# **ROUTE 6 SEWER AND WATER EXTENSIONS**

# **TOWN OF WESTPORT**

March 2024



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#### SECTION 00020

#### INVITATION TO BID

#### ROUTE 6 SEWER AND WATER EXTENSIONS

Sealed Bids for ROUTE 6 SEWER AND WATER EXTENSIONS will be received by the Town Administrator at the Town Hall, 816 Main Road, Westport, MA 02790 until 2:00PM on Friday, April 19, 2024 at which place and time said bids will be publicly opened and read aloud. A virtual pre-bid informational meeting will be held on Wednesday, March 27, 2024, at 10:00 AM. All plan holders as of the time of the pre-bid meeting will be sent a link to be able to attend virtually.

The work includes the installation of four (4) pumping stations; approximately 18,500 feet of force mains; 19,900 feet of new gravity sewer; 12,400 feet of water mains, and related work.

Bids must be accompanied by Bid security made payable to Owner in an amount of 5% of Bidder's maximum bid price and in the form of a certified check or Bid Bond issued by surety meeting the requirements of the General Conditions. No bid may be withdrawn for at least 60 days (not including weekends and holidays) after receipt of bids unless released by the Owner.

Contract Documents may be obtained free of charge in electronic format by contacting Jeff Ling at jling@kleinflelder.com and becoming a registered bidder. Hard copies of the Bidding Documents are not available. Only bidders registered with Kleinfelder will receive Addenda.

The date that the Bidding Documents are transmitted via email will be considered the prospective Bidder's date of receipt of the Bidding Documents. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including Addenda if any, obtained from sources other than the email listed above.

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

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

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

This contract is expected to be funded in whole or in part by the Commonwealth of Massachusetts Department of Environmental Protection (DEP) CWSRF program. Neither

the Commonwealth of Massachusetts nor any of its departments, agencies, or employees is or will be a party to this contract. The word "agency" in the contract documents refers to the DEP and all other involved funding agencies.

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

The contractor must comply with all Federal Requirements per the CWSRF Supplementary Conditions, including submittal of pre-award certification regarding Lobbying.

Minimum Wage Rates as determined by the Executive Office of Labor and Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract. Federal Minimum Wage Rates as determined by the United States Department of Labor under the Davis-Bacon Act also apply to this project.

All work must be completed within 540 consecutive calendar days after the date when the Notice to Proceed is issued, as provided in paragraph 2.03 of the General Conditions.

Complete instructions for filing Bids are included in the Instruction to Bidders.

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 bidding and award of the Contract shall be in full compliance with Sections 39M inclusive of Chapter 30 of the General Laws of the Commonwealth of Massachusetts as last revised.

# TOWN OF WESTPORT, MA

# END OF SECTION 00020

#### SECTION 00100

#### INSTRUCTIONS TO BIDDERS

#### ROUTE 6 SEWER AND WATER EXTENSIONS

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- Article 2. Drawings and Documents
- Article 3. Ability and Experience of Bidder
- Article 4. Information not Guaranteed
- Article 5. Subsurface Investigation
- Article 6. Not Used
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- Article 8. Bidders to Investigate
- Article 9. Questions Regarding Drawings and Documents
- Article 10. Blank Form for Bid
- Article 11. Subcontracts
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- Article 13. Withdrawal of Bids
- Article 14. Right to Reject Bids
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- Article 17. Contract Bonds
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- Article 19. Insurance Certificates
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- Article 27. Material Price Adjustments
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# ARTICLE 1. RECEIPT AND OPENING OF BIDS

- 1.1 Sealed Bids for the work of this Contract will be received at the time and place indicated in the Invitation to Bid.
- 1.2 OWNER may consider informal any Bid not prepared and submitted in accordance with the provisions hereof.
- 1.3 Bidders are cautioned that it is the responsibility of each individual bidder to assure that his/her bid is in the possession of the responsible official or his/her designated alternate prior to the stated time and at the place of the Bid Opening. Owner is not responsible for bids delayed by mail and/or delivery services, of any nature.
- 1.4 If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope and addressed to the Town Administrator, Town Hall, 816 Main Road, Westport, MA 02790. The envelope must be clearly marked with the correct project name.
- 1.5 The Town may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informality in or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of the bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw its bid for a period of sixty (60) days, excluding Saturdays, Sundays and legal holidays, after the actual date of the opening thereof.
- 1.6 All blank spaces on the Bid Sheet must be completed and the phraseology of the Bid Sheet is not to be changed. Any additional conditions, limitations or provisions attached to the Bid Sheet may result in its rejection.
- 1.7 Bidder may only submit one Bid for the above-named project. Submission of multiple bids may be cause for rejection of all submitted bids.

## ARTICLE 2. DRAWINGS AND DOCUMENTS

2.1 Upon award of the Contract, the Contractor will be provided with two (2) copies of the Contract Documents and one full size set of reproducibles from which he can make, at his own expense, full size prints necessary for execution of the Work.

