar next to or below the main distribution board or main disconnect, ground bus bar to be approximately 8” above finished floor.

B. Grounding bus bars shall be copper, not less than ¼ inch by 2 inch by 24 inch.

C. All lugs, bolts and nuts shall be silicon bronze.

D. Buses shall be mounted to the room wall with standoff isolators, standoff brackets, and mounting bolts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Grounding electrode conductors shall be run in rigid steel conduits. Protecting conduits shall be bonded to the grounding electrode conductors at both ends.

B. Grounding conductors shall be run with feeders where shown on the drawings or hereinafter specified.

C. Liquid tight flexible metal conduit in sizes 1 inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps. Tie wraps shall be installed 12 inches apart and not more than 6 inches from ends.

D. Connect the following equipment by separate wire or cable directly to the grounding grid system:

1. Service entrance circuit breaker
2. Ground buses
3. Metal Fencing
4. Door frames and railings.

E. Connect the following equipment by separate wire or cable to the ground bus in the distribution equipment servicing the equipment:

1. Panelboards
2. Control panels
3. All feeders and branch circuits
4. Receptacle circuits

F. The following equipment shall be grounded through the metallic raceway systems with permanent and effective ground connections:

1. All metal cases and support frames
2. Lighting system
3. 120 Volt motors

G. Bond the following N.E.C. approved electrodes together to form a ground grid system:

1. Building steel frame
2. Building steel reinforcing rods within concrete at 4 ft. intervals.
3. Grounding rods and buses
4. Buried bare copper conductors

H. Grounding electrodes shall be driven where shown on the drawings. Spacing between electrodes shall be twice the length of the electrodes.

I. All grounding connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal.

J. All buried connections shall be made by a thermic welding process equal to Cadweld. Molds used for the welding process shall be new having no prior usage. Molds shall be the specific type for the connection to be made.

K. Light fixture bases shall be furnished with a grounding point.

L. All buried conductors shall be laid slack in trenches. The earth surrounding the cables shall be void of sharp objects which may injure the cables. Backfill material shall be natural earth. Where cables are exposed to mechanical injury they shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard. Connections shall be made as hereinbefore specified.

M. Do not allow water main connection to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

3.02 TESTING

A. The grounding system shall be tested under this section.

B. The equipment grounding shall be checked to insure continuity of the ground return path.

C. The ground grid systems shall be tested using the three terminal fall in potential method. A minimum of eight test points for each ground grid system shall be submitted for review by the Engineer. The test points shall be made along a straight line from the grid system to the reference terminal. The distance between the grid system and the reference terminal shall be consistent with normal practices for ground testing.

D. All test equipment shall be furnished hereunder and shall be similar to Biddle Earth Tester No. 250220 or equal.

E. These tests shall be performed during the dry season. Tests shall be performed before loaming and seeding or paving work has been performed.

F. The Contractor shall notify the Engineer immediately if the ground grid system exceeds 5 ohms.

3.03 CLOSEOUT ACTIVITIES:

A. Provide in accordance with Section 01700.

END OF GROUNDING SYSTEMS

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SECTION 16080

UNDERGROUND SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing and installing of a complete underground system of raceways, handholes, and frames and covers as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Raceways
2. Handhole frames and covers
3. Warning Tape

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

PART 2 PRODUCTS

2.01 RACEWAYS

A. Raceways shall be PVC schedule 40 conduit. Raceway materials shall be in accordance with Section 16130 (Raceways and Fittings).

2.02 HANDHOLES

A. Non-Utility Hand holes shall be UL listed, made of Polymer Concrete with Polymer Concrete Cover and open bottom.

B. The polymer concrete shall be molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

C. Impact resistant tested per ASTM D-2444.

D. Hand hole enclosure and covers shall meet or exceed the Tier 22 load requirements set forth in the American National Standards Institute's ANSI/SCTE 77 2010

E. Hand holes shall be a minimum 11"x18".

F. Covers shall be securely bolted to enclosure with stainless steel bolts and be on type and be embedded with the following logs:

1. "ELECTRICAL" logo for electrical power applications
2. "COMMUNICATIONS" logo telecommunication applications.
3. "CONTROL" logo low voltage applications.

G. Provide 12 inches of compacted crushed stone under all hand holes

2.03 POLYETHYLENE WARNING TAPE

A. Warning tape shall be red polyethylene film, 6 inch minimum width, Type XB-720 by W.H. Brady Co., or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Raceways shall be installed to drain away from buildings. Raceways between handholes shall drain toward the handholes. Raceway slopes shall not be less than 3 inches per one hundred feet.

B. Raceway banks shall be encased in concrete. Concrete shall be reinforced with steel rods.

C. Plastic spacers shall be used to hold raceways in place. Spacers shall provide not less than two inch clearance between raceways.

D. The minimum cover for raceway banks shall be 30 inches unless otherwise permitted by the Engineer.

E. Raceway entrances to buildings and structures shall be made with steel conduit not less than ten feet long.

F. Conduits in duct banks entering buildings and structures shall be spread to allow adequate room for conduit wall seals, pull and terminal boxes.

G. Where bends in raceways are required, long radius elbows, sweeps and offsets shall be used. Sweeps at riser pole shall be rigid steel encased in concrete.

H. All raceways shall be swabbed clean before cable installation.

I. Spare raceways shall be plugged and sealed watertight at all buildings and structures.

J. Raceways in use shall be sealed watertight at all buildings and structures.

K. Rigid steel conduit shall be used for risers at the service pole and other locations shown on the drawings. Conduit sweep at pole base shall be rigid steel conduit.

L. Raceway terminations at manholes shall be with end bells.

M. Pulling-in irons shall be installed opposite all raceway entrances to manholes.

N. All underground metallic conduit run underground in direct contact with earth shall be coated with asphaltum or bitumastic varnish or similar corrosion protection the entire length of the run.

O. All underground raceways/ductbanks shall be marked with warning tape located approximately 12 inches below grade above the raceway/ductbank.

P. Refer to paragraph titled "Conduit Embedded in Slabs" in Section 16000 (Electrical General Conditions).

END OF UNDERGROUND SYSTEMS

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SECTION 16085

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of all miscellaneous equipment as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Enclosure types
2. Electrical Enclosure
3. Surge Suppression Devices
4. Power Monitoring Relay
5. Nameplates
6. Meter Socket

B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.

C. Record Drawings - Prepare as specified in Section 16000.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. All circuit breakers, magnetic motor starters, and fuses furnished under this section shall be of the same manufacturer for each type of equipment.

PART 2 PRODUCTS

2.01 ENCLOSURE TYPE

A. NEMA Type 3R enclosure shall be general purpose sheet steel.

B. NEMA Type 4X enclosures shall be cast iron or stainless steel.

C. NEMA Type 7 shall be cast iron.

2.02 ELECTRICAL ENCLOSURE CABINET

A. Provide a free standing heavy-duty stainless steel, NEMA 3R, vented, corrosion resistant custom fabricated electrical cabinet enclosure with sealed neoprene gasketing around all edges of the door. Cabinet enclosures shall be made of 14 gauge steel. The enclosure shall have the minimum dimensions as shown on the drawings. Actual sizes of the enclosures and lengths of the enclosures may be larger to incorporate all of the required equipment. The Contractor is responsible to properly size the control cabinet required at no additional cost to the owner. Submit cabinet layout drawing with all dimensions shown for all installed devices.

B. Control Cabinet shall have a natural mill finish.

C. Enclosures shall have a sidewall mounted venting louvers on the opposite sidewall and heights. Ventilation louvers shall be equipped with filters. Doors shall have vault type operating handles with three point catch. Doors shall be fully gasketed with opening of sufficient size to permit ready removal of any of the equipment installed in the compartments. Doors shall have provisions for pad locking.

D. Heavy duty padlock with six sets of keys for each lock shall be furnished. Padlocks shall have forged brass case with brass shackle. Shackle shall be 5/16 inch diameter with 2½ inch clearance. Locks shall be No. 3841 as manufactured by Yale, or equal by Corbin.

E. Pedestal roof shall slant to the rear of the enclosure. Drip shield shall extend over door opening. All exposed hardware shall be Type 316 stainless steel.

F. Cabinet enclosures shall be bolted to a concrete pad on stainless steel or aluminum feet using Type 316 stainless steel hardware.

G. In the cabinet enclosure provide a linear LED light with light switch, a dedicated 120V receptacle for owner provided heater, a dedicated 120V receptacle for the security alarm panel, ground bus, and a duplex 120 Volt weather-proof convenience outlet.

I. Rigid steel conduits shall enter from below. All conduits routed from the NEMA 7 Diversion structure area shall have EYS fittings sealed with epoxy.

2.03 SURGE PROTECTION DEVICE (SPD)

A. Electrical Service SPD

1. Certify unit listed to UL 1449, 3rd Edition and UL 1283.

2. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent devices. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

3. SPD to be enclosed, surfaced mount and to include surge counter, audible alarm and dry contact for remote status.

4. Minimum surge current capability (single pulse rated) per phase shall be 200kA

5. Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
120/240	700V	700V	1000V	600V

6. Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
120/240	25%	150V

7. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

2.04 POWER MONITORING RELAY

A. Power monitoring relay shall be a undervoltage relay mounted in a 6"x 6" NEMA 3R enclosure within din rail mounting.

B. Undervoltage Relay

1. Din rail mounted single phase undervoltage relay with adjustable setting range, time delay, and output contacts.

2. Input voltage: 0-300V, 1-phase.

3. Adjustable range: Min: 5-95%, Max: 10-100%

4. Adjustable response time delay: 0.1 – 10s

5. Contacts: (2) PDT floating contacts,

C. Undervoltage Relay shall be EDM-FL-V-300 or equal by others.

2.05 NAMEPLATES

A. Nameplates shall be provided for all special purpose tumbler switches, disconnect switches, remote control stations, motor starters, time clocks, panelboards, terminal cabinet, etc. to designate the equipment controlled and function.

B. Nameplates shall be black and white laminated, phenolic material having engraved letters approximately 1/4 inch high, extending through the black face into the white layer.

C. Nameplates shall be attached to the panel by self-tapping stainless steel screws or rivets.

2.06 METER SOCKET

A. Provide a meter socket in a NEMA 3R enclosure with HASP cover provision of the type approved by the utility company.

B. Meter Socket shall be 4 terminal, self-contained ringless type meter socket with a manual single handled bypass with locking jaw and safety arc shield.

C. The main circuit breaker shall be molded case, two pole unless otherwise noted, with voltage rating as required and service entrance rated. Ampere rating shall be as shown on the drawings. The interrupting capacity shall be not less than 10,000 Amperes, RMS symmetrical at 240VAC.

PART 3 EXECUTION

3.01 INSTALLATION

A. All field mounted devices shall be mounted four feet-six inches above the finished floor or grade. Devices shall be adequately supported on walls, columns or other supports. The Contractor shall furnish and install channel iron imbedded in the ground or floor to support devices where necessary.

B. All control equipment shall be identified as to the equipment it controls. Provide lamacoid nameplates at all equipment.

3.02 TESTS AND CHECKS

A. The following minimum tests and checks shall be made before energizing the automatic transfer switch.

1. Perform insulation resistance tests phase-to-phase and phase-to-ground with switch in both source positions. The Insulation resistance test voltages and minimum values to be in accordance with manufacturer's published data.

2. Measure contact resistance in normal and alternate source position.

3. Determine contact resistance in micro-ohms. Investigate any value exceeding 500 micro-ohms or any values which deviate from adjacent poles by more than fifty percent (50%).

END OF MISCELLANEOUS EQUIPMENT

SECTION 16120

WIRES AND CABLES

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing, installing and testing of all wire, cable and appurtenances as specified herein and as shown on the drawings. All wiring of a given type shall be the product of one manufacturer.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Wire
2. Cable
3. Terminations
4. Lugs
5. Wire and Cable Markers

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Wire for single phase circuits shall be Type XHHW or THWN-THHN.

B. Wire for service feeder shall be Type XHHW.

C. Single conductor wire for control, indication and metering shall be Type THWN/THHN No. 12 or 14 AWG, stranded.

D. Multi-conductor control cable shall be used for the underground system and shall be No. 12 or 14 AWG, stranded with an overall jacket.

E. Wire for process instrumentation shall be twisted shielded pairs No. 16 AWG, stranded.

F. Ground wires shall be Type THW, green. Bare ground wires shall be soft drawn copper, 98 percent conductivity.

1.05 MINIMUM SIZES

A. Except for control and signal wiring, no wire smaller than number 12 AWG shall be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors No. 8 AWG and larger sizes shall be stranded.

2.02 600 VOLT WIRE

A. Type XHHW shall be cross-linked polyethylene, as manufactured by Prysmian Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.

B. Type THWN/THHN shall be as manufactured by Prysmian Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.

C. Multi-conductor control cable shall be stranded, 600 Volt, cross-linked polyethylene insulated, neoprene jacketed, as manufactured by Allied Wire and Cable, or equal.

2.03 INSTRUMENTATION CABLE

A. Process instrumentation wire shall be twisted pair, 600 Volts, polyethylene insulated, aluminum tape, tinned copper braid shielded, polyvinyl chloride jacketed, as manufactured by Okonite Co., Belden Corp., or equal.

2.04 CONNECTORS AND TERMINAL LUGS

A. Splices for No. 10 or No. 12 A.W.G. solid wires, such as for lighting branch circuits, shall be made with insulated wire connectors.

B. Connectors and terminal lugs on wires No. 8 A.W.G. and larger shall be of the mechanical or clamp type.

2.05 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be “Omni-Grip” as manufactured by W.H. Brady Co., or equal.

B. Wire and cables with diameters exceeding the capacity of the “Omni-Grip” shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by W.H. Brady Co., T&B Fasteners Inc., or equal.

C. The "to" and "from" destinations shall be clearly identified on each cable at each termination and within manholes, pull boxes and junction boxes.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. All wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) shall be uniquely identified at each end with wire and cable markers.

1. Where wiring originates from a motor control center or process control panel the wire identification number shall incorporate the terminal numbers used in the control center or panel and a number to identify the motor control center or panel.

2. Wires shall be identified at both ends and at intermediate junction boxes, terminal cabinets, etc. Wire identification numbers shall be unique.

3. A typed list of the numbers used at each motor control center and control cabinet shall be submitted with the as built drawings.

C. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. approved for use with the insulation specified.

D. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

E. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire.