# ARTICLE 3. ABILITY AND EXPERIENCE OF BIDDER

- 3.1 No award will be made to any bidder who cannot satisfy the Owner that he/she 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's decision or judgment on these matters shall be final, conclusive, and binding.
- 3.2 The Owner may make such investigations as it deems necessary, and the Bidder shall furnish to the Owner, under oath if so required, all such information and data for this purpose as the Owner may request.
- 3.3 The investigation of a Bidder will seek to determine whether the organization is adequate in size, is authorized to do business in the jurisdiction where the project is located, has had previous experience and whether available equipment and financial resources are adequate to assure Owner that the Work will be completed in accordance with the terms of the Agreement. The amount of other work to which the Bidder is committed may also be considered.
- 3.4 Whenever 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 can be considered if the equipment supplier or manufacturer is willing to provide an "Efficiency Guarantee Bond" or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure."
- 3.5 To be considered a responsive Bidder, the Contractor shall have obtained at least one set of plans and specifications from the Engineer. The Bid will not be awarded to a Bidder unless a record for the acquisition of at least one set of plans and specifications exists.
- 3.6 Owner reserves the right to reject any Bid if the evidence submitted by, or the investigation of, such Bidder fails to satisfy Owner that such Bidder is properly qualified to carry out the obligations of the Contract Documents and to complete the Work contemplated therein

# ARTICLE 4. INFORMATION NOT GUARANTEED

- 4.1 All information given on the Drawings or in the other 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 and Engineer. All such information is furnished only for the information and convenience of bidders and is not guaranteed.
- 4.2 It is agreed and understood that the Owner and Engineer do 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 on the Drawings or in the other Contract Documents.

- 4.3 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 Engineer, 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.
- 4.4 At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Drawings and Contract Documents (including all addenda.) The failure or omission of any bidder to examine any form, instrument, or documents shall in no way relieve any bidder from any obligation in respect to his/her bid.
- ARTICLE 5. Not Used
- ARTICLE 6. Not Used
- ARTICLE 7. Not Used

## ARTICLE 8. BIDDERS TO INVESTIGATE

- 8.1 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.
- 8.2 If a site conference is to be held prior to the bid opening it will be noted in the advertisement for bids.

## ARTICLE 9. QUESTIONS REGARDING DRAWINGS AND DOCUMENTS

- 9.1 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 Drawings or other Contract Documents, or the equality or use of products or methods other than those designated or described on the Drawings or in the Specifications. Any information given to bidders other than by means of the Drawings and other 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 Engineer on account thereof.
- 9.2 To receive consideration, such questions shall be submitted in writing to the Engineer (Kleinfelder, One Beacon Street, Suite 8100, Boston, Massachusetts 02108, Attention: Alex Silveri or ASilveri@kleinfelder.com) at least seven days before the established date for receipt of Bids. The Engineer 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, in accordance with the requirements of Section 01300 - SUBMITTAL PROCEDURES.

- 9.3 The Engineer will set forth as Addenda, which shall become a part of the Contract Documents, such questions received as above provided as in his sole judgment are appropriate or necessary and his decision regarding each. At least five days prior to the receipt of Bids, he will send a copy of these Addenda to those prospective bidders and parties known to have taken out sets of the Drawings and Contract Documents.
- 9.4 The Contractor agrees to use and base his/her bid on the products and methods designated or described in the Specifications as amended by the Addenda and as shown on the drawings.

# ARTICLE 10. BLANK FORM FOR BID

- 10.1 All bids must be upon the blank form for Bid annexed hereto (Section 00301) state the proposed price of each item of the Work, both in words and in figures, and be signed by the bidder with his/her business address and place of residence. All blanks for bid prices must be filled in, in ink or typewritten.
- 10.2 Each general bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his/her address, the name of the project for which the bid is submitted and an envelope containing the bid security as specified below. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope. General bids shall be addressed to the Town Administrator, Town Hall, 816 Main Road, Westport, MA 02790.
- 10.3 It shall be bidders' sole responsibility to ensure bids are delivered to the specified location by the stated date and time.

ARTICLE 11. Not Used

# ARTICLE 12. BID SECURITY

- 12.1 Each bid must be accompanied by cash or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company and payable to the order of the Town of Westport or by a bid bond prepared on the form of BID BOND (see Section 00430) or bond company's standard form and attached hereto duly executed and acknowledged by the bidder, as Principal, and by a surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Owner, as Surety. The cash, check or bid bond shall be in the sum of 5 percent of the value of the Bid and shall be enclosed in, or attached to, the sealed envelope containing the Bid.
- 12.2 Every bid bond, every performance bond and every payment bond issued for any construction work in the Commonwealth shall be the bond of a surety company organized pursuant to Section 105 of Chapter 175 or of a surety company authorized to do business in Commonwealth under the provisions of Section 106 of said Chapter

175 and be approved by the U. S. Department of Treasury and acceptable as sureties and reinsurers on federal bonds under Title 31 of the United States Code, sections 9304 to 9308.

- 12.3 Each such check, bid bond, or cash amount may be held by the Owner as security for the fulfillment of the bidder's agreements as hereinabove set forth and as set forth in the BID. Should the bidder fail to fulfill such agreements his/her cash or 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 cash or 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.
- 12.4 Bid securities will be returned to all except the three lowest bidders within five days, Sundays and legal holidays excluded, after the opening of Bids, and to the three lowest bidders within five days, Sundays and legal holidays excluded, after the Owner and the accepted bidder have executed the AGREEMENT. In the event that the AGREEMENT has not been executed by both the accepted bidder and the Owner within thirty (30) consecutive days after the opening of Bids, the bid security will be returned promptly to any bidder who has not been notified of the acceptance of his/her Bid.
- 12.5 Bid checks or cash accompanying Bids which are rejected will be returned within five days, Sundays and legal holidays excluded, after rejection.
- 12.6 None of the three lowest Bids shall be deemed rejected, notwithstanding of any BID, until the AGREEMENT has been executed by both the Owner and the accepted bidder.

## ARTICLE 13. WITHDRAWAL OF BIDS

- 13.1 Except as hereinafter in this subsection otherwise expressly provided, once his/her Bid is submitted and received by the Owner for consideration and comparison with other bids similarly submitted, the bidder agrees that he/she may not and will not withdraw it within sixty (60) days excluding Saturdays, Sundays and legal holidays after the actual date of the opening of Bids.
- 13.2 Upon proper written request and identification, Bids may be withdrawn only as follows:
  - 1. At any time prior to the designated time for the opening of Bids.
  - 2. Provided the Bid has not theretofore been accepted by the Owner, at any time subsequent to the expiration of the period during which the bidder has agreed not to withdraw his/her Bid.
- 13.3 Unless a Bid is withdrawn as provided above, the bidder agrees that it shall be deemed open for acceptance until the AGREEMENT has been executed by both parties thereto or until the Owner notifies a bidder in writing that his/her Bid is

rejected or that the Owner does not intend to accept it, or returns his/her Bid deposit. Notice of acceptance of a Bid shall not constitute rejection of any other Bid.

# ARTICLE 14. RIGHT TO REJECT BIDS

- 14.1 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.
- 14.2 The Owner may reject Bids which in its sole judgment are either incomplete, conditional, obscure or not responsive or which contain additions not called for, erasures not properly initialed, alterations, or similar irregularities, or the Owner may waive such omissions, conditions or irregularities.

## ARTICLE 15. COMPARISON OF BIDS

- 15.1 The several Bids will be compared on the basis of the prices bid, and the contract will be awarded to the lowest responsible and eligible bidder, as defined in Section 44A, Chapter 149, General Laws of Massachusetts.
- 15.2 In the event that there is a discrepancy in the Bid between the lump sum and unit prices written in words and figures, the prices written in words shall govern.
- 15.3 The Owner agrees to examine and consider each Bid submitted in consideration of the Bidder's agreements, as hereinabove set forth and as set forth in the BID.

## ARTICLE 16. SCOPE OF WORK

16.1 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 or 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.

#### ARTICLE 17. CONTRACT BONDS

- 17.1 The Bidder whose Bid is accepted agrees to furnish the Contract Bonds in the forms which follow in Section No. 00610 Performance Bond and Section 00615 Payment Bond, each in the sum of the full amount of the Contract and duly executed by the said bidder as Principal and by a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the Owner, as Surety, for the faithful performance of the Contract and payment for labor and materials. The premiums for such Bonds shall be paid by the Contractor.
- 17.1.1 The Massachusetts Department of Transportation (MassDOT) shall be named as Co-Obligee on the performance bond. Upon substantial completion the value of the

Contract 1 Route 6 Sewer	INSTRUCTIONS TO BIDDERS
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performance bond can be reduced to the full value of the portion of the work in the state highway. MassDOT shall hold the bond for three years following substantial completion to insure against settlement and other defects caused by the construction. See MassDOT permit.

- 17.2 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.
- 17.3 Every bid bond, every performance bond and every payment bond issued for construction work in the Commonwealth shall be the bond of a surety company organized pursuant to Section 105 of Chapter 175 or of a surety company authorized to do business in the Commonwealth under the provisions of Section 106 of said Chapter 175 and be approved by the U.S. Department of Treasury and acceptable as sureties and reinsurers on federal bonds under Title 31 of the United States Code, Sections 9304 to 9308.

## ARTICLE 18. EXECUTION OF AGREEMENT

- 18.1 The Bidder whose Bid is accepted will be required and 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.
- 18.2 The Bidder to whom the Contract is awarded shall comply with the provisions of Chapter 30, Section 39R of the General Laws of Massachusetts as amended to date; and as provided therein shall, prior to execution of the contract, file a statement of management on internal accounting controls and an audited financial statement for the most recent completed fiscal year.
- 18.3 The contractor guarantees that the Work and Services to be performed under the Contract, 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 shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the Work as stated in the final estimate. Work in the state highway shall be guaranteed for 3 years, per Paragraph 17 above. If part of the Work is accepted in accordance with that subsection of this AGREEMENT titled "Partial Acceptance", the guarantee for that part of the Work shall be for a period of one year from a period of one year for a period of one year for a period of one year for a section of the state highway shall be guaranteed for 3 years, per Paragraph 17 above. If part of the Work is accepted in accordance with that subsection of this AGREEMENT titled "Partial Acceptance", the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance.
- 18.4 If at any time within the said period of guarantee any part of the Work requires repairing, 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, corrections or replacements to the satisfaction of the Owner within seven (7) days from the date of receipt of such notice, or having commenced fails to prosecute such Work with diligence, the Owner may employ

other persons to make said repairs, correction or replacements, and charge the costs, including compensation for additional professional services, to the Contractor."

# ARTICLE 19. INSURANCE CERTIFICATES

19.1 The Contractor will not be permitted to start any construction work until he/she has submitted certificates covering all insurances called for under Supplementary Condition 2.05 of Section 00800.

# ARTICLE 20. MASSACHUSETTS SALES AND USE TAX

20.1 Materials and equipment purchased for permanent installation in this project will be exempt from the Massachusetts Sales and Use Tax. The exemption certificate number will be furnished to the Contractor. Each bidder shall take this exemption into account in calculating his/her bid for the work.

# ARTICLE 21. MASSACHUSETTS WAGE RATES

- 21.1 Minimum Wage Rates as determined by the Executive Office of Labor and Workforce Development under the provision of the Massachusetts General Laws, Chapter 149 Section 26-27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, and additional information on Minimum Wage Rates for those trade people who may be employed for the proposed work under contract. Federal Minimum Wage Rates as determined by the United States Department of Labor under the Davis-Bacon Act also apply to this project. The Massachusetts Wage Determination is included in these specifications in the Appendices.
- 21.2 The Contractor shall submit certified weekly payroll records to the Department of Labor and Industries, and the Owner. Failure to submit records shall be cause for withholding of payments due to Contractor.

# ARTICLE 22. MANUFACTURER'S EXPERIENCE

22.3 Wherever it is written that an equipment manufacturer must have a specified period of experience with his/her product, equipment which does not meet the specified experience period can 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. Such bond shall be an Efficiency Guarantee Bond executed on a form to be approved by the Owner.