F. Shielding on instrumentation wire shall be grounded at the transmitter end only.

G. No more than three lighting circuits, each from a different phase, shall be connected to a common neutral.

H. Cables penetrating fire rated floors, walls, etc. shall be fireproofed. Fireproofing material shall be U.L. classified for three hour fire rating. Fire-proofing system shall be as manufactured by 3M Co., Thomas & Betts, or equal.

I. Power conductors (other than lighting & receptacle) shall be run continuous and splicing should be kept to a minimum. The Engineer should be informed of where splices will occur.

3.02 TESTS

A. All 600 Volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 500 Volts. Submit a written test report of the results to the Engineer.

END OF WIRES AND CABLES

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SECTION 16130

RACEWAYS AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of complete raceway systems as specified herein and as shown on the drawings.

B. All raceway systems shall be complete with fittings, boxes or cabinets, and necessary connections to result in a complete system.

C. Aluminum materials shall not be used.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Raceways.

2. Boxes and Fittings.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Except where otherwise shown on the drawings, or hereinafter specified, all raceways installed exposed shall be rigid heavy wall galvanized steel conduit.

B. Except where otherwise shown on the drawings, or hereinafter specified, all raceways installed within the Administration building shall be electrical metallic tubing.

C. PVC coated galvanized rigid steel conduit shall be used within all Diversion Structures and Tunnels.

D. PVC Schedule 40 conduit shall be used underground except as specified herein and where otherwise indicated on the drawings.

E. When routing signal cables in raceways, maintain 12” spacing from power raceways and only cross at a 90 degree angle.

F. Unless otherwise hereinafter specified or shown on the drawings, all boxes shall be metal.

G. Exposed switch, outlet and control station boxes and fittings shall be cast or malleable iron.

H. Concealed switch, outlet and control station boxes in dry-wall finished areas shall be pressed steel.

I. Terminal boxes, cabinets, junction boxes, pull boxes and wireways used in areas designated as NEMA 4X shall be stainless steel 316, gasketed.

J. Combination expansion-deflection fittings shall be used where conduits cross structure expansion joints. Refer to Structural drawings for expansion joint locations.

K. Conduit wall seals shall be used where underground conduits penetrate walls or at other locations shown on the drawings.

L. Fire stops shall be used where cables or conduits penetrate through fire resistant rated walls, floors, ceilings or partitions. All fire stopping shall be inspected by an owner hired special inspector.

M. PVC coated rigid steel conduit sweeps shall be used where concealed PVC conduits rise up out of floor slabs.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Conduit

1. Rigid heavy wall steel conduit shall be hot-dipped galvanized as manufactured by the Youngstown Sheet and Tube Co., Allied Tube and Conduit Corp., Wheeling-Pittsburgh Steel Corp., or equal.

2. PVC conduit, up to 4 inch in diameter, where installed concealed in floor slabs, walls or underground shall be rigid polyvinyl chloride Schedule 40 as manufactured by Carlon, Phillips Petroleum Co., Triangle Pipe & Tube Co., Inc., or equal.

3. PVC conduit, 5 inch in diameter and larger, used underground and at other locations shown on the Drawings shall be rigid polyvinyl chloride schedule 40 as manufactured by Carlon, Phillips Petroleum Co., Triangle Pipe & Tube Co., Inc., or equal.

4. PVC coated rigid steel conduit shall have a 0.040 inch thick, polyvinyl chloride coating permanently bonded to hot-dipped galvanized steel conduit, as manufactured by Calbond, Ocal, Robroy Industries, or equal.

B. Electrical metallic tubing shall be hot-dipped galvanized steel as manufactured by Youngstown Sheet and Tube Co., Allied Tube and Conduit Corp., Wheatland Tube Co., or equal.

C. Liquidtight, Flexible Metal Conduit, Couplings and Fittings.

1. Liquidtight, flexible metal conduit shall be Sealtite, Type UA, as manufactured by Anaconda American Brass Co., or equal by American Flexible Conduit Co., Inc., or equal.

2. Fittings used with flexible conduit shall be of the screw-in type as manufactured by Thomas and Betts Co., Crouse-Hinds Co., O.Z. Manufacturing Co., or equal.

D. Flexible couplings shall be as manufactured by Crouse-Hinds Co., Appleton Electric Co., O.Z. Manufacturing Co., or equal.

E. Boxes and Fittings

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized as manufactured by Raco Manufacturing Co., Adalet Co., O.Z. Manufacturing Co., or equal.

2. All boxes including, but not limited to, terminal boxes, junction boxes and pull boxes shall be sheet steel unless otherwise shown on the drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Boxes shall be as manufactured by Hoffman Engineering Co. or equal.

3. All boxes and fittings used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal. The tensile strength of the bond shall be not less than 2,000 pounds.

4. All boxes and fittings used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal, the same thickness as used on the coated steel conduit.

5. Cast or malleable iron boxes and fittings shall be galvanized with cast galvanized covers and corrosion-proof screws as manufactured by the Crouse-Hinds Co., Appleton Electric Co., O.Z. Manufacturing Co., or equal.

6. PVC fittings shall be as manufactured by Carlon, An Indian Head Co., O.Z. Manufacturing Co., or equal.

7. EMT fittings shall be watertight compression type. Set-screw type fittings are not acceptable

8. Steel elbows and couplings shall be hot-dipped galvanized. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the steel, the same thickness as used on the coated steel conduit.

9. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., O.Z. Manufacturing Co., or equal.

10. Conduit wall seals shall be Type WSK as manufactured by O.Z. Manufacturing, Co., or equal by Link Seal Co.

11. Combination expansion-deflection fittings shall be Type XD as manufactured by Crouse-Hinds Co., or equal by Appleton Electric Co., O.Z. Manufacturing Co.

12. Conduit seal bushings shall be Type CSB as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co.

13. Fire stops shall be Type CFSF as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co., Appleton Electric Co.

14. Explosion proof conduit seals shall be Type EYS as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co. and Appleton Electric Co.

F. Conduit Mounting Equipment. Hangers, rods, backplates, beam clamps, fasteners, etc. shall be hot-dipped galvanized iron or steel for all areas except for the wet well. Mounting equipment shall be as manufactured by B Line Co., Thomas and Betts Co., Unistrut Corp., or equal.

G. Conduit Mounting Equipment. Hangers, rods, backplates, beam clamps, fasteners, etc. shall be stainless steel for within the Diversion Structures and Tunnels. Mounting equipment shall be as manufactured by B Line Co., Thomas and Betts Co., Unistrut Corp., or equal.

H. Corrosion Protection for Galvanized Conduit located exterior to buildings shall be provided. Corrosion protection for galvanized conduit shall be cold galvanized zinc based paint as manufactured by L.P.S. Co., Los Angeles, California, CRS Chemicals, Drecher, Pennsylvania, or equal.

I. Watertight Silicone Type Sealant. Sealant shall be non slumping type silicone meeting UL water leakage test, W Rating and have excellent adhesion characteristics to most construction surfaces, including: concrete, gypsum, metal, plastic, wood and insulation

PART 3 EXECUTION

3.01 INSTALLATION

A. No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than three 90 degree bends in any one run. Approved factory elbows shall be used when sharper bends are necessary. Pull boxes shall be provided as required or directed.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

D. Conduit supports shall be spaced at intervals of eight feet or less, as required to obtain rigid construction.

E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Plastic "CLIC" system supports are not acceptable. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8 inch diameter. Wire hangers will not be accepted.

F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

G. All conduits on exposed work and concealed above hung ceilings shall be run at right angles to or parallel with surrounding wall and shall conform to the form of the ceiling. Diagonal runs will not be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

H. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

I. PVC conduits shall be installed using a fusing cement process. Conduits shall be water tight.

J. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.

K. Metallic heavy wall conduits shall be installed using threaded fittings. Threadless fittings may be used in isolated instances when approved by the Engineer.

L. Liquidtight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.

M. PVC coated rigid steel conduits shall extend a minimum of 12 inches above finished slabs. Conduits penetrating walls shall be caulked gas tight on both sides.

N. When a conduit has to be cut in the field, it shall be cut square using a hand or power hacksaw cutter, or an approved pipe cutter using knives. The use of pipe cutter wheels will not be permitted. The cut ends of the field cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory cut threads on conduits. Field cut threads shall be protected by a field applied cold galvanizing compound.

O. Conduits entering buildings below grade shall be furnished with a conduit seal bushing.

P. Concealed conduits in floor slabs and walls and encased in concrete envelope shall be run in direct line with bends of largest possible radius.

Q. Ducts installed in concrete slabs shall be installed as specified in Section 03300 (Cast-In-Place Concrete). Ducts shall be arranged to minimize crossings.

R. Ducts shall not be installed in slabs where the slab is below the highest known groundwater level.

S. Where ducts terminate at panelboards, terminal cabinets, etc. panel of sufficient width and depth shall be provided to maintain the 2 inch spacing between ducts or wireways shall be provided below panels, cabinets, etc.

T. A ground wire shall be run in all runs of electric metallic tubing and PVC conduit.

U. All bends in PVC conduit shall be made using a hotbox and bending guide tool.

V. Conduits run underground below the highest known ground water level shall not enter buildings below this groundwater level without first being run through a drain manhole, handhole, or exterior pull box.

END OF RACEWAYS AND FITTINGS

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SECTION 16442

PANELBOARDS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of all panelboards as specified herein and as shown on the drawings. All panelboards shall be provided with the applicable NEMA enclosure in accordance with the 16000 Basic Electrical Requirements.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300

1. Panelboards, including construction details and enclosures
2. Terminals and lugs
3. Trim
4. Buses
5. Circuit Breakers
6. Groundfault Circuit Interrupter

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Panelboard ratings shall be as shown on the drawings. All panelboards shall be rated for the intended voltage.

B. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. “Standard for Panelboards” and “Standard for Cabinets and Boxes” and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

PART 2 PRODUCTS

2.01 PANELBOARD CONSTRUCTION

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, and buses. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper wire of the sizes indicated.

2. Interiors shall be designed such that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be such that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A factory provided label shall be provided listing panel type, number of circuit breakers and ratings.

5. The main breaker shall be at the top or bottom of the bus construction and not a branch breaker.

B. Buses

1. Main bus shall be copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper. All buses shall be tinned.

2. Main bus shall be distribution line sequence type configuration to allow installation of two pole circuit breakers at any location.

3. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

4. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

5. Solderless main lugs or main circuit breakers shall be furnished as shown on the drawings.

6. Bus bracing to be at least equal to the interrupting rating of lowest rated circuit breaker installed in panel. Series rated breakers and panels shall not be acceptable.

C. Boxes

1. Boxes shall be made from galvanized code gauge steel having multiple knockouts unless otherwise noted. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of four inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as specified herein. Surface mounted boxes shall be field punched for conduit entrances.

3. At least four interior mounting studs shall be provided.

4. Panelboards shall be "door-in-door" construction.

D. Trim

1. Hinged door-in-door construction shall enclose all circuit breaker handles and shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 inch in height shall have a vault handle and three point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike. A directory frame and card having a transparent cover shall be furnished on each door.

3. Trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of NEMA 1, 1A, 3R and 12 panelboards shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer

1. 120/240 Volt, single phase, 3 wire, branch circuit panelboards rated for 225 Amps and less shall be Pow-R-Line 1X type as manufactured by Eaton, or equal by Square D and General Electrical.

2.02 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the drawings. Circuit breaker mounting shall not exceed 78 inches above floor.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers installed in 120/240 Volt and 120/208 Volt panelboards shall have an interrupting capacity of not less than 10,000 Amperes, RMS symmetrical.

D. Circuit breakers installed in 277/480 Volt panelboards shall have an interrupting capacity as shown on the Electrical Contract Drawings.

E. Main circuit breaker shall be attached to the main vertical bus.

2.03 GROUND FAULT CIRCUIT INTERRUPTER (GFCI)

A. GFCI shall be provided for circuits where indicated on the drawings. GFCI units shall be molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity matching the circuit breakers in the panelboards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least ½ inch air space between the box and the wall.

B. Circuit directories shall be typed identifying location and nature of load served.

C. Panelboards installed in areas with finished walls shall be installed recessed into the wall with the front of the panel flush with the finished wall.

END OF PANELBOARDS

SECTION 16720

SECURITY ALARM SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Work of this Section includes the furnishing and installing of complete a security alarm system as specified in the Contract Documents.

B. The system shall include, but not be limited to, an alarm monitoring control panel, magnetic door switches, timed exit/entry delay control keypad, motion detectors, heat detectors, help call pushbuttons, conduit, fittings and wire.

C. Provide all required coordination with door installations for proper installation of alarm devices and wiring.

1.02 SUBMITTALS

A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of the SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Complete system wiring diagrams and elementary or control schematic.

2. Data sheets and outline drawings showing details for mounting all control devices and panel.

3. Battery system load calculations.

4. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. The security alarm system shall be the standard product, as modified by these Specifications of the manufacturer stated for this type equipment. In addition, the manufacturer shall maintain a permanent service organization and a supply of spare parts as necessary to provide adequate service to this system within 24 hours from receipt of a request for service.

B. The system shall be UL approved for commercial burglary alarm system type DSC by Johnson Controls, not equal as the city's has standardized this system in their other pump stations.

C. The system design and installation shall conform to the following standards:

1. All equipment shall be UL listed for its intended purpose.

2. NFPA standards 70, 72, 90A, 92A, and 101.

3. Current State Building Code.

4. The Americans with Disabilities Act (ADA).

5. All requirements of all local authorities having jurisdiction.

D. System Provider Qualifications:

1. Minimum 20 years experience in the manufacturing, integration and testing of security alarm systems.

2. An experienced security alarm system equipment supplier who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1.05 SYSTEM OPERATION

A. The system shall be have the following alarm zones.

1. Pump Station Fire (Heat Detectors)

2. Intrusion

3. Spare

4. Spare

B. Actuation of the door switch or heat detector when the system is armed shall

1. Actuate discrete remote dry contact alarm for the associated zone to SCADA system.

2. Actuate the respective zone alarm lamp at the system alarm key pad.

3. Visually indicate the alarm initiating zone via the LCD display on the system alarm keypad.

C. The system alarm key pad panel shall allow a timed exit/entry control to access the building without tripping the intrusion alarm. Authorized personnel entering the building will have up to five minutes to de-activate the alarm system prior to sending an alarm output.

D. Opens, ground, or tampering, occurring on the zone monitor circuit shall cause a trouble signal and actuate a discrete remote dry contact alarm for the associated zone to SCADA system. To clear a

trouble signal transmission, the trouble must be corrected and the system will automatically return to its normal state of operation. To restore the device actuating the alarm, the alarm must be secured to its normal position and the system reset switch operated. A trouble signal on an individual zone monitor circuit shall not interfere with the automatic transmission of an alarm signal on another zone monitor circuit occurring during the same period.