# ARTICLE 23. SAFETY AND HEALTH REGULATIONS

23.1 This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to all subsequent amendments, and to any applicable Massachusetts regulations. Contractors shall be familiar with the requirements of these regulations.

- 23.2 The Successful Bidder shall comply with the Department of Labor Safety and Health Regulations for Construction promulgated under the Occupational Safety and Health Act of 1970 (PL-91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL-91-54).
- 23.3 The Successful Bidder shall have a competent person or persons, as required under the Occupational Safety and Health Act on the Site to inspect the Work and to supervise the conformance of the Work with the regulations of the Act.
- 23.4 The Contractor is to be aware that the Westport Fire Department has specific safety policies and procedures regarding gas main breaks. Among other requirements, the Contractor must shut down all equipment when a gas break occurs, and the equipment cannot be restarted until authorized to do so by the Westport Fire Department. The Contractor shall contact the Westport Fire Department and fully comply with their policies and procedures in this regard.

# ARTICLE 24. ACCESS TO WORK

24.1 Representative of the Commonwealth and any local agencies having a direct interest in the Work shall have access to the Work under this contract wherever it is in preparation or progress and which required the Contractor to provide proper facilities for such access and inspection.

# ARTICLE 25. CHANGE ORDERS

25.1 Change orders will be processed in accordance with Article 10 of the General Conditions.

## ARTICLE 26. STATE AND FEDERAL REQUIREMENTS

26.1 Applicable provisions of Massachusetts General Laws and Regulations and/or the United States Code and Code of Federal Regulations govern this Contract and any provision in violation of the foregoing shall be deemed null, void and of no effect. Where conflict between Code of Federal Regulations and State Laws and Regulations exist, the more stringent requirement shall apply.

## ARTICLE 27. MATERIAL PRICE ADJUSTMENTS

This project is subject to the requirements of the Department of Environmental Protection's Diesel Retrofit Program. Bidders must submit a signed and dated Statement of Intent to Comply form as part of their bid proposal documents. Within 10 days of being notified that it has been awarded the contract, the bidder and each of its Contractors and Subcontractors shall submit a Diesel Retrofit Program Contractor Certification. Refer to Section 00315 – Massachusetts Diesel Retrofit Program.

27.1 In accordance with MGL Chapter 30, 39M, Section 38A, price adjustments for diesel fuel, gasoline fuel, liquid asphalt, and Portland cement contained in pre-cast concrete, are included in the Contract. The base price and the price index used for each material is set by the awarding authority and is included in the bid documents.

Contract price adjustments shall be made on a monthly basis when the monthly cost change exceeds plus or minus 5% of the base price listed herein. Period prices include applicable taxes. Upward price adjustments shall be made to the Contractor; downward price adjustments shall be made as form of a credit to the Owner.

Adjustments will be made only when the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments. No adjustments will be made for work performed beyond the specified Contract completion date.

- 27.2 The base price for diesel fuel and gasoline fuel are actual prices paid by MassDOT and as listed on the MassDOT price Adjustment Period Prices Index indicated on MassDOT website (https://www.mass.gov/service-details/2019-massdot-contract-price-adjustments). Fuel (diesel and gasoline) adjustments shall be made based on quantity of excavation performed as part of the specified work within the monthly period. Excavation will be calculated based on the cubic yards of excavation as determined by (length of main or service installed, in feet, times specified limit of trench depth, in feet, times specified limit of trench width, in fee, total divided by 27). No additional calculation for excavation will be made for valves, blow offs, manholes or fittings. For main excavation, a fuel factor of 0.29 gallons/CY shall be utilized for diesel fuels and fuel factor of 0.15 gallons/CY shall be utilized for gasoline fuels. For work related to paving operations, a fuel factor of 2.90 gallons/Ton of asphalt placed will be used. Paving tonnage shall be calculated as described in Measurement and Payment section of the Specifications.
- 27.3 The base price for liquid asphalt is based on monthly price as determined by MassDOT-Highway Division using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast market-New England, Boston MA area" section of Poten & Partners, Inc., "Asphalt Weekly Monitor" The average selling price listed in the issue having a publication date of the 2d Friday of the month and as posted as the Period Price for that month on MassDOT price Adjustment Period Prices Index. The price adjustment for liquid asphalt applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Specifications and the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03 and within the specified payment limits and thicknesses. Price adjustment will be determined by multiplying the number of tons of hot mix asphalt mixture placed during each monthly period times the liquid asphalt content percentage times the variance in price between the Base Price and Period Price of liquid asphalt. Contractor shall provide certified documentation as to the Job Mix formula showing the virgin liquid asphalt content of the mixture.
- 27.4 Portland cement price adjustments will apply only to project requiring greater than 100 cubic yards of Portland cement concrete containing Portland cement. The price adjustments will be determined by using the latest published price, in dollars per U.S. Ton for Portland cement (Type 1) quoted for Boston MA area in the Construction Economics section of the ENR Engineering News-Record magazine or the ENR website http://www.enr.com under Construction Economics. The period

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price will be posted on MassDOT price Adjustment Period Prices Index. The price adjustment shall apply only to the actual Portland cement content of the cement concrete mix placed on the job in accordance with the Specifications and the Standard Specifications for Highways and Bridges, Division III, Section M4.02.01. No adjustments will be made for any cement replacement materials such as fly ash or ground granulated blast furnace slag. If less than 100 CY is required or placed, no price adjustments shall be made for this material. Contractor shall provide certified documentation as to the Portland cement content for the cement utilized.