PART 2 PRODUCTS

2.01 SYSTEM CONFIGURATION

A. Provide a complete security system consisting of the following major subsystems:

1. Detection subsystem: Subsystem shall consist of sensors to detect alarm and trouble conditions.

2. System Alarm Key Pad: Subsystem shall consist a speaker, annunciation lights, function keys, and LCD annunciation display to properly display and control all system functions and alarms.

3. Communications subsystem: Subsystem shall consist of elements required to ensure that pertinent data is transferred from the point of origin to the point where appropriate actions can be taken.

4. Assessment subsystem: Subsystem shall consist of electronic devices required to visually and audibly verify the validity of security system alarms.

5. Alarm reporting subsystem: Subsystem shall consist of electronic devices to control, process, integrate, and annunciate security system data.

6. Power subsystem: Subsystem shall consist of components required to ensure continuous operation of the entire security system.

B. All system functions, alarms and annunciations shall be monitored and controlled at the system alarm key pad.

C. The system shall have the capacity to collect date/time entry data in non-volatile memory and display the date/time entry when requested by an authorized user.

D. The system shall have the capacity to collect, communicate, and display a minimum of 8 programmable sensor zone alarms and to enable control of one or more response devices in each of the sensor zones.

E. A single alarm shall be annunciated at system alarm key panel within approximately 2 seconds after sensor transducer or other detection device activation.

F. Provide the capability to detect when a critical component of the system experiences temporary or permanent loss of power and to declare an alarm at the system alarm keypad.

G. Alarms shall not be generated by power switching; however, an indication of power switching and on-line source shall be provided at the system alarm keypad. Upon restoration of normal power, the system shall automatically switch back to the primary source. Low voltage condition of an on-line battery and battery charger circuit failure shall be detected and reported as a trouble condition.

2.02 SYSTEM CONTROL PANEL

A. Provide micro-processor based modular components to make up a complete control system. The panel shall have a NEMA 3R rating with the following features:

1. Alarm output relays.

2. Zone modules, number as required for proper functionality for each system, access lamps, secure lamps, access/secure key switches for each.

3. Earth detection module.

4. Sealed lead acid battery standby power shall be supplied. It shall be under lock and key within this supervised cabinet to prevent deliberate tampering.

5. Solid state battery charger.

6. Alarm resound module.

7. Total system supervision by a micro-processor which will supervise all wiring regardless whether or not the area of protection is bypassed or not.

8. Quantity five normally open dry contacts which close on alarm conditions.

9. Surge protector.

B. Electrical power shall be obtained by the normal electrical distribution system. Power shall be continuously monitored and, if interrupted, automatic switching from primary to emergency backup source shall be accomplished without interruption or degradation of critical system function.

C. Furnish 120 volt AC service, transformed through a two-winding isolation transformer and rectified to low-voltage DC for system operation. Obtain primary power at the 120V breaker as indicated in the Contract Documents.

D. Provide lockable device at circuit breaker and label the circuit breaker in that panelboard: "Alarm System Do Not Turn Off."

E. Provide backup power to the primary power by dedicated batteries in the Control Panel. Batteries shall be capable of operation in any position and shall be protected against venting caustic chemicals or fumes within an equipment cabinet. Batteries shall also be capable of continuous operation for up to 4 hours without recharge or replacement. If the sensors power requirements exceed the allowable UL rated capacity of the control communicator battery, provide the number of separate power supplies required to power the sensors. Provide each power supply with its own rechargeable battery and charger.

F. Provide system components to facilitate modular subassembly and part replacement. Electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Circuitry shall not be so densely placed as to impede maintenance. Power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Light duty relays and similar switching devices shall be solid-state or hermetically sealed electromechanical type.

G. Provide only components in current manufacturing production. Components shall be manufactured to meet requirements specified herein and shall be free from characteristics and defects which affect appearance or serviceability or which render equipment unsuitable for the intended purpose. Provide components designed for continuous operation at specified conditions.

H. Alarm detection, communication, and power circuits shall be protected against lightning and voltage transients. Surge suppression device shall conform to UL 1449, rated single pulse transient energy by metal oxide varistor (MOV). The protective device shall be automatic and resettable and shall be active at all times. Fuses shall not be permitted as protection devices.

I. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices, input and output connectors, terminals, and test points shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location. Terminal markings and labels shall be of a permanent and legible type and located to be visible when the associated system wiring is in place. Identification markings shall be associated with each adjustment device or item requiring periodic maintenance. Safety warning or cautions shall be marked in conspicuous red letters. Controls not required for operation of the system shall be inaccessible to the system operator.

J. Cabinets, control communicators, wiring gutters, and other component housings, collectively referred to as enclosures, shall be formed and assembled to be sturdy and rigid. Metal thickness shall not be less than those in Tables 8.1, 8.2, and 8.3 of UL 1610 for alarm components, and NEMA ICS 2 and NEMA ICS 6 for other enclosures.

K. Doors and covers shall be flanged. Where doors are mounted on hinges with exposed pins, hinges shall be of the tight-pin type, or ends of hinge pins shall be tack welded to prevent ready removal. Provide doors having a latch edge length of less than 24 inches with a single lock. Covers of junction boxes provided to facilitate initial installation of the system shall be held in place by tack welding, brazing, or one-way screws.

L. Ventilation openings in enclosures and cabinets shall conform to the requirements of UL 1610. Sheet metal enclosures shall be designed for surface or recessed wall mounting with top hole slotted.

M. Locks and key-lock-operated switches required to be installed on component enclosures shall be UL listed, round-key type with three dual, one mushroom, and three plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of five cylinder pin and five-point three-position side bar in the same lock. Keys shall be stamped "DO NOT DUP". Key-lock-operated switches shall be keyed differently.

2.03 SYSTEM ALARM KEY PAD

A. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location.

B. Entry/Exit delay. Timer shall be adjustable from 0 to 5 minutes.

C. Annunciators shall be liquid crystal displays (LCDs). Annunciators shall be so connected in the circuit that failure of the annunciator, socket, or protective circuitry shall not result in an improper or indeterminate signal. LCDs shall be compatible with standby power supplies.

D. Common trouble signal, trouble silencing switch, power on lamp, reset switch, alarm acknowledge switch and common zone test.

E. An alarm shall be annunciated to clearly identify any component experiencing power loss.

2.04 MAGNETIC DOOR SWITCHES

A. The switch mechanism shall have a minimum gap of 3/8-inch and a maximum gap of 1 ¼ inches without internal adjustment.

B. Surface mount switch housing for the switch element shall have capabilities to receive threaded conduit.

C. The housing cover for surface mounted switches shall be secured using tamper resistant stainless steel screws. The magnet housing cover shall not be readily removable.

D. Conductors running from the door to alarm circuits shall be jumpered within a flexible armored cord constructed from corrosion-resistant metal.

E. Each end of the armored cord shall terminate in a junction box or other enclosure. Armored cord ends shall be mechanically secured to junction boxes by clamps or bushings. Conductors within the armored cord shall be provided with lug terminals at each end. Jumpered conductors and the armored cord shall experience no mechanical strain as the door is removed from fully open to closed. The switch circuit shall initiate an alarm if a short circuit is applied to the door cord.

2.05 HEAT DETECTORS

A. Fixed temperature 135 degrees F, vapor-tight industrial grade units.

PART 3 EXECUTION

3.01 INSTALLATION

A. No wire smaller than No. 14 AWG shall be installed. All wiring shall be color coded.

B. Coordinate the installation of the door switches and wiring with the existing doors.

C. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.02 FINAL TESTS / WARRANTY

A. The system shall be fully tested by a UL certified testing company, in accordance with UL guidelines and NFPA standards. Each and every device shall be tested.

B. A copy of the final test report shall be submitted indicating proper functioning of the system and conformance to the specifications. The test shall be performed by UL certified and factory-trained qualified technicians. Each and every device shall be tested, and standalone operation of remote panels shall be verified. Final testing [and UL certification] shall be performed by the same company that will hold and execute the Test and Inspection contract.

C. The manufacturer shall guarantee all system equipment for a period of three (3) years from the date of final acceptance.

D. The contractor shall guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one (1) year from the date of final acceptance of the system.

3.03 ADJUSTING

A. Occupancy Adjustment. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide up to two visits for this purpose without additional cost.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to explain programming and operation of system and to train Owner's maintenance personnel on procedures and schedules for maintaining, programming, operating, adjusting, troubleshooting, and servicing system. Provide a minimum of four hours' training in operation and maintenance.

3.05 TRAINING

A. The contractor shall provide the services of the manufacturer's representative for a period of 4 hours, during normal business hours, to instruct the owner's designated personnel on the operation of the system.

END OF SECURITY ALARM SYSTEM

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DIVISION 17

INSTRUMENTATION & CONTROL

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SECTION 17300

INSTRUMENTATION AND CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section includes furnishing all labor, materials, tools and equipment required to furnish and install a complete Diversion Structure monitoring control panel, and instrumentation. The system shall include instrumentation equipment, and a cellular RTU (Remote Telemetry Unit) monitoring panel.

B. The work required by this section shall include all primary instrumentation equipment and devices necessary to provide process data and monitoring as shown and as specified. The particular requirements of this section are specific in that this system supplier must furnish and install a system which will provide for remote monitoring interface. All input shall be collected as noted in the I/O lists of this project.

C. The system supplier shall carefully review all requirements of this section in order to fully understand the limit of responsibility and the extent of what must be done to complete this portion of the system. It shall be understood that this system supplier will provide for a complete and operational monitoring system that shall be completely documented and coordinated. Data collection shall be accomplished through a cellular monitoring RTU system by Telog.

D. The capacity and quality of instruments and equipment shall be provided such that they perform the function described in the SYSTEM DESCRIPTION, as shown on the Contract Drawings and as listed in the Instrumentation List at the end of this section. It is the intent of this section of the specifications to specify a complete instrumentation and monitoring system. Anything that is not shown on the drawings but is mentioned anywhere in the specifications or vice versa, or anything not expressly set forth in either but which is reasonably implied, shall be furnished and performed as though specified, shown and mentioned in both. If an item appears in one area of the contract documents but not in another, it shall be provided in its entirety. This system supplier shall obtain and review complete set of the specifications and drawings prior to submitting final costs for the work of this section and/or any related sections.

E. Equipment under this section shall be furnished, installed, and placed in proper operating condition in full compliance with details, drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the Engineer.

F. The Instrumentation System supplier under this Section shall insure total compatibility where interfacing between equipment is required and shall initiate and maintain close communication and cooperation with the supplier of the equipment throughout the shop drawing and equipment start-up and testing phases of the work and insure total compatibility of all required interfacing at no extra cost to the Owner.

G. Provide and configure a new Telog RTU monitoring system that shall include, but not be limited the RTU panel, instrumentation, cellular antenna, and antenna cable.

H. Work specifically required under this Section includes all Instrumentation/Controls work shown on or required by Contract Drawings GI-1, GI-2, I-1, and I-2.

I. The contractor undertaking the work of this section shall review the other specification sections for additional scope items that are included in or bear upon the work.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals:

1. Manufacturer's data, order sheet or equivalent for each individual panel, instrument or device being supplied. The information shall include but not be limited to model number, exact chart, scale or calibration range, type of enclosure and mounting, input/output and power data and the instrument tag number (or loop number for auxiliary equipment). Sales literature will not be accepted.

2. Manufacturer's outline and mounting dimensions for all field mounted devices, and scaled layout drawings for primary and supplemental control panels.

3. The system supplier shall clearly identify any exception to the specification or drawings. Failure to do this will be grounds for rejection of the submittal.

B. For approval before release for manufacturing:

1. All equipment to be furnished under this Section must be approved prior to any of this equipment being released for manufacturing unless otherwise noted by the Engineer.

C. Shop drawings shall be submitted in accordance with Section 01300 - Submittals and include the following special conditions:

1. All material submitted for review shall be contained in one submission. The material shall be furnished in bound volumes as required for a complete submittal. Loose material submitted will not be reviewed. Partial submittals unless agreed to by the Engineer will not be reviewed. Sales bulletins or other general publications are not acceptable as submittals.

2. If more than two submittals (initial submittal and one re-submittal) are required for approval, the system supplier shall be liable for back charges for the Engineer's services to review additional submittals.

D. Operation and Maintenance Manuals shall be submitted in accordance with the requirements of Section 01730 - Submittals.

1.03 RESPONSIBILITY FOR EQUIPMENT

A. The Contractor shall be responsible for providing and placing in satisfactory operation all monitoring panels, instruments and equipment necessary for a complete system. This shall include all piping, electrical connections, and system engineering as provided by a qualified Instrumentation and Control System Supplier, and accessories required by the Work of this Section or other related Work included under other Sections in the Contract Documents.

B. The supply of the monitoring panel and instrumentation shall be by a single Instrumentation and Control System Supplier. The supplier shall be responsible to the Contractor for: (1) satisfactory detailed design of a complete and coordinated system (2), start-up and testing services, (3) training, and (4) services to assure satisfactory operation.

C. The Contractor shall not purchase separate equipment and attempt to assemble a system. This Work is to be performed by a qualified Instrumentation and Control System Supplier as approved by the Engineer.

D. The Contractor shall furnish record drawings for each entire system. This shall include drawings for all locations with point to point wiring for the equipment. The drawings shall be complete and shall require on site verification and acceptance by the Engineer.

E. The Instrumentation and Control System Supplier shall be required to furnish equipment that is installed under other Sections in the Contract Documents. The Contractor shall be responsible for coordinating this Section with the necessary equipment in order to provide for a complete installation. It shall be coordinated such that there is proper installation of this equipment between suppliers in order to avoid delays in completion due to availability of this equipment. The Instrumentation and Control System Supplier shall provide a separate submittal on this specific equipment for early approval in order to avoid delays.

1.04 DESIGN CRITERIA

A. All instrumentation shall meet or exceed I.S.A. Standards and Recommended Practices, ANSI, National Electrical Code, OSHA, and any other applicable code or local regulation. All panel instruments shall be of the same manufacturer and model type to provide uniform appearance.

1.05 INSTRUMENTATION AND CONTROL SYSTEM SUPPLIER

A. The Instrumentation and Control System Supplier shall be one of the following pre-qualified Instrumentation and Control System Supplier's listed in alphabetical order.