27.5 For this contract, base prices on the day of the bid as indicated in the below website, shall be utilized:

MassDOT current contract price adjustments | Mass.gov

This project is subject to the American Iron and Steel requirements of P.L. 113-76, the Consolidated Appropriations Act of 2014.

The Contractor shall comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel Requirement") unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project. Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

ARTICLE 28. Not Used

## ARTICLE 29. UTILITY UNDERGROUND PLANT DAMAGE PREVENTION SYSTEM

29.1 All excavations within public or private ways are subject to the requirements of Massachusetts General Law and OSHA Regulations.

## ARTICLE 30. COMPETITIVE BIDDING

30.2 If at the time this contract is to be awarded, the lowest bid submitted by a responsible eligible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the contract, the contract will be awarded on the basis of such bid. If such bid exceeds such amount, the Owner may reject all bids or take other action deemed to be in the best interest of the Owner.

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# ARTICLE 31. CONTRACTOR'S GUARANTEE

- 31.1 The Contractor guarantees the work under this contract and the materials furnished by him for use in connection therewith to be free from defects or flaws for one (1) year after the completion of the contract, and guarantees for a term of one (1) year from the date of final completion of the work to maintain the stability of all materials, equipment or workmanship, except that due to normal wear and tear, at his/her own expense when notified in writing to do so by the Engineer and such work shall be performed to the satisfaction of the Engineer. Paving shall be guaranteed for three years. If at any time within said guarantee period, any part of the work constructed under the terms of this contract shall in the opinion of the Engineer require repair or replacement due to defective work or materials furnished by the Contractor, he/she may notify the Contractor in writing to make the required work and repairs (including all labor and materials) and the Contractor shall perform the same within 10 days. If he/she shall not do so, the Owner may do it and charge the Contractor.
- 31.2 It is expressly understood, however, that these guarantee provisions shall not absolve the Contractor from any liability to the Owner arising out of a failure to substantially complete the work in accordance with the plans and specifications.
- 31.3 The Contractor shall not participate in or cooperate with an international boycott, as defined in Section 999 (b) (3) and (4) of the Internal Revenue code of 1954, as amended, or engage in conduct declared to be unlawful by Section 2 of Chapter 151E of the Massachusetts General laws.

# ARTICLE 32. TRAFFIC POLICE DETAILS

32.1 Traffic control, when required by the Chief of Police, MassDOT, or the Owner, will normally be paid for by the Owner directly. However, any police overtime expenses incurred by the Town due to the Contractor electing to work longer than the normal workday shall be the responsibility of the Contractor, the cost of which will be deducted from the monthly pay requisition. The Contractor will also be charged for police expenses when police coverage is requested, but the Contractor does not work.

# ARTICLE 33. THIRD PARTY WORK

- 33.1 The Contractor is responsible for maintaining a safe and secure worksite at all times, and for expeditiously repairing any damage done to private property. If, in the opinion of the Owner, the Contractor is negligent in these duties the Owner shall have the right to employ a third party to remedy the problem.
- 33.2 Situations which develop and require the services of and payment to a third party will be handled in the following manner:
  - A. The Contractor will be given a reasonable period of time determined at the discretion of the Owner to remedy the situation without third party involvement. If the Contractor is unavailable the Owner will authorize work by a third party on the Contractor's behalf.

- B. Third party work authorized on the Contractor's behalf by the Owner shall be paid for by the Contractor within a reasonable time period (generally two weeks). If payment is not made within a reasonable time period the Owner will make payment and deduct the cost from the next payment requisition.
- C. In the case of inadequately secured worksites necessitating extra or increased police details or other public safety personnel, the following procedure will be followed. The Contractor (if available) will be notified that the worksite needs to be secured in order to prevent the need for weekend/night police coverage. If the area is not immediately secured as determined by the Owner or Engineer, a police, fire, or highway department detail will be used and the Contractor will be charged for the cost. It is understood that in many instances worksites cannot realistically be secured to a point where police or other public safety personnel are not needed. In these instances, the Owner will continue to pay for the coverages.

# TOWN OF WESTPORT, MA

END OF SECTION 00100

#### SECTION 00301

#### BID

To the Town of Westport, MA herein called the Owner for Route 6 Water and Sewer Extensions, acting by and through its Town Administrator.

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 and examined the Drawings, the 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 Engineer 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) 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

BID 00301 -1 only approximate and are subject to increase or decrease as deemed necessary by the Engineer; and

(7) 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 Engineer, 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 things required by the Contract Documents in the manner and within the time therein prescribed and according to the requirements of the Engineer as therein set forth, and that he will take in full payment therefore the lump sum or unit price applicable to each item of the Work as stated in the schedule below.

All entries in the entire BID must be made clearly and in ink; price bid must be written in both words and figures. In case of discrepancy between written words and figures, the written words shall govern. In case of discrepancy between the sum of the total figure of the items and the total amount listed, the actual sum shall apply.

Refer to Section 01150 - Measurement and Payment for Item Descriptions.