1. Electrical Installations, Inc.
   Moultonboro, New Hampshire
   603-253-4525

2. Harbor Controls
   North Kingstown, RI
   401-667-0930

3. R. E. Erickson Co., Inc.
   Walpole, Massachusetts
   508-668-9330

B. Only pre-qualified Instrumentation and Control System Suppliers shall be allowed.

PART 2 PRODUCTS

2.01 INSTRUMENTATION GENERAL

A. All equipment shall be of the latest proven design. First generation equipment with less than three years general use shall have documentation on construction operation, field test and user list.

B. All equipment shall be suitable for operation in the environment of the Project.

C. Transmission to and from analog devices shall be 4-20 mAdc.

D. All equipment necessary to complete the requirements of this Section shall be supplied by the Instrumentation and Control System Supplier.

E. Electronic transmitting equipment shall provide loop power. True 2-wire transmitter may have its loop power supplied in the receiving instrument, if available, or by a plug in power supply mounted in the receiving instrument panel.

F. All conductors running from the field to the control panel shall be of a single, continuous length, without splices except at approved junction boxes.

G. All shielded cable shall be grounded at the monitoring panel end only. Shields shall be carried through junction boxes with the least possible resistance and kept isolated from ground at these points. The field end of the shield shall be insulated to prevent grounding.

H. All field electronics and panel equipment shall be suitable for operation in ambient temperatures of -40 degrees F to 140 degrees F.

I. Nameplates shall be provided on all field mounted transmitters, panels, indicators, etc. Nameplates shall be identical to those specified for Control Panels.

2.02 RTU MONITORING PANEL

A. A fourteen input channel recorder, power source and cellular communications housed within a NEMA 4X rated, environmental enclosure with watertight fittings for sensors, power and antenna connections.

B. Power Supply: 120VAC with battery UPS backup.

C. Enclosure Size: 16” x 13” x 7”

D. Analog Input Channels (Qty. 8) with the following inputs:

1. Diversion Structure Level – LIT-XXXX

2. Electrical Enclosure Temperature – TIT-XXXX

3. Spare Channel

4. Spare Channel

5. Spare Channel

6. Spare Channel

7. Spare Channel

8. Spare Channel

E. Digital Input Channels (Qty. 6) with the following inputs:

1. Diversion Structure Level Switch High – LSH-XXXX

2. Electrical Enclosure Intrusion – XA-XXXX

3. Undervoltage – JA-XXXX

4. Spare Channel

5. Spare Channel

6. Spare Channel

F. Provide remote cellular antenna and interconnecting antenna cable.

G. RTU Monitoring panels shall be RS-33 by Telog no equal as NBC has standardized on this equipment.

2.03 EQUIPMENT

A. INTRINSICALLY SAFE PANEL

1. Provide a 8" x 8" x 6" NEMA 3R panel to house intrinsically safe intrinsically safe relays. The panel shall have din-rail mounting terminal strips for all wiring and shall receive 120VAC power from a panelboard.

2. Intrinsically Safe Relays (IS Relays)

a. Din rail mounted intrinsically safe relays shall be furnished for interconnection of each float switch located in the wet well.

b. Operating voltage shall be 115 or 230 VAC, 50/60 Hz.

c. Load contacts shall be double pole, double throw and shall be rated for 10 amperes resistive load or 3 amperes inductive load at 120 VAC.

d. The intrinsically safe control circuit shall be approved by Factory Mutual and the Canadian Standards Association for Class 1, 119 111; Division 1; Groups A, B, C, D, E, F, G hazardous locations.

2.04 LEVEL INDICATING TRANSMITTER – RADAR TYPE

A. Type: Microwave pulse; 2 wire; integral microprocessor electronics, antenna and indication package.

B. Operation: The transmitter antenna transmits short microwave pulses and is reflected by the liquid surface level back to the antenna, the time for the pulse emission to reception is proportion of the container level.

C. Approvals: ATEX, IEC and FM for Intrinsically Safe

D. Physical

1. Housing – IP66, double chamber precision casting stainless steel, aggressive environment and extreme mechanical stress.

2. Antenna – 316L stainless steel

3. Process Fitting – 316L flange and bolts stainless steel

4. Wetted Parts – 316L stainless steel

5. Process Seal – PTFE

6. Ambient Temperature Limits: minus 40° Fahrenheit to plus 176° Fahrenheit.

E. Functional

1. Operating Voltage: 9.6 – 36 VDC

1. Signal Output: Hart, 2-wire, 4-20 mA DC loop powered

2. Range: 114 feet with a +/- 0.32” deviation

3. Frequency Range: C-Band

F. Level transmitters shall be VEGAPLUS 66 by VEGA or equal by Endress & Hauser and Siemens.

2.05 LEVEL SWITCH - FLOAT TYPE

A. Float switches shall be of non mercury type, 3½-in diameter hermetically sealed, molded polypropylene construction and include a Form C, tilt-type, switch rated for switching 10 ampere resistive loads at 120 VAC. Switches shall include 40 feet of nitrile PVC jacketed, Type SO, conductor, No. 14 AWG cable suitable for underwater service. Switches shall be rated for the NEMA area in which installed. Switches shall also include Type 316 stainless steel mounting hardware and weighted cord collar. Switches shall be installed per the manufacturer's requirements.

B. Level switches shall be manufactured by Consolidated Electric Co., Flygt, Magnetrol, or equal.

2.06 TEMPERATURE INDICATING TRANSMITTER

A. The temperature indicating transmitter shall provide a 4-20 mA output that is linear to the measured ambient temperature, with a temperature sensing range of 0 to 100 degrees Fahrenheit. Accuracy shall be 0.5% of the span. Temperature sensor shall have a local LED display of temperature. The temperature sensor shall be UL listed.

B. Temperature indicating transmitter shall be loop powered, 13 to 40 vDC.

C. Temperature indicating transmitter shall be Model RTTI as manufactured by Devar, Inc. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the best field and shop practices.

B. The workmanship shall be in accordance with the best field shop practices for the instrument and control systems.

C. All workmen shall be skilled in the work to which they are assigned and all work shall be performed under the direct supervision of an experienced and competent instrument foreman.

D. All instruments shall be mounted, piped and connected in strict accordance with the manufacturer's instructions.

E. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the Instrumentation Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

F. Interfacing fixtures shall be compatible with the equipment to which they are attached and shall comply with the applicable specifications.

G. Coordination with the process and equipment in addition to standard quoted fixtures require to conform the instrumentation to the process shall be the responsibility of the General Contractor. The Instrumentation Contractor shall provide detail information on the fixtures being supplied and the extent of the field installation required.

H. Brackets and hangers required for mounting of equipment shall be provided as noted on the drawings or as required. They shall be done in a workmanlike manner and not interfere with any other equipment.

I. Investigate each space in the structures through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.

J. The shield on each process instrumentation cable shall be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground be employed for each shield.

K. Maximum practical separation shall be maintained between signal (analog, alarm, and status) conduits and power feeders and AC systems.

L. All conductors running from the field to the control panel shall be a single, continuous length without splices, except at approved junction boxes. The junction boxes shall have terminal blocks

with 20% spare in addition to terminals for all wires including spare wires. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.

M. All field conductors shall terminate at the monitoring panel terminal board.

N. All wire ends shall be terminated with hook fork type non-split compression lugs.

O. All wire ends shall be identified at both ends with wire markers.

3.02 START-UP

A. It shall be the responsibility of the vendor to provide a factory trained and qualified serviceman from the manufacturer's of the equipment to TEST AND CALIBRATE ALL EQUIPMENT and to INSTRUCT the Contractor on EQUIPMENT INSTALLATION and the ENGINEER on operation of the equipment.

B. No other instrumentation system manufacturer's personnel other than those persons directly from the service department of the manufacturer of the equipment shall be acceptable to perform this work.

C. The start-up services shall be performed by qualified personnel from the service department of the equipment manufacturer with a minimum of five years experience on the equipment being provided by this contract, or equal.

D. During the start-up, the Instrumentation shall provide sufficient personnel to aid with the start-up of the instrument and control equipment to be provided and installed by this Section and by this Contract. This shall include services to correct any faults and to make the necessary adjustments for the proper operation of the equipment and installation.

3.03 TESTING AND CALIBRATING

A. Test and calibrate all instrumentations.

B. The panel and other equipment grounding shall be verified.

C. Visual inspection and continuity testing shall be made to verify that no damaging wiring errors occur between power and signal wiring.

D. The systems shall be checked for improper or accidental grounding.

E. Each system and component shall be energized and their inputs simulated. The output shall be checked to verify the proper calibration and interaction with associated hardware.

F. Hypotting shall not be permitted on instrument systems unless specific instructions are given to s safeguard electronic equipment from damage.

G. The factory serviceman shall verify the calibration and direction of the final control element in accordance with the requirements for each portion of the system.

H. Instrument and control calibration and instrumentation loop checkout shall be the responsibility of the manufacturer of the equipment.

I. The Instrumentation Contractor shall arrange for and obtain the services of a factory trained service qualified engineer from the manufacturer's of the equipment to perform the calibration and commissioning of the entire system.

J. Each instrument shall be calibrated at 10 percent, 50 percent, and 90 percent using test instruments that are rated to an accuracy of at least five times greater than the instrument being checked. The test instrument shall have its accuracy traceable to the National Bureau of Standard as applicable.

K. Upon completion of the work, the Instrumentation Contractor shall demonstrate to the Owner the proper operation of all equipment and systems.

L. The Instrumentation Contractor shall submit to the Engineer all test data, inspection test certificates, manufacturers' warranties certified calibration data, certified prints, manufacturers' installation, operation and maintenance manuals, electrical wiring and control diagrams with all noted field modification for an as-built record for the system, and required and suggested spare parts lists.

M. No equipment shall be allowed to be shipped from the factory without approval of the test certificates submission.

3.04 MANUFACTURER'S SERVICES

A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided for a period of not less than four 8-hour days during construction to assist the Instrumentation and Electrical Contractors in equipment installation, the location of sleeves, 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, the services of the above service engineer shall be provided for a period of not less than six 8-hour days for calibration, testing and start-up of the equipment. The instrumentation system supplier shall conduct a group training program on the operation and routine maintenance of the system. The training shall be conducted at the installation site and consist of five classroom and field training sessions, 8 hours a day during normal working hours. The text shall be the loop diagrams, operation and maintenance manual and shall concentrate on the operation of the equipment as applied to this process. The minimum days specified above do not relieve the manufacturer of providing sufficient service to place the system in satisfactory operation.

3.05 PRODUCT HANDLING

A. Upon completion of shop testing, all panels shall be enclosed in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving the equipment without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.

B. Special instructions for proper field handling and installation required by the manufacturer for proper protection shall be securely attached to each piece of equipment prior to shipment.

C. Each package shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

D. A permanent stainless steel or other noncorrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number as given in the tabulation shall be provided on each piece of equipment supplied under this section.

E. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and, including in-line equipment, shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Instrumentation Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Instrumentation Contractor or the apparatus shall be replaced by the Instrumentation Contractor at his own expense.

3.06 GUARANTEE

A. For guarantee, refer to General Conditions.

INSTRUMENTATION LIST								
TAG #	**FACILITY**	**FUNCTION**	**INSTRUMENT**	**TYPE**	**LOCATION**	**RANGE**	**UNITS**	**REMARKS**
LIT-XXXX	Diversion Structure OF-217	OF-217 Level	Level Ind/Transmitter	Electronic Radar Pulse	Diversion Structure OF-217	0-25	FEET	/#
LSH-XXXX	Diversion Structure OF-217	OF-217 High Level	Level Switch	Float Switch	Diversion Structure OF-217	N/A	N/A	/#
TIT-XXXX	Diversion Structure OF-217	Electrical Enclosure Temperature	Temperature Ind/Transmitter	Electronic	Electrical Enclosure	0-100	Degrees F	/#

END OF INSTRUMENATION AND CONTROLS

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APPENDIX A
Geotechnical Data Report
(previously submitted with 30% Design Submission)

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APPENDIX B
Environmental Technical Memo
(previously submitted with 30% Design Submission)

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APPENDIX C

National Grid Health & Safety Requirements

(pending)

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APPENDIX D
Tidewater Data

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BETA Soil Analytical Results
NBC Phase III CSO Program Consolidation Conduits - Phase IIA-4 and IIIA-5
Pawtucket, Rhode Island