Item No.	Description	Units	Estimated Quantity	Extended Total
	Mobilization/Demobilization (up to 5% of all other base bid items)			
1		LS	1	
	Dollars (\$) per unit			
	State Road			
2a		LS	1	
	Dollars (\$) per unit			
	Pump Station – 287-291 State Road			
2b		LS	1	
	Dollars (\$) per unit			
	8" PVC Sanitary Sewer Gravity Pipe			
20		IE	2 480	
<i>3</i> a		Lſ	2,480	
	Dollars (\$) per unit			
3b	12" PVC Sanitary Sewer Gravity Pipe	LF	130	

# **BASE BID**

Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Is" PVC Sanitary Sewer Gravity Pipe       LF       930         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit         Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit       Image: Dollars (\$ ) per unit	Item No.	Description	Units	Estimated Quantity	Extended Total
Joilars (b) per unit     LF     930       Joilars (\$) per unit     LF     930       Joilars (\$) per unit     LF     1,680       James (\$) per unit     VF     160       James (\$) per unit     VF     160       James (\$) per unit     VF     20       James (\$) per unit     VF     20       James (\$) per unit     VF     20		Dollars (\$ ) per unit			
3c     LF     930       Dollars (\$) per unit     LF     930       18" PVC Sanitary Sewer Gravity Pipe     LF     1,680       3d     Dollars (\$) per unit     LF     1,680       Dollars (\$) per unit     VF     160       4a     VF     160       Dollars (\$) per unit     VF     20       4b     VF     20       Image: Arrow of the original server force Main     VF     20		15" PVC Sanitary Sewer Gravity Pipe			
Dollars (\$) per unit       I8" PVC Sanitary Sewer Gravity Pipe         3d       I8" PVC Sanitary Sewer Gravity Pipe         Jollars (\$) per unit       IF         4a       Dollars (\$) per unit         4a       VF         Jollars (\$) per unit       If 00         Dollars (\$) per unit       VF         6-Foot Diameter Sewer Manholes       VF         4b       VF         Dollars (\$) per unit       VF         6-Foot Diameter Sewer Manholes       VF         4b       VF         20       VF	3c		LF	930	
3d       Is" PVC Sanitary Sewer Gravity Pipe         3d       LF       1,680         Dollars (\$) per unit       1,680         4a       VF       160         Dollars (\$) per unit       160         6-Foot Diameter Sewer Manholes       VF       20         4b       VF       20         Dollars (\$) per unit       VF       20         4" and 12" PVC Sanitary Sewer Force Main       VF       20		Dollars (\$) per unit			
3d       LF       1,680         Dollars (\$) per unit       LF       1,680         4a       4-Foot Diameter Sewer Manholes       VF       160         4a       Dollars (\$) per unit       160       160         bollars (\$) per unit       VF       160       160         4b       6-Foot Diameter Sewer Manholes       VF       20         bollars (\$) per unit       VF       20       160         4'' and 12'' PVC Sanitary Sewer Force Main       VF       20		18" PVC Sanitary Sewer Gravity Pipe			
Dollars (\$) per unit       4-Foot Diameter Sewer Manholes       4a       4a       Dollars (\$) per unit       6-Foot Diameter Sewer Manholes       4b       6-Foot Diameter Sewer Manholes       VF       160       Dollars (\$) per unit       VF       20	3d		LF	1,680	
4a     VF     160       4a     Oollars (\$) per unit     160       6-Foot Diameter Sewer Manholes     VF     20       4b     VF     20       Dollars (\$) per unit     VF     20		Dollars (\$ ) per unit			
4a     VF     160       Dollars (\$) per unit     160       6-Foot Diameter Sewer Manholes     VF       4b     VF     20       Dollars (\$) per unit     VF       4" and 12" PVC Sanitary Sewer Force Main		4-Foot Diameter Sewer Manholes			
Dollars (\$) per unit       6-Foot Diameter Sewer Manholes       4b       Dollars (\$) per unit       VF       20	4a		VF	160	
Dollars (\$ ) per unit       6-Foot Diameter Sewer Manholes       4b       Dollars (\$ ) per unit       VF       20					
4b     VF     20       Dollars (\$) per unit     4" and 12" PVC Sanitary Sewer Force Main		Dollars (\$) per unit			
4b     VF     20       Dollars (\$) per unit     4" and 12" PVC Sanitary Sewer Force Main		0-1 oot Diameter Sewer Mannoles			
Dollars (\$) per unit       4" and 12" PVC Sanitary Sewer Force Main	4b		VF	20	
4" and 12" PVC Sanitary Sewer Force Main		Dollars (\$) per unit			
		4" and 12" PVC Sanitary Sewer Force Main			
(parallel in the shared trench)		(parallel in the shared trench)			
5a LF 2,580	5a		LF	2,580	
Dollars (\$ ) per unit		Dollars (\$) per unit			
6 PVC Sanitary Sewer Force Main		6 PVC Santary Sewer Force Main			
5b LF 90	5b		LF	90	
Dollars (\$ ) per unit		Dollars (\$ ) per unit			
PVC Sanitary Sewer Service		PVC Sanitary Sewer Service			
6 LF 1,420	6		LF	1,420	
Dollars (\$) per unit		Dollars (\$) per unit			
Utility Support and Coordination		Utility Support and Coordination			
Curry Support and Coordination		Clinty Support and Coordination			
7 LS 1	7		LS	1	
Dollars (\$) per each		Dollars (\$ ) per each			
Exploratory Investigations		Exploratory Investigations			
8 CY 850	8		CY	850	
Dollars (\$ ) per unit		Dollars (\$ ) per unit			

Item No.	Description	Units	Estimated Quantity	Extended Total
	Rock Excavation			
9	Dellers (© ) new soch	CY	250	
10	Excavation and Disposal of Unsuitable Material Below Grade		100	
10		CY	100	
11	Removal and Disposal of PCCP Water Aqueduct Short Sections	EA	1	
11	Dollars (\$) per unit		1	
	Misc. Concrete			
12		СҮ	100	
	Dollars (\$) per unit			
13a	Temporary Pavement (3")	TON	1,640	
	Dollars (\$) per unit			
13b	Permanent Pavement on State Roads (7 <sup>th</sup> )	TON	3,810	
	Dollars (\$ ) per unit			
13c	Dollars (\$ ) per unit	TON	1090	
13d	Permanent Pavement on Town Roads (2")	TON	40	
	Dollars (\$) per unit Roadway Concrete Slab Removal			
14		СҮ	2,150	
	Dollars (\$) per unit			
15		AL	1	\$109,000.00