Sample Designation	B-4 0-2ft	B-4 2-4ft	B-4 4-6ft	B-4 6-10ft	B-5 0-2ft	B-5 2-4ft	B-5 4-6ft	B-5 6-10ft	B-6 0-2ft	B-6 2-4ft	B-6A 0-2ft	B-6A 2-4ft	B-6A 4-6ft	B-6A 6-10ft	B-7 0-2ft	B-7 2-4ft	B-7 4-6ft	B-7 6-10ft	B-8 0-2ft	B-8 2-4ft	B-8 4-6ft	B-8 6-10ft	RIDEM	RIDEM
Sample Date	**08/28/2019**	**08/28/2019**	**08/28/2019**	**08/28/2019**	**08/27/2019**	**08/27/2019**	**08/27/2019**	**08/27/2019**	**08/29/2019**	**08/29/2019**	**9/18/2019**	**9/18/2019**	**9/18/2019**	**9/18/2019**	**08/30/2019**	**08/30/2019**	**08/30/2019**	**08/30/2019**	**09/03/2019**	**09/03/2019**	**9/10/2019**	**9/10/2019**	**ResDEC**	**ICDEC**
Volatile Organic Compounds, mg/kg																								
Acetone	0.0331 U	0.0379 U	0.0449 U	0.028 U	0.0347 U	0.0354 U	0.044 U	0.0393 U	0.0386 U	**0.0513**	0.0359 U	0.0462 U	0.04 U	0.0384 U	0.0395 U	**0.0472**	0.0582 U	0.0407 U	0.0409 U	0.0397 U	0.0369 U	0.0346 U	7,800	10,000
1,1-Dichloroethene	0.0033 U	0.0038 U	0.0045 U	0.0028 U	0.0035 U	0.0035 U	0.0044 U	0.0039 U	0.0039 U	0.0041 U	0.0036 U	0.0046 U	0.004 U	0.0038 U	0.004 U	0.0046 U	0.0058 U	0.0041 U	0.0041 U	0.004 U	0.0037 U	0.0035 U	0.2	9.5
1,2-Dibromo-3-Chloropropane	0.0033 U	0.0038 U	0.0045 U	0.0028 U	0.0035 U	0.0035 U	0.0044 U	0.0039 U	0.0039 U	0.0041 U	0.0036 U	0.0046 U	0.004 U	0.0038 U	0.004 U	0.0046 U	0.0058 U	0.0041 U	0.0041 U	0.004 U	0.0037 U	0.0035 U	0.5	4.1
1,2-Dibromoethane	0.0033 U	0.0038 U	0.0045 U	0.0028 U	0.0035 U	0.0035 U	0.0044 U	0.0039 U	0.0039 U	0.0041 U	0.0036 U	0.0046 U	0.004 U	0.0038 U	0.004 U	0.0046 U	0.0058 U	0.0041 U	0.0041 U	0.004 U	0.0037 U	0.0035 U	0.01	0.07
Benzene	0.0033 U	0.0038 U	0.0045 U	0.0028 U	0.0035 U	0.0035 U	0.0044 U	0.0039 U	0.0039 U	0.0041 U	0.0036 U	0.0046 U	0.004 U	0.0038 U	0.004 U	**0.291**	0.0058 U	0.0041 U	0.0041 U	0.004 U	0.0037 U	0.0035 U	2.5	200
Methylene Chloride	0.0166 U	0.0189 U	0.0225 U	0.014 U	0.0173 U	0.0177 U	0.022 U	0.0197 U	0.0193 U	0.0203 U	0.018 U	0.0231 U	0.02 U	0.0192 U	0.0198 U	**0.0733**	**0.0732**	0.0204 U	0.0205 U	0.0199 U	0.0185 U	0.0173 U	45	760
Tetrachloroethene	0.0033 U	0.0038 U	0.0045 U	0.0028 U	0.0035 U	0.0035 U	0.0044 U	0.0039 U	0.0039 U	0.0041 U	0.0036 U	0.0046 U	0.004 U	0.0038 U	0.004 U	**0.0560**	**0.0787**	0.0041 U	0.0041 U	0.004 U	0.0037 U	0.0035 U	12	110
Toluene	0.0033 U	0.0038 U	0.0045 U	0.0028 U	0.0035 U	0.0035 U	0.0044 U	0.0039 U	0.0039 U	0.0041 U	0.0036 U	0.0046 U	0.004 U	0.0038 U	0.004 U	**0.151**	0.0058 U	0.0041 U	0.0041 U	0.004 U	0.0037 U	0.0035 U	190	10,000
Vinyl Chloride	0.0066 U	0.0076 U	0.009 U	0.0056 U	0.0069 U	0.0071 U	0.0088 U	0.0079 U	0.0077 U	0.0081 U	0.0072 U	0.0092 U	0.008 U	0.0077 U	0.0079 U	0.0092 U	0.0116 U	0.0081 U	0.0082 U	0.0079 U	0.0074 U	0.0069 U	0.02	3
Xylene P,M	0.0066 U	0.0076 U	0.009 U	0.0056 U	0.0069 U	0.0071 U	0.0088 U	0.0079 U	0.0077 U	0.0081 U	0.0072 U	0.0092 U	0.008 U	0.0077 U	0.0079 U	**0.0539**	0.0116 U	0.0081 U	0.0082 U	0.0079 U	0.0074 U	0.0069 U	110	10,000
Total VOCs	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.05**	ND	ND	ND	ND	ND	**0.67**	**0.15**	ND	ND	ND	ND	ND	NE	NE
Semi-Volatile Organic Compounds, mg/kg																								
Anthracene	0.75 U	0.717 U	0.754 U	0.718 U	0.344 U	0.372 U	**0.879**	0.356 U	0.381 U	0.369 U	0.376 U	0.354 U	0.377 U	0.366 U	1.53 U	1.64 U	1.67 U	**0.523**	0.359 U	0.364 U	0.387 U	0.396 U	35	10,000
Benzo(a)anthracene	0.75 U	**0.800**	0.754 U	0.718 U	0.344 U	0.372 U	**2.29**	**0.388**	0.381 U	**0.370**	0.376 U	0.354 U	0.377 U	0.366 U	0.766 U	0.823 U	0.836 U	**1.83**	0.359 U	0.364 U	0.387 U	**0.473**	0.9	7.8
Benzo(a)pyrene	0.376 U	**0.665**	0.378 U	0.36 U	0.173 U	0.187 U	**1.98**	**0.300**	**0.250**	**0.331**	0.189 U	0.178 U	0.189 U	**0.261**	0.305 U	**0.399**	**0.394**	**1.70**	0.18 U	0.183 U	**0.385**	**0.559**	0.4	0.8
Benzo(b)fluoranthene	0.75 U	0.717 U	0.754 U	0.718 U	0.344 U	0.372 U	**1.40**	0.356 U	0.381 U	0.369 U	0.376 U	0.354 U	0.377 U	0.366 U	0.766 U	0.823 U	0.836 U	**1.49**	0.359 U	0.364 U	**0.481**	**0.625**	0.9	7.8
Benzo(g,h,i)perylene	0.75 U	0.717 U	0.754 U	0.718 U	0.344 U	0.372 U	**1.11**	0.356 U	0.381 U	0.369 U	0.376 U	0.354 U	0.377 U	0.366 U	0.459 U	0.493 U	0.5 U	**0.847**	0.359 U	0.364 U	0.387 U	0.396 U	0.8	10,000
Benzo(k)fluoranthene	0.75 U	0.717 U	0.754 U	0.718 U	0.344 U	0.372 U	**2.07**	0.356 U	0.381 U	0.369 U	0.376 U	0.354 U	0.377 U	0.366 U	0.766 U	0.823 U	0.836 U	**1.58**	0.359 U	0.364 U	0.387 U	**0.523**	0.9	78
Chrysene	0.376 U	**0.815**	**0.398**	0.36 U	0.173 U	0.187 U	**2.04**	**0.324**	**0.230**	**0.337**	0.189 U	0.178 U	0.189 U	**0.262**	0.305 U	**0.413**	**0.485**	**1.95**	0.18 U	0.183 U	**0.453**	**0.616**	0.4	780
Dibenzo(a,h)Anthracene	0.376 U	0.36 U	0.378 U	0.36 U	0.173 U	0.187 U	**0.510**	0.178 U	0.191 U	0.185 U	0.189 U	0.178 U	0.189 U	0.184 U	0.305 U	0.328 U	0.333 U	**0.305**	0.18 U	0.183 U	0.194 U	0.198 U	0.4	0.8
Fluoranthene	0.75 U	**1.80**	0.754 U	0.718 U	0.344 U	0.372 U	**4.35**	**1.02**	**0.468**	**0.665**	0.376 U	0.354 U	0.377 U	**0.395**	1.53 U	1.64 U	1.67 U	**4.49**	0.359 U	0.364 U	**0.834**	**1.01**	20	10,000
Indeno(1,2,3-cd)Pyrene	0.75 U	0.717 U	0.754 U	0.718 U	0.344 U	0.372 U	**1.10**	0.356 U	0.381 U	0.369 U	0.376 U	0.354 U	0.377 U	0.366 U	0.766 U	0.823 U	0.836 U	**0.811**	0.359 U	0.364 U	0.387 U	0.396 U	0.9	7.8
Naphthalene	0.75 U	0.717 U	0.754 U	0.718 U	0.344 U	0.372 U	0.383 U	0.356 U	0.381 U	0.369 U	0.376 U	0.354 U	0.377 U	0.366 U	0.382 U	0.41 U	0.417 U	**0.401**	0.359 U	0.364 U	0.387 U	0.396 U	54	10,000
Phenanthrene	0.75 U	**1.73**	0.754 U	0.718 U	0.344 U	0.372 U	**3.52**	**1.12**	0.381 U	**0.376**	0.376 U	0.354 U	0.377 U	0.366 U	1.53 U	1.64 U	1.67 U	**3.47**	0.359 U	0.364 U	0.387 U	0.396 U	40	10,000
Pyrene	0.75 U	**1.82**	**0.859**	0.718 U	0.344 U	0.372 U	**4.02**	**0.844**	**0.424**	**0.593**	0.376 U	0.354 U	0.377 U	**0.482**	1.53 U	1.64 U	1.67 U	**3.73**	0.359 U	0.364 U	**0.825**	**1.07**	13	10,000
Total SVOCs	ND	**7.6**	**1.3**	ND	ND	ND	**25.3**	**4.0**	**1.4**	**2.7**	ND	ND	ND	**1.4**	ND	0.8	0.9	**23.1**	ND	ND	**3.0**	**4.9**	NE	NE
Total Petroleum Hydrocarbons, mg/kg																								
Total Petroleum Hydrocarbons	**886**	**1,370**	**744**	**543**	**160**	**1,850**	**233**	**136**	**390**	**205**	41.5 U	**310**	40.6 U	**60.3**	**973**	**735**	**1,220**	**143**	41.8 U	38.8 U	**59.6**	**68.6**	500	2,500
Total Metals, mg/kg																								
Antimony	3.93 U	5.19 U	1.79 U	4.06 U	5.24 U	3.98 U	4.49 U	5.37 U	1.97 U	5.2 U	4.33 U	5.2 U	4.56 U	4.16 U	3.29 U	4.75 U	2.39 U	**5.24**	3.69 U	3.93 U	4.96 U	4.91 U	10	820
Arsenic	1.97 U	**5.74**	**5.60**	**7.69**	2.62 U	**3.16**	**4.79**	**5.09**	**4.89**	**6.57**	2.16 U	2.6 U	**5.11**	**3.49**	**3.82**	**9.20**	**8.15**	**52.5**	**9.94**	**6.88**	**16.8**	**12.4**	7	7
Beryllium	**0.33**	**0.27**	**0.31**	**0.28**	**0.73**	**0.40**	**0.32**	**0.67**	**0.28**	**0.32**	**0.29**	**0.33**	**0.25**	**0.23**	**0.37**	**0.30**	**0.41**	0.05 U	**0.25**	**0.21**	**0.33**	**0.35**	1.5	1.5
Cadmium	0.39 U	0.52 U	0.18 U	0.41 U	0.52 U	0.4 U	0.45 U	0.54 U	0.2 U	0.52 U	0.43 U	0.52 U	0.46 U	0.42 U	0.33 U	0.47 U	0.24 U	2.46 U	0.37 U	0.39 U	0.5 U	0.49 U	39	1,000
Chromium	**9.53**	**12.8**	**12.1**	**15.6**	**12.1**	**14.0**	**11.5**	**20.1**	**8.99**	**10.8**	**4.25**	**7.43**	**6.59**	**7.88**	**4.95**	**9.32**	**9.59**	**17.2**	**7.00**	**7.48**	**14.3**	**14.1**	1,400	10,000
Copper	**10.4**	**22.2**	**24.7**	**17.7**	**11.4**	**14.3**	**23.8**	**14.4**	**25.5**	**25.7**	**6**	**8.64**	**10.6**	**18.8**	**7.56**	**23.1**	**20.7**	**327**	**6.78**	**5.93**	**37.5**	**37.5**	3,100	10,000
Lead	**14.1**	**53.2**	**85.4**	**60.8**	**8.02**	**27.8**	**90.3**	**60.6**	**51.6**	**51.4**	**5.87**	**7.03**	**20.7**	**35.7**	**6.43**	**28.9**	**21.8**	**153**	**5.41**	**5.02**	**68.0**	**67.8**	150	500
Mercury	**0.023**	**0.105**	**0.250**	**0.158**	0.016 U	**0.033**	**0.215**	0.025 U	**0.102**	**0.191**	0.029 U	0.033 U	**0.04**	**0.223**	0.027 U	**0.157**	**0.092**	**0.177**	0.027 U	0.031 U	**0.068**	**0.074**	23	610
Nickel	**8.15**	**11.5**	**10.7**	**12.1**	**9.89**	**11.5**	**8.35**	**14.1**	**8.26**	**9.12**	**5.96**	**8.49**	**8.41**	**9.14**	**6.77**	**9.50**	**9.89**	**105**	**9.00**	**8.62**	**14.6**	**16.3**	1,000	10,000
Selenium	3.93 U	5.19 U	0.18 U	4.06 U	5.24 U	3.98 U	4.49 U	5.37 U	1.97 U	5.2 U	4.33 U	5.2 U	4.56 U	4.16 U	3.29 U	4.75 U	2.39 U	**0.72**	3.69 U	3.93 U	0.5 U	0.49 U	390	10,000
Silver	0.39 U	0.52 U	0.36 U	0.41 U	0.52 U	0.4 U	0.45 U	0.54 U	0.2 U	0.52 U	0.43 U	0.52 U	0.46 U	0.42 U	0.33 U	0.47 U	0.48 U	2.46 U	0.37 U	0.39 U	0.5 U	0.49 U	200	10,000
Thallium	0.39 U	0.52 U	0.18 U	0.41 U	0.52 U	0.4 U	4.49 U	0.54 U	0.2 U	0.52 U	4.33 U	5.2 U	4.56 U	4.16 U	0.33 U	4.75 U	0.24 U	0.25 U	0.37 U	0.39 U	0.5 U	0.49 U	5.5	140
Zinc	**24.5**	**43.9**	**66.8**	**54.8**	**30.3**	**41.8**	**68.9**	**45.9**	**44.4**	**48.1**	**33.5**	**37.2**	**29.9**	**31.3**	**25.2**	**41.4**	**37.1**	**106**	**24.6**	**27.1**	**87.9**	**79.3**	6,000	10,000
Toxicity Characteristic Leaching Procedure Metals, mg/L																								
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.054**	NA	NA	NA	NA	5 (EPA)	
Polychlorinated Biphenyls, mg/kg																								
Aroclor 1262	0.06 U	0.05 U	0.06 U	0.06 U	0.05 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.05 U	0.05 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.05 U	0.05 U	0.06 U	**0.1**	10	10
Aroclor 1260	0.06 U	0.05 U	0.06 U	0.06 U	0.05 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.05 U	0.05 U	**0.2**	0.06 U	0.06 U	0.06 U	0.06 U	0.05 U	0.05 U	0.06 U	0.05 U	10	10
PCBs, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.2**	ND	ND	ND	ND	ND	ND	ND	**0.1**	10	10

Notes
Bold indicates detection above laboratory detection limit
Bold and yellow shading indicates exceedance of RIDEM RDEC
Bold and green shading indicates exceedance of RIDEM RDEC and I/CDEC
U - Analyte not detected above laboratory minimum detection limits
NE - Standard not established
NA - Not analyzed
ND - Not detected

GZA Soil Analytical Results
NBC Phase III CSO Program Consolidation Conduits - Phase IIA-4 and IIIA-5
Pawtucket, Rhode Island