Item No.	Description	Units	Estimated Quantity	Extended Total
	Dollars (\$109,000.00) per each			
	Unforeseen Conditions			\$50,000.00
16		AL	1	
	Dollars (\$50,000.00) per unit			
	Traffic Management			
17		LS	1	
	Dollars (\$) per unit			
	100-lb Bags of Calcium Chloride			
18		EA	100	
	Dollars (\$) per unit			
	Hydrant Relocation			
19		LS	1	
	Dollars (\$) per unit			
	Water Services			
20		LF	410	
	Dollars (\$) per unit			
	Reconfigure Hebert Terrace Drain Culvert			
	Crossing			
21		LS	1	
	Dollars (\$) per unit			

# Total Amount of Base Bid (Items 1 through 21) inclusive:

# \$

(Amount in Figures)

(Amount in Words)

# ALTERNATE BID A

Item	Description	Units	Estimated	Extended
No.			Quantity	Total

Item No.	Description	Units	Estimated Quantity	Extended Total
	Mobilization/Demobilization (up to 5% of all other Alternate A bid items)			
A-1		LS	1	
	Dollars (\$) per unit       Pump Station – 833 State Road			
A-2		LS	1	
	Dollars (\$) per unit         8" PVC Sanitary Sewer Gravity Pipe (<12')			
A-3a	Deep)	LF	5,550	
	Dollars (\$) per unit			
A-3b	8" PVC Sanitary Sewer Gravity Pipe	LF	490	
	Dollars (\$) per unit			
	12" PVC Sanitary Sewer Gravity Pipe			
A-3c		LF	800	
	Dollars (\$) per unit15" PVC Sanitary Sewer Gravity Pipe			
A-3d		LF	430	
	Dollars (\$ ) per unit			
A-3e		EA	10	
	Dollars (\$) per unit			
	4-Foot Diameter Sewer Manholes			
A-4a		VF	240	
	Dollars (\$ ) per unit       5-Foot Diameter Sewer Manholes			
A-4b		VF	50	
	Dollars (\$) per unit			
A-5a		LF	10,920	

Item No.	Description	Units	Estimated Quantity	Extended Total
	Dollars (\$) per unit			
A-5b	Force Main Air Release Valve Manhole	EA	4	
A-6	PVC Sanitary Sewer Service Dollars (\$) per unit	LF	2,930	
A-7	Utility Support and Coordination           Dollars (\$) per each	LS	1	
A-8	Exploratory Investigations           Dollars (\$) per unit	СҮ	1,950	
A-9	Rock Excavation Dollars (\$) per each	СҮ	910	
A-10	Excavation and Disposal of Unsuitable Material Below Grade Dollars (\$) per unit	СҮ	100	
A-11a	Removal and Disposal of PCCP Water Aqueduct Short Sections Dollars (\$) per unit	EA	21	
A-11b	Removal and Disposal of PCCP Water Aqueduct Long Sections Dollars (\$) per unit	LF	2,300	
A-12	Misc. Concrete	СҮ	100	

Item No.	Description	Units	Estimated Quantity	Extended Total
	Dollars (\$) per unit			
	Temporary Pavement (3")			
A-13a		TON	2 050	
11 104			2,000	
	Dollars (\$) per unit			
	Permanent Pavement on State Roads (7")			
A-13b		TON	4.780	
_			,	
	Dollars (\$ ) per unit			
	Mill and Overlay on State Roads (2")			
A-13c		TON	1.340	
11 100		1011	1,010	
	Dollars (\$) per unit			
	Permanent Pavement on Town Roads (2")			
A-13d		TON	140	
11 154			110	
-	Dollars (\$) per unit			
	Roadway Concrete Slab Removal			
A-14		CY	2.400	
			_,	
	Dollars (\$) per unit			
	Police Details			
A-15		AL	1	\$266,000,00
			_	\$200,000.00
	Dollars (\$266,000.00) per each			
	Unforeseen Conditions			\$50,000.00
A-16		AL	1	
	Dollars (\$50,000.00) per unit			
	Traffic Management			
A 17		TC	1	
A-1/		LS	1	
	Dollars (\$) per unit			
	100-lb Bags of Calcium Chloride			
A 10		E A	100	
A-18		EA	100	
	Dollars (\$) per unit			
	Hydrants (new)			
A 10			r -	
A-19		EA	6	
	Dollars (\$) per unit			

Item No.	Description	Units	Estimated Quantity	Extended Total
	Water Services			
A-20		LF	2,550	
	Dollars (\$) per unit			
	6" DI Water Main			
A-21a		LF	450	
	Dollars (\$ ) per unit			
	8" DI Water Main			
A-21b		LF	520	
	Dollars (\$) per unit			
	12" DI Water Main			
A-21c		LF	3.670	
			- )	
	Dollars (\$ ) per unit			
	Fittings, Couplings			
A-22a		LB	20,000	
	Dollars (\$ ) per unit			
	Restants			
A-22b		EA	240	
	Dollars (\$ ) per unit			
	6" Gate Valve and Gate Box			
A-23a		EA	12	
	Dollars (\$) per unit			
	8" Gate Valve and Gate Box			
A 224		EA	o	
A-230		EA	0	
	Dollars (\$) per unit			
	12" Gate Valve and Gate Box			
A-23c		EA	9	
	Dollars (\$) per unit			
	water Main Manual Air Kelease Valve			
A-24		EA	1	
	Dollars (\$ ) per unit			
A-25		EA	1	

Item No.	Description	Units	Estimated Quantity	Extended Total
	Dollars (\$) per unit			
A-26	Pressure Reducing Valve and Assess Vault	LS	1	
	Dollars (\$) per unit			