Sample Designation	MW-314D	MW-314D	TP-310	TP-318	TP-319	TP-320	TP-320A	TP-323	TP-324	TP-325	TP-326	TP-326	TP-327	TP-353	TP-354	TP-354A	TP-354B	TP-354B	TP-367	TP-374	RIDEM	RIDEM
Sample Depth	12-14 ft	16-18 ft	0-2 ft	NA	0-2 ft	4-6 ft	4-6 ft	NA	NA	5-6 ft	0-2 ft	9-10 ft	1-2 ft	3-4 ft	3-4 ft	9-10 ft	7-8 ft Center	7-8 ft NE	8-9 ft	1-2 ft	ResDEC	ICDEC
Sample Date	5/12/2010	5/12/2010	6/15/2010	6/3/2010	6/3/2010	6/3/2010	6/3/2010	6/4/2010	6/4/2010	6/14/2010	6/4/2010	6/4/2010	6/15/2010	6/4/2010	6/4/2010	6/4/2010	6/7/2010	6/7/2010	6/4/2010	6/15/2010		
Volatile Organic Compounds, mg/kg																						
sec-Butylbenzene	-	-	-	NA	-	-	**0.25**	NA	NA	**0.25**	-	**0.25**	-	-	-	-	-	**0.21**	-	-	NE	NE
n-Butylbenzene	-	-	-	NA	-	-	**0.97**	NA	NA	**0.62**	-	**0.41**	-	-	-	**3.8**	-	**1.4**	-	-	NE	NE
Isopropylbenzene	-	-	-	NA	-	-	-	NA	NA	**0.32**	-	**0.43**	-	-	-	-	-	**0.055**	-	-	NE	NE
n-Propylbenzene	-	-	-	NA	-	-	-	NA	NA	-	-	**0.33**	-	-	-	-	-	**0.17**	-	-	NE	NE
Naphthalene	**-**	**-**	**3.4**	NA	**1,300**	-	-	NA	NA	-	**1.3**	**-**	**490**	-	-	-	-	**-**	-	**1.7**	54	10,000
Styrene	-	-	-	NA	-	-	-	NA	NA	-	-	-	-	**29**	**140**	-	-	-	-	-	13	190
Benzene	**-**	**-**	**1.0**	NA	-	**11**	**2.2**	NA	NA	-	-	-	-	**44**	**160**	-	-	-	-	-	2.5	200
Toluene	**-**	**-**	**1.8**	NA	**22**	-	-	NA	NA	-	**5.6**	-	-	**56**	**220**	-	-	-	-	-	190	10,000
p-Isopropyltoluene	-	-	-	NA	-	-	-	NA	NA	**0.27**	-	-	-	-	-	-	-	**0.44**	-	-	NE	NE
Ethylbenzene	**-**	**-**	**0.023**	NA	**56**	**28**	-	NA	NA	**0.37**	-	-	**5.6**	**12**	**42**	-	-	-	-	-	71	10,000
1,3,5-Trimethylbenzene	**-**	**-**	**0.36**	NA	**11**	**7.8**	-	NA	NA	**0.38**	**0.16**	-	-	**18**	**63**	**5.8**	-	**0.53**	-	-	NE	NE
1,2,4-Trimethylbenzene	**-**	**-**	**0.73**	NA	**20**	**22**	-	NA	NA	**3.3**	**0.48**	-	**9.1**	**49**	**170**	**14**	-	**0.28**	-	-	NE	NE
Xylene P,M	**-**	**-**	**2.1**	NA	**37**	**15**	-	NA	NA	-	**0.87**	-	-	**72**	**280**	-	-	-	-	-	NE	NE
Xylene O	**-**	**-**	**0.66**	NA	**15**	**6.9**	-	NA	NA	**0.77**	**0.53**	-	**5.1**	**33**	**130**	-	-	-	-	-	NE	NE
Total VOCs	**-**	**-**	**10.1**	NA	**1,461**	**90.7**	**3.42**	NA	NA	**6.28**	**8.94**	**1.42**	**509.8**	**313**	**1,205**	**23.6**	**-**	**3.085**	**-**	**1.7**	NE	NE
Semi-Volatile Organic Compounds, mg/kg																						
2-Methylnaphthalene	-	-	-	NA	**150**	**260**	**0.51**	NA	NA	**36**	**2.9**	-	**400**	**240**	**310**	**33**	-	**72**	-	-	35	10,000
Acenaphthylene	-	-	-	NA	**160**	**33**	**1.5**	NA	NA	**-**	**1.8**	**0.93**	**45**	**160**	**160**	**100**	-	**99**	-	**0.84**	23	10,000
Acenaphthene	-	-	-	NA	**51**	**56**	**0.33**	NA	NA	**9.6**	-	**3.1**	**100**	**390**	**430**	**32**	-	**39**	-	-	43	10,000
Anthracene	-	-	-	NA	**460**	**37**	**1.9**	NA	NA	**5.2**	**1.3**	**1.8**	**96**	**780**	**970**	**92**	-	**110**	-	**0.94**	35	10,000
Benzo(a)anthracene	-	-	-	NA	**390**	**37**	**1.8**	NA	NA	**-**	**3**	**1.2**	**69**	**610**	**710**	**73**	-	**75**	-	**2.5**	0.9	7.8
Benzo(a)pyrene	-	-	**0.51**	NA	**300**	**22**	**1.3**	NA	NA	**-**	**2.4**	**0.65**	**45**	**420**	**440**	**50**	-	**50**	-	**2**	0.4	0.8
Benzo(b)fluoranthene	-	-	**0.66**	NA	**290**	**20**	**1.5**	NA	NA	**-**	**4.1**	**0.67**	**43**	**570**	**600**	**68**	-	**64**	-	**2.8**	0.9	7.8
Benzo(g,h,i)perylene	-	-	**0.49**	NA	**140**	**6.8**	**0.72**	NA	NA	**-**	**1.7**	-	**14**	**200**	**220**	**25**	-	**26**	-	**0.92**	0.8	10,000
Benzo(k)fluoranthene	-	-	-	NA	**72**	**6.1**	**0.49**	NA	NA	**-**	**1.3**	-	**16**	**200**	-	**25**	-	**25**	-	**1**	0.9	78
Chrysene	-	-	-	NA	**320**	**36**	**1.9**	NA	NA	**-**	**4.4**	**0.97**	**82**	**580**	**600**	**69**	-	**61**	-	**2.2**	0.4	780
Dibenzo(a,h)Anthracene	-	-	-	NA	**39**	**2.8**		NA	NA	**-**	**0.34**	-	-	**51**	**56**	**6.4**	-	**5.1**	-	-	0.4	0.8
Fluorene	-	-	-	NA	**85**	**76**	**2.5**	NA	NA	**7.4**	-	**2**	**160**	**980**	**1,300**	**100**	-	**130**	-	**0.45**	28	10,000
Fluoranthene	-	-	-	NA	**500**	**57**	**2.9**	NA	NA	**7.6**	**4.7**	**2.3**	**100**	**320**	**330**	**400**	-	**240**	-	**4.6**	20	10,000
Indeno(1,2,3-cd)Pyrene	-	-	**0.52**	NA	**130**	**7.7**	**0.81**	NA	NA	**-**	**1.8**	-	**15**	**250**	**260**	**31**	-	**30**	-	**1**	0.9	7.8
Naphthalene	**-**	**-**	**-**	NA	**160**	**670**	**1.9**	NA	NA	-	**2.4**	**0.33**	**830**	**890**	**120,000**	**90**	-	**1.3**	-	**0.8**	54	10,000
Phenanthrene	-	-	-	NA	**440**	**260**	**4.5**	NA	NA	**16**	**5.7**	**5.2**	**330**	**420**	**450**	**400**	-	**290**	-	**3.1**	40	10,000
Pyrene	-	-	-	NA	**970**	**81**	**3.7**	NA	NA	**12**	**5.1**	**3.5**	**160**	**230**	**1,500**	**290**	-	**170**	-	**4.3**	13	10,000
Total SVOCs	**-**	**-**	**2.2**	NA	**4,657**	**1,668.4**	**28**	NA	NA	**93.8**	**42.9**	**22.7**	**2,505**	**7,291**	**128,336**	**1,884.4**	-	**1,487**	-	**27.45**	NE	NE
Total Petroleum Hydrocarbons, mg/kg																						
Total Petroleum Hydrocarbons	**30**	**17**	**24**	NA	**14,000**	**4,100**	**1,800**	NA	NA	**14,000**	**730**	**4,300**	**50,000**	**160,000**	**110,000**	**9,800**	**13**	**12,000**	**59**	**300**	500	2,500
Total Metals, mg/kg																						
Antimony	-	-	-	NA	**2**	-	**2.0**	NA	NA	-	-	-	-	-	-	-	-	-	**2.8**	**2.6**	10	820
Arsenic	**2.5**	**2.0**	**3.3**	NA	**6.5**	**0.92**	**1.6**	NA	NA	**9.8**	**2.8**	**4.5**	**4.4**	**6.3**	**3.2**	-	**1.6**	**1.3**	**3.5**	**7**	7	7
Beryllium	**0.46**	**0.25**	**-**	NA	**0.58**	**0.52**	**0.46**	NA	NA	**0.28**	**0.46**	**-**	**0.36**	**0.35**	**-**	**0.65**	**-**	**0.28**	**8.7**	**0.37**	1.5	1.5
Cadmium	**-**	**-**	**0.7**	NA	-	-	-	NA	NA	-	-	-	-	**0.5**	-	-	-	-	-	**0.48**	39	1,000
Chromium	**10**	**9.2**	**19**	NA	**19**	**7.3**	**6.9**	NA	NA	**6**	**5**	**6**	**8.3**	**13**	**7.4**	**6.4**	**6.6**	**4.9**	**17**	**16**	1,400	10,000
Copper	**6.6**	**6.1**	**30**	NA	**110**	**8.6**	**8.7**	NA	NA	**13**	**35**	**11**	**17**	**19**	**21**	**11**	**8.2**	**8.1**	**19**	**27**	3,100	10,000
Lead	**7.2**	**4.4**	**75**	NA	**220**	**11**	**11**	NA	NA	**5**	**34**	**6.5**	**15**	**71**	**52**	**6.2**	**5.7**	**5.0**	**11**	**20**	150	500
Mercury	**-**	**-**	**0.4**	NA	**0.46**	**0.0074**	-	NA	NA	**-**	**0.076**	**0.0093**	**0.1**	**0.19**	**0.095**	**0.027**	-	-	-	**0.019**	23	610
Nickel	**9.6**	**12**	**9.4**	NA	**17**	**10**	**9.9**	NA	NA	**6.9**	**9**	**7**	**11**	**14**	**11**	**8**	**8.1**	**7.1**	**19**	**18**	1,000	10,000
Selenium	-	-	-	NA	-	-	-	NA	NA	-	-	-	-	-	-	-	-	-	-	-	390	10,000
Silver	-	-	-	NA	-	-	-	NA	NA	-	-	-	-	-	-	-	-	-	-	-	200	10,000
Thallium	-	-	-	NA	-	-	-	NA	NA	-	-	-	-	-	-	-	-	-	-	-	5.5	140
Zinc	**29**	**31**	**51**	NA	**93**	**25**	**28**	NA	NA	**19**	**38**	**21**	**33**	**87**	**81**	**27**	**25**	**20**	**51**	**48**	6,000	10,000
Cyanide, mg/kg																						
Total Cyanide	**-**	**-**	**-**	NA	**47**	**89**	**53**	NA	NA	**-**	**-**	**-**	**-**	**15**	**38**	**190**	**-**	**230**	**-**	**-**	NE	10,000
Physically Available Cyanide	-	-	-	NA	-	-	-	NA	NA	-	-	-	-	-	-	-	-	-	NA	-	NE	NE
Polychlorinated Biphenyls, mg/kg																						
Aroclor 1260	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10	10

Notes
Bold indicates detection above laboratory detection limit
Bold and yellow shading indicates exceedance of RIDEM RDEC
Bold and green shading indicates exceedance of RIDEM RDEC and I/CDEC
NE = Standard not established
NA = Not analyzed
- = Analyte not detected above laboratory minimum detection limits

GZA Soil Analytical Results
NBC Phase III CSO Program Consolidation Conduits - Phase IIA-4 and IIIA-5
Pawtucket, Rhode Island

Sample Designation	TP-374	TP-381A	TP-386A	TP-386B	TP-386B	SS-105	SS-109	SS-112	SS-113	SS-114	SS-115	SS-116	SS-117	SS-122	SS-123	SS-135	SS-136	SS-137	SS-138	SS-139	RIDEM ResDEC	RIDEM ICDEC
Sample Depth	**10-11 ft**	**NA**	**NA**	**1.5-7.5 ft**	**9-10 ft NE**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**	**0-1 ft**		
Sample Date	**6/15/2010**	**11/9/2010**	**11/9/2010**	**11/9/2010**	**11/9/2010**	**12/28/2009**	**12/28/2009**	**12/29/2009**	**12/29/2009**	**12/29/2009**	**12/29/2009**	**12/29/2009**	**12/29/2009**	**1/4/2010**	**1/4/2010**	**1/4/2010**	**1/6/2010**	**1/6/2010**	**1/6/2010**	**1/6/2010**		
Volatile Organic Compounds, mg/kg																						
sec-Butylbenzene	-	NA	NA	NA	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
n-Butylbenzene	-	NA	NA	NA	**0.14**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Isopropylbenzene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
n-Propylbenzene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Naphthalene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54	10,000
Styrene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	190
Benzene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	200
Toluene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	190	10,000
p-Isopropyltoluene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Ethylbenzene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71	10,000
1,3,5-Trimethylbenzene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
1,2,4-Trimethylbenzene	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Xylene P,M	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Xylene O	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Total VOCs	**-**	NA	NA	NA	**0.14**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Semi-Volatile Organic Compounds, mg/kg																						
2-Methylnaphthalene	-	NA	NA	NA	**0.86**	**1.5**	**1.2**	-	-	-	**1.5**	**2.1**	-	**4.6**	**3.7**	-	-	-	-	-	35	10,000
Acenaphthylene	**2.8**	NA	NA	NA	**2.7**	**16**	**3.9**	-	-	-	**3.1**	**9.8**	-	**16**	**10**	-	-	-	**3.6**	**-**	23	10,000
Acenaphthene	-	NA	NA	NA	**1.3**	-	-	**1.3**	-	-	-	-	-	-	-	-	-	-	-	-	43	10,000
Anthracene	**6.9**	NA	NA	NA	**3.6**	**6.9**	**2.2**	**2.2**	-	-	**1.7**	**3.7**	-	**11**	**4.9**	-	-	-	**3.7**	**-**	35	10,000
Benzo(a)anthracene	**4.5**	NA	NA	NA	**2**	**24**	**6.8**	**3.8**	-	-	**7**	**12**	-	**27**	**17**	-	-	**0.45**	**7.6**	**1.5**	0.9	7.8
Benzo(a)pyrene	**4.1**	NA	NA	NA	**0.93**	**27**	**4.6**	**3.2**	-	-	**7**	**10**	-	**33**	**25**	-	-	**0.74**	**8.2**	**1.1**	0.4	0.8
Benzo(b)fluoranthene	**4**	NA	NA	NA	**1.3**	**32**	**8**	**3.9**	-	-	**10**	**14**	**0.58**	**42**	**30**	-	-	**0.82**	**9.5**	**2.5**	0.9	7.8
Benzo(g,h,i)perylene	**1.5**	NA	NA	NA	-	**18**	**2.6**	**1.9**	-	-	**5.1**	**7.4**	-	**15**	**17**	-	-	**0.61**	**6.9**	**1.4**	0.8	10,000
Benzo(k)fluoranthene	**1.4**	NA	NA	NA	-	**18**	**4.8**	**1.6**	-	-	**4.4**	**7.6**	-	**16**	**35**	-	-	**-**	**4.7**	**-**	0.9	78
Chrysene	**4.7**	NA	NA	NA	**1.7**	**34**	**8.7**	**3.4**	-	-	**6.8**	**14**	**0.40**	**35**	**21**	-	-	**0.43**	**8**	**1.4**	0.4	780
Dibenzo(a,h)Anthracene	**0.49**	NA	NA	NA	-	**5.2**	-	-	-	-	**1.4**	**2.6**	-	**6.3**	**5.7**	-	-	-	**1.7**	**-**	0.4	0.8
Fluorene	**0.4**	NA	NA	NA	**4.9**	**1.4**	-	**1.1**	-	-	-	-	-	**2.7**	**1.0**	-	-	-	**2.0**	**-**	28	10,000
Fluoranthene	**8.9**	NA	NA	NA	**3.5**	**28**	**14**	**10**	-	-	**12**	**16**	**0.46**	**49**	**22**	**0.38**	-	**-**	**18**	**1.8**	20	10,000
Indeno(1,2,3-cd)Pyrene	**1.7**	NA	NA	NA	-	**19**	**3**	**1.7**	-	-	**5**	**7.3**	-	**14**	**16**	-	-	**0.49**	**6.1**	**1.3**	0.9	7.8
Naphthalene	-	NA	NA	NA	**0.11**	**4.3**	**2**	**1.1**	-	**1.1**	**7.5**	**4.7**	-	**8.8**	**6.1**	-	-	-	**2.6**	**1.7**	54	10,000
Phenanthrene	**6.6**	NA	NA	NA	**11**	**7.2**	**6.2**	**9.6**	-	-	**5.2**	**5.6**	-	**29**	**9.5**	-	-	-	**11**	**-**	40	10,000
Pyrene	**9.5**	NA	NA	NA	**3.3**	**37**	**13**	**8.6**	-	-	**13**	**23**	**0.42**	**57**	**33**	-	-	**0.84**	**16**	**1.7**	13	10,000
Total SVOCs	**57.49**	NA	NA	NA	**37.2**	**279.5**	**81**	**53.4**	**-**	-	**90.7**	**139.8**	**1.86**	**366.4**	**256.9**	**0.38**	-	**4.38**	**109.6**	**14.4**	NE	NE
Total Petroleum Hydrocarbons, mg/kg																						
Total Petroleum Hydrocarbons	**500**	NA	NA	**140,000**	**380**	**800**	**330**	**180**	**160**	**140**	**310**	**2,000**	**80**	**4,600**	**2,000**	**51**	**150**	**94**	**1,100**	**1,500**	500	2,500
Total Metals, mg/kg																						
Antimony	-	NA	NA	NA	-	-	-	**-**	-	-	-	-	**-**	-	-	**-**	-	-	**-**	**-**	10	820
Arsenic	**-**	NA	NA	NA	**1.1**	**5.7**	**6.8**	**8.3**	**3.4**	**6.0**	**8.8**	**9.9**	**3.1**	**5.5**	**9.0**	**4.7**	**2.9**	**4.1**	**7.3**	**14**	7	7
Beryllium	**-**	NA	NA	NA	**-**	**-**	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	**-**	-	-	1.5	1.5
Cadmium	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	1,000
Chromium	**-**	NA	NA	NA	**4.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1,400	10,000
Copper	**-**	NA	NA	NA	**6.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	3,100	10,000
Lead	**-**	NA	NA	NA	**5**	**100**	**62**	**310**	**170**	**390**	**1,300**	**880**	**190**	**190**	**1,400**	**150**	**540**	**370**	**5,900**	**2,200**	150	500
Mercury	**-**	NA	NA	NA	**0.011**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	23	610
Nickel	**-**	NA	NA	NA	**6.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1,000	10,000
Selenium	-	NA	NA	NA	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	390	10,000
Silver	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	10,000
Thallium	-	NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.5	140
Zinc	**-**	NA	NA	NA	**21**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	6,000	10,000
Cyanide, mg/kg																						
Total Cyanide	**-**	NA	NA	NA	**38**	**17**	**14**	**2.2**	**-**	**-**	**110**	**530**	**200**	**16**	**51**	**-**	**-**	**-**	**37**	**280**	NE	10,000
Physically Available Cyanide	-	NA	NA	NA	-	**5.7**	**3**	-	-	-	**4.6**	**41**	**6.1**	**4.7**	**12**	-	-	-	**13**	**31**	NE	NE
Polychlorinated Biphenyls, mg/kg																						
Aroclor 1260	NA	NA	NA	NA	NA	NA	NA	-	-	-	-	**1.6**	-	NA	NA	-	**0.11**	-	-	-	10	10

Notes
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Bold and green shading indicates exceedance of RIDEM RDEC and I/CDEC
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GZA Groundwater Analytical Results
NBC Phase III CSO Program Consolidation Conduits - Phase IIA-4 and IIIA-5
Pawtucket, Rhode Island

Sample Designation	M+E MW-1		MW-3		MW-5	MW-7												MW-206	MW-208									RIDEM GB	RIDEM GB
Sample Date	**1/18/2010**	**6/30/2010**	**1/14/2010**	**7/2/2010**	**1/18/2010**	**1996**	**2006**	**1/18/2010**	**7/7/2010**	**Jul-11**	**Jul-12**	**Aug-13**	**Oct-14**	**Nov-15**	**Nov-16**	**Oct-17**	**10/25/2018**	**1/18/2010**	**2006**	**1/18/2010**	**6/30/2010**	**Jul-11**	**Jul-12**	**Aug-13**	**Oct-14**	**Nov-15**	**Nov-16**	**Oct-17**	**10/25/2018**	**UCL**	**Objective**
Volatile Organic Compounds, µg/L																														
sec-Butylbenzene	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	**9.2**	**7.4**	-	**6.8**	**7.7**	**6.6**	**3.2**	**2.4**	**2.6**	**3.3**	-	NE	NE
n-Butylbenzene	-	-	-	**1.2**	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	**15**	**1.2**	**7.6**	**15.4**	**13.2**	-	-	**3.4**	-	-	NE	NE
Isopropylbenzene	-	-	**6.8**	**4.8**	-	NA	NA	-	-	-	-	-	-	-	-	-	-	-	**12.6**	**11**	-	-	-		-	-	-	-	-	NE	NE
n-Propylbenzene	-	-	**1.3**	**1.7**	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	**7.5**	**9.0**	-	**2.1**	**1.9**	**1.2**	-	-	-	-	-	NE	NE
Chloroform	-	-	-	-	-	NA	**4.8**	-	-	-	-	**1.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Naphthalene	-	-	-	**16**	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	**1.4**	**2.3**	-	**2.1**	**2.8**	-	-	**18.7**	-	-	-	NE	2,670
Acetone	-	-	-	-	-	NA	NA	-	**3.5**	-	-	-	-	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	NE	NE
Styrene	-	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	50,000	2,200
Benzene	**2.1**	**3.2**	**2.5**	**2.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1.6**	**4.0**	-	-	**1.7**	-	**1.6**	**3.2**	**1**	-	-	18,000	140
Toluene	-	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	**1.7**	-	-	-	-	-	-	-	-	-	21,000	1,700
p-Isopropyltoluene	-	-	-	-	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	NA	**1.4**	-	-	-	-	-	-	-	-	-	NE	NE
Ethylbenzene	-	-	**1.6**	**6.4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1.2**	**3.3**	-	**3.7**	**5**	**9.6**	-	**1.2**	-	-	-	16,000	1,600
1,3,5-Trimethylbenzene	-	-	-	**2.0**	-	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
1,2,4-Trimethylbenzene	-	-	-	**9.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Xylene P,M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Xylene O	-	-	**2.5**	**8.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3.6**	**2.5**	-	**2**	**3.9**	**4.4**	-	**1**	-	-	-	NE	NE
Total VOCs	**2.1**	**3.2**	**14.7**	**53.8**	-	-	**4.8**	-	**3.5**	-	-	**1.8**	-	-	-	-	-	-	**37.1**	**57.6**	**1.2**	**24.3**	**38.4**	**35.0**	**4.8**	**26.5**	**7.0**	**3.3**	-	NE	NE
Semi-Volatile Organic Compounds, µg/L																														
2-Methylnaphthalene	-	-	-	**9.5**	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	**33**	-	-	-	**0.2**	NA	NA	NA	NA	NE	NE
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	**1.3**	-	-	-	**2**	**2**	**0.5**	NA	NA	NA	NA	NE	NE
Acenaphthene	-	**2.5**	**6.9**	**5.9**	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	**1.56**	-	**6.7**	-	**3**	**2.3**	**1.4**	NA	NA	NA	NA	NE	NE
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	**0.5**	**0.5**	**0.2**	NA	NA	NA	NA	NE	NE
Benzo(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Dibenzo(a,h)Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Fluorene	**2.1**	**2.7**	**2.5**	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	**1.39**	-	**11**	-	**2**	**1.5**	**2**	NA	NA	NA	NA	NE	NE
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	**0.3**	**0.2**	-	NA	NA	NA	NA	NE	NE
Indeno(1,2,3-cd)Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Naphthalene	-	-	-	**7.3**	-	-	-	-	-	-	**1**	**0.4**	**1.2**	NA	NA	NA	NA	-	**0.94**	-	**7.6**	-	**2**	**1.3**	**4.7**	NA	NA	NA	NA	NE	2,670
Phenanthrene	**2.5**	**3.3**	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	**0.74**	-	**10**	-	**2**	**2**	**1.2**	NA	NA	NA	NA	NE	NE
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	**0.27**	-	-	-	**0.5**	**0.3**	**0.2**	NA	NA	NA	NA	NE	NE
Total SVOCs	**4.6**	**8.5**	**9.4**	**22.7**	-	-	-	-	-	-	**1**	**0.4**	**1.2**	NA	NA	NA	NA	-	**6.2**	-	**68.3**	-	**12.3**	**10.1**	**10.4**	NA	NA	NA	NA	NE	NE
Total Petroleum Hydrocarbons, µg/L																														
Total Petroleum Hydrocarbons	**430**	**1,100**	**2,500**	**3,100**	-	NA	NA	-	-	-	-	-	-	NA	NA	NA	NA	-	NA	**570**	**800**	**310**	**1,000**	**900**	**480**	NA	NA	NA	NA	NE	NE
Total Metals, µg/L																														
Arsenic	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	**15.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Beryllium	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Chromium	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Copper	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Lead	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Nickel	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Zinc	NA	NA	NA	NA	NA	**0.023**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Arsenic	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Beryllium	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Chromium	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Copper	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Lead	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Nickel	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Zinc	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Cyanide, mg/L																														
Total Cyanide	**0.19**	**0.30**	**0.06**	**0.056**	**0.020**	-	NA	NA	NA	**0.02**	**0.0205**	**0.0316**	**0.0454**	NA	NA	NA	NA	-	**0.170**	**0.010**	**0.050**	**0.030**	**0.0299**	**0.0302**	**0.108**	NA	NA	NA	NA	NE	NE
Physically Available Cyanide	-	**0.010**	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	**0.073**	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE

Notes
Bold indicates detection above laboratory detection limit
Bold and yellow shading indicates exceedance of RIDEM GB Objective
Bold and green shading indicates exceedance of RIDEM GB Upper Concentration Limit
NE = Standard not established
NA = Not analyzed
- = Analyte not detected above laboratory minimum detection limits

GZA Groundwater Analytical Results
NBC Phase III CSO Program Consolidation Conduits - Phase IIA-4 and IIIA-5
Pawtucket, Rhode Island

Sample Designation	MW-209		MW-303	MW-314S									MW-314D									RIDEM GB	RIDEM GB
Sample Date	1/18/2010	6/30/2010	7/2/2010	6/28/2010	Jul-11	Jul-12	Aug-13	Oct-14	Nov-15	Nov-16	Oct-17	10/23/2018	6/29/2010	Jul-11	Jul-12	Aug-13	Oct-14	Nov-15	Nov-16	Oct-17	10/23/2018	UCL	Objective
Volatile Organic Compounds, µg/L																							
sec-Butylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
n-Butylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Isopropylbenzene	**12**	-	**140**	**1.6**	**1.6**	**2.8**	-	-	-	-	-	**3.8**	-	-	-	-	-	-	-	-	-	NE	NE
n-Propylbenzene	**4.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Chloroform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Naphthalene	**270**	**24**	**8,200**	**4.1**	-	**8.3**	-	**1.4**	-	-	-	**4.4**	**2.3**	-	-	-	-	-	-	-	-	NE	2,670
Acetone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Styrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50,000	2,200
Benzene	**1**	**2.3**	**5,200**	-	-	-	-	-	-	-	-	-	**1.6**	**1**	-	-	-	-	-	-	-	18,000	140
Toluene	**3.6**	-	**110**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21,000	1,700
p-Isopropyltoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
Ethylbenzene	**21**	**1.3**	**3,900**	-	-	-	-	-	-	-	-	**1.6**	-	-	-	-	-	-	-	-	-	16,000	1,600
1,3,5-Trimethylbenzene	**6.1**	-	**130**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NE	NE
1,2,4-Trimethylbenzene	**22**	**2.1**	**670**	**1.7**	-	**5.3**	-	-	-	-	-	**4.6**	-	-	-	-	-	-	-	-	-	NE	NE
Xylene P,M	**15**	-	**1,500**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**36.6**	-	-	NE	NE
Xylene O	**30**	**1.3**	**1,400**	**4.1**	-	**5.2**	-	-	-	-	-	**14.2**	-	-	-	-	-	-	**16.5**	-	-	NE	NE
Total VOCs	**385.3**	**31.0**	**21,250**	**11.5**	**1.6**	**21.6**	-	**1.4**	-	-	-	**28.6**	**3.9**	**1**	-	-	-	-	**53.1**	-	-	NE	NE
Semi-Volatile Organic Compounds, µg/L																							
2-Methylnaphthalene	-	-	**220**	-	-	**0.3**	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Acenaphthylene	**13**	**2.9**	**5**	-	-	**0.6**	**0.4**	-	NA	NA	NA	NA	-	-	**0.3**	**0.2**	-	NA	NA	NA	NA	NE	NE
Acenaphthene	**29**	**8.4**	**70**	**2.9**	-	**3**	**2.5**	**1.3**	NA	NA	NA	NA	**3.7**	**2.7**	**3**	**3.1**	**1.3**	NA	NA	NA	NA	NE	NE
Anthracene	**4.7**	**24**	**4.4**	-	-	**0.5**	**0.4**	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(a)anthracene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(a)pyrene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Chrysene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Dibenzo(a,h)Anthracene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Fluorene	**29**	**7.4**	**22**	-	-	**1**	**0.8**	**0.3**	NA	NA	NA	NA	-	-	**0.4**	-	-	NA	NA	NA	NA	NE	NE
Fluoranthene	**4.1**	**2.7**	**2.0**	-	-	**0.2**	**0.3**	-	NA	NA	NA	NA	-	-	**0.2**	-	-	NA	NA	NA	NA	NE	NE
Indeno(1,2,3-cd)Pyrene	-	-	-	-	-	-	-	-	NA	NA	NA	NA	-	-	-	-	-	NA	NA	NA	NA	NE	NE
Naphthalene	**91**	**13**	**3,900**	-	-	**4**	**0.3**	-	NA	NA	NA	NA	-	-	**4**	**0.4**	-	NA	NA	NA	NA	NE	2,670
Phenanthrene	**38**	**23**	**26**	-	-	**0.5**	-	-	NA	NA	NA	NA	**2**	-	**0.2**	-	-	NA	NA	NA	NA	NE	NE
Pyrene	**4.7**	**3.3**	**2.6**	-	-	**0.3**	**0.4**	**0.3**	NA	NA	NA	NA	-	-	**0.3**	**0.2**	-	NA	NA	NA	NA	NE	NE
Total SVOCs	**213.5**	**84.7**	**4,252.0**	**2.9**	-	**10.4**	**5.1**	**1.9**	NA	NA	NA	NA	**5.7**	**2.7**	**8.4**	**3.9**	**1.3**	NA	NA	NA	NA	NE	NE
Total Petroleum Hydrocarbons, µg/L																							
Total Petroleum Hydrocarbons	**1,100**	**230**	**8,800**	**1,200**	**1,400**	**4,650**	**2,080**	**570**	NA	NA	NA	NA	-	**330**	**1,690**	**530**	**370**	NA	NA	NA	NA	NE	NE
Total Metals, µg/L																							
Arsenic	-	-	**220**	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Beryllium	**13**	**2.9**	**5**	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Chromium	**29**	**8.4**	**70**	**2.9**	NA	NA	NA	NA	NA	NA	NA	NA	**3.7**	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Copper	**4.7**	**24**	**4.4**	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Lead	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Nickel	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Zinc	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Arsenic	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Beryllium	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Chromium	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Copper	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Lead	**29**	**7.4**	**22**	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Nickel	**4.1**	**2.7**	**2.0**	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Dissolved Zinc	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE
Cyanide, mg/L																							
Total Cyanide	**0.17**	**0.21**	**0.83**	**0.20**	**0.10**	**0.0637**	**0.0902**	**0.176**	NA	NA	NA	NA	**0.46**	**0.32**	**0.1440**	**0.317**	**0.16**	NA	NA	NA	NA	NE	NE
Physically Available Cyanide	-	-	**0.020**	-	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE

Notes
Bold indicates detection above laboratory detection limit
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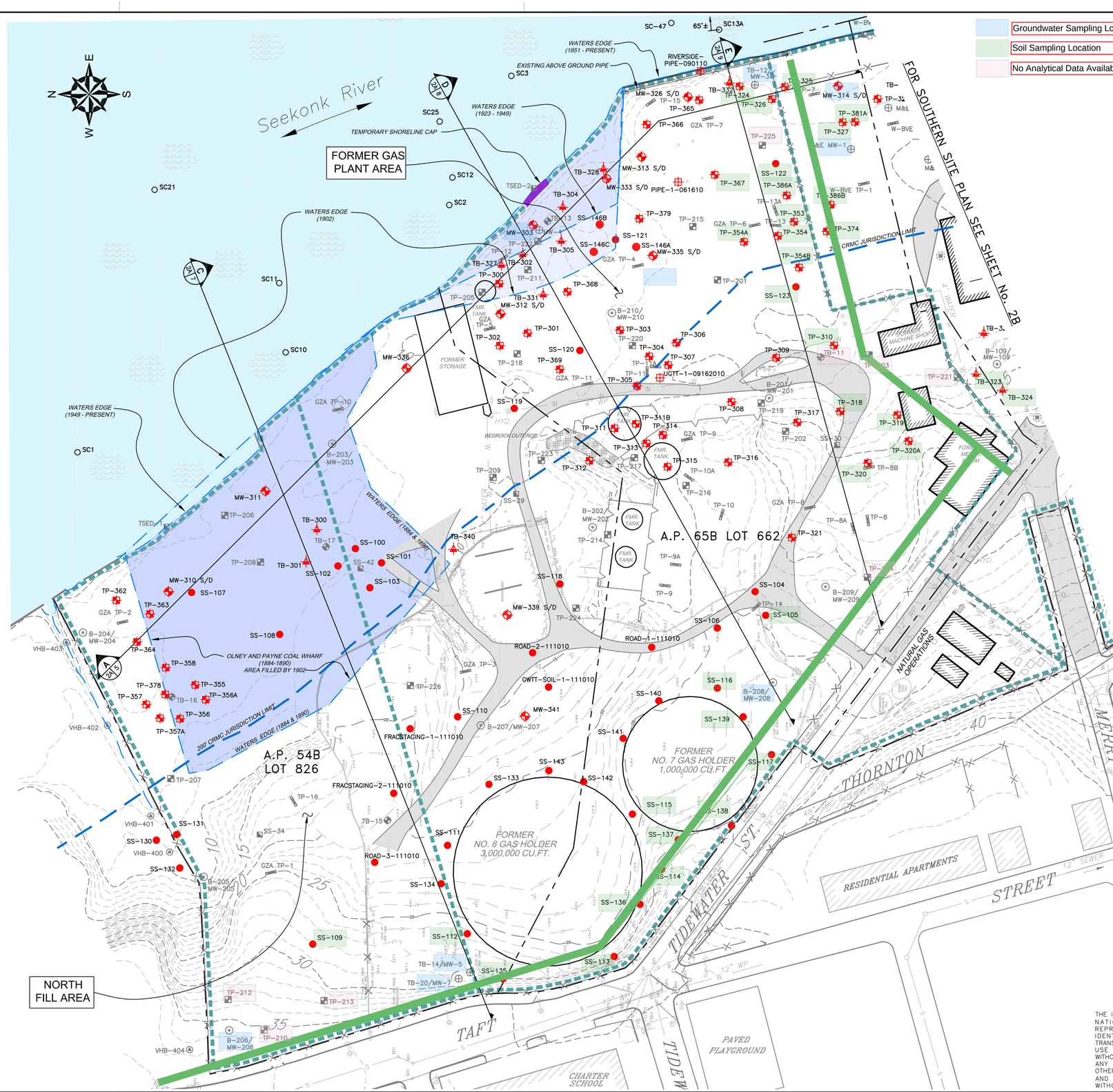
NE = Standard not established
NA = Not analyzed
- = Analyte not detected above laboratory minimum detection limits



Groundwater Sampling Location

Soil Sampling Location

No Analytical Data Available

LEGEND:

- SITE AREA BOUNDARIES
- EXISTING BUILDINGS ON-SITE
- EXISTING FOUNDATION/PAD ON-SITE
- EXISTING BUILDINGS/STRUCTURES OFF-SITE
- EXISTING CONTOUR (MINOR 1 FOOT INTERVAL)
- EXISTING CONTOUR (MAJOR 5 FOOT INTERVAL)
- PROPERTY LINE
- APPROX. 200 FT. CRMC JURISDICTION LIMIT
- APPROX. WATERS EDGE
- EXISTING NBC INTERCEPTOR SANITARY SEWER
- EXISTING CITY OF PAWTUCKET STORM DRAIN
- EXISTING WATER LINE
- EXISTING STORM/COMBINED SAN. SEWER OVERFLOW
- EXISTING UNDERGROUND ELECTRIC CABLE IN CONDUIT
- EXISTING UNDERGROUND ELECTRIC MH/STRUCTURE
- EXISTING ACCESS ROAD
- EXISTING RETAINING WALLS
- EXISTING FENCE
- EXISTING CATCH BASIN LOCATIONS

SAMPLE LEGEND

SS-9	ATLANTIC SURFACE SOIL SAMPLE LOCATION
TSED-6	ATLANTIC SEDIMENT SAMPLE LOCATION
W-BVE SS-3	WESTON/BLACKSTONE VALLEY ELECTRIC SEDIMENT SAMPLE LOCATION
RIDEM SS-3	RIDEM SURFACE SOIL SAMPLE LOCATION
B-109/MW-109	MONITORING WELL/BORING (VHB) SURVEYED
TP-3A	ATLANTIC TEST PIT LOCATION
W-BVE	WESTON/BLACKSTONE VALLEY ELECTRIC TEST PIT LOCATION
GZA TP-8	GZA/VALLEY GAS TEST PIT LOCATION
TB-15	ATLANTIC SOIL BORING LOCATION
MW-3	ATLANTIC MONITORING WELL LOCATION
M&E MW-1	METCALF & EDDY MONITORING WELL LOCATION
VHB-400	VHB SURFACE SOIL SAMPLE LOCATION NON-SURVEYED
TP-204	VHB TEST PIT (2006)
GZ-01	GZA TEST PIT (2009)
TB-300	GZA TEST BORING LOCATION (2010)
MW-320 S/D	GZA MONITORING WELL LOCATION (2010)
TP-306	GZA TEST PIT LOCATION (2010)
SS-100	GZA SURFACE SOIL SAMPLE LOCATION (2010)
SC31	ARCADIS SEDIMENT SAMPLE LOCATION (2008)
PIPE-1-061610	GZA RESIDUAL MATERIAL SAMPLE (2010)

GENERAL NOTES:

1. EXISTING CONDITIONS BASE MAP DEVELOPED FROM THE FOLLOWING:
   - ELECTRONIC FILES FROM GEI CONSULTANTS, INC. (FORMERLY AES) ENTITLED "HISTORIC STRUCTURES AND SAMPLE LOCATIONS", ORIGINAL SCALE 1"=80', DATED JULY 1999
   - ELECTRONIC FILES FROM VANASSE HANGEN BRUSTLIN, INC. ENTITLED "SOIL BORING, TEST PIT AND MONITOR WELL LOCATIONS", SCALE: 1"=60', UNDATED
   - ELECTRONIC FILES FROM WELSH ASSOCIATES LAND SURVEYORS, INC. ENTITLED "TOPOGRAPHIC SURVEY (AS-BUILT), FORMER TIDEWATER FACILITY, DEMOLITION OF GAS HOLDERS NOS. 7 & 8", DATED DECEMBER 17, 2010
   - ON-SITE INVESTIGATIONS AND SURVEYS BY GZA PERSONNEL DURING VARIOUS SITE VISITS DURING 2009 AND 2010.
2. PROPERTY LINES AND LOT INFORMATION ESTABLISHED FROM INFORMATION PROVIDED ON A DRAWING ENTITLED "PERIMETER SURVEY OF LAND AT THE TIDEWATER FORMER MGP SITE IN PAWTUCKET, RHODE ISLAND FOR ATLANTIC ENVIRONMENTAL SERVICES INC." DEVELOPED BY LOUIS FEDERICI AND ASSOCIATES AND AN AUTO CAD FILE ENTITLED "MAX READ FIELD TRACK EXPANSION 2007" PROVIDED BY THE CITY OF PAWTUCKET.
3. HORIZONTAL DATUM IS BASED ON NAD 1983 FROM BASE MAPPING PROVIDED BY GEI CONSULTANTS, INC.
4. VERTICAL DATUM IS BASED ON NGVD 1929 (MSL) FROM BASE MAPPING PROVIDED BY GEI CONSULTANTS, INC.
5. REFERENCE SEWER DATA FROM SCANNED IMAGE PROVIDED BY THE CITY OF PAWTUCKET, RHODE ISLAND, ENTITLED "STUDY OF SEWERAGE FACILITIES" BY WATERMAN ENGINEERING CO. & ANDERSON NICHOLS CO. DATED NOV. 1975, ORIGINAL SCALE 1"=400' & SCANNED IMAGES OF HISTORIC PLAN & PROFILE DRAWINGS PROVIDED BY THE CITY OF PAWTUCKET, RHODE ISLAND.
6. SITE UTILITIES TAKEN FROM 1984 SANBORN MAP AND HISTORIC FIGURES PROVIDED BY NATIONAL GRID. ALL UTILITY LOCATIONS ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY.

NO.	ISSUE/DESCRIPTION	BY	DATE

FORMER TIDEWATER FACILITY

PAWTUCKET, RHODE ISLAND

EXPLORATION LOCATION PLAN
NORTH FILL AREA AND FORMER GAS PLANT AREA

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
530 BROADWAY
PROVIDENCE, RHODE ISLAND 02909
(401) 421-4140

PREPARED FOR: NATIONAL GRID

PROJ MGR: MSK	REVIEWED BY: WF	CHECKED BY: MSK	FIGURE 2A
DESIGNED BY: WF	DRAWN BY: CRD	SCALE: 1"=50'	
DATE: JANUARY 2011	PROJECT NO.: 43654.00	REVISION NO.: 0	SHEET NO. 1 OF 24