# Total Amount of Alternate Bid A (Items A-1 through A-26) inclusive:

\$

(Amount in Figures)

(Amount in Words)

# ALTERNATE BID B

Item No.	Description	Units	Estimated Quantity	Extended Total
B-1	Mobilization/Demobilization (up to 5% of all other Alternate B bid items)	LS	1	
B-2	Dollars (\$) per unit         Pump Station – 1115 State Road         Dollars (\$) per unit	LS	1	
B-3a	8" PVC Sanitary Sewer Gravity Pipe           Dollars (\$) per unit	LF	3,170	
B-3b	12" PVC Sanitary Sewer Gravity Pipe	LF	520	

Item No.	Description	Units	Estimated Quantity	Extended Total
	Dollars (\$) per unit			
B-3c	15" PVC Sanitary Sewer Gravity Pipe (<12' Deep)	LF	2,660	
B-3d	15" PVC Sanitary Sewer Gravity Pipe (>12' Deep) Dollars (\$) per unit	LF	1,060	
B-3e	Sanitary Sewer Gravity Chimneys	EA	10	
B-4	4-Foot Diameter Sewer Manholes       Dollars (\$ ) per unit	VF	220	
B-5a	Dollars (\$) per unit	LF	4,920	
B-5b	Force Main Air Release Valve Manhole	EA	1	
B-6	PVC Sanitary Sewer Service           Dollars (\$) per unit	LF	2,510	
B-7	Utility Support and Coordination	LS	1	
B-8	Exploratory Investigations           Dollars (\$) per unit	СҮ	650	

Item No.	Description	Units	Estimated Quantity	Extended Total
	Rock Excavation			
В-9	Dollars (\$) per each	СҮ	190	
B-10	Excavation and Disposal of Unsuitable Material Below Grade	СҮ	100	
B-11a	Dollars (\$ ) per unit         Removal and Disposal of PCCP Water         Aqueduct Short Sections         Dollars (\$ ) per unit	EA	28	
B-11b	Removal and Disposal of PCCP Water Aqueduct Long Sections Dollars (\$) per unit	LF	2,000	
B-12	Misc. Concrete Dollars (\$) per unit	СҮ	100	
B-13a	Temporary Pavement (3") Dollars (\$) per unit	TON	770	
B-13b	Permanent Pavement on State Roads (7") Dollars (\$) per unit	TON	1,780	
B-13c	Mill and Overlay on State Roads (2")           Dollars (\$)         ) per unit	TON	2,220	
B-13d	Permanent Pavement on Town Roads (2") Dollars (\$) per unit	TON	100	
B-14	Roadway Concrete Slab Removal	СҮ	950	

Item No.	Description	Units	Estimated Quantity	Extended Total
	Dollars (\$ ) per unit			
	Police Details			
B-15		AL	1	
	Dollars (\$ ) per each			
	Unforeseen Conditions			\$194,000.00
B-16		AL	1	
	Dollars (\$194,000.00) per unit			
B-17		LS	1	
	Dollars (\$ ) per unit			
	100-lb Bags of Calcium Chloride			
D 10			100	
B-18		EA	100	
	Dollars (\$) per unit			
	Hydrants (new)			
B-19		EA	14	
	Water Services			
B-20		LF	2,470	
	Dollars (\$) per unit			
	6" DI Water Main			
B-21a		LF	110	
D 214			110	
	Dollars (\$) per unit			
D 011	8 DI water Main		020	
B-21b			830	
	Dollars (\$) per unit			
B-21c		LF	6,840	
	Dollars (\$ ) per unit			
	Fittings, Couplings			
B_220			25.000	
D-22a			23,000	
	Dollars (\$) per unit			
Item No.	Description	Units	Estimated Quantity	Extended Total
-------------	-------------------------------------	-------	-----------------------	-------------------
	Restraints			
B-22b		EA	390	
	Dollars (\$) per unit			
	6" Gate Valve and Gate Box			
B-23a		EA	17	
	Dollars (\$) per unit			
	8" Gate Valve and Gate Box			
B-23b		EA	12	
B 250			12	
	Dollars (\$) per unit			
	12" Gate Valve and Gate Box			
B-23c		EA	14	
	Dollars (\$ ) per unit			
	Water Main Manual Air Release Valve			
B-24		EA	1	
	Dollars (\$) per unit			
	Water Main Blow Off Connection			
B-25		EA	1	
D 20			1	
	Dollars (\$) per unit			
	Catch Basin Relocation			
B-26		EA	7	
	Dollars (\$) per unit			

# Total Amount of Alternate Bid B (Items B-1 through B-26) inclusive:

\$

(Amount in Figures)

(Amount in Words)

#### Total Amount of Base Bid plus Alternate Bid A inclusive:

\$

(Amount in figures)

(Amount in words)

#### Total Amount of Base Bid plus Alternate Bid A plus Alternate Bid B inclusive:

\$

(Amount in figures)

(Amount in words)

Determination of the lowest responsible Bidder will be accomplished in the following manner: first, bids for the Base Bid will be compared against available funds (as determined by the Town). If available funds remain following that comparison, Alternate Bid Items may be added to the Base Bid in ascending order until available funds are exhausted, or all Alternate Items have been added, and the determination of the lowest responsible Bidder will be determined on that basis. Failure to provide a cost for the Alternate Bid Items will be basis for rejection of the bid.

The undersigned agrees that, extra work, if any, shall be performed in accordance with Article 10 of the General Conditions of the Contract and Contractor will be paid for the extra work in accordance with Article 11 of the General Conditions of the Contract.

If this BID is accepted by the Owner, the undersigned agrees to complete the entire work to be done under the Contract within the time stipulated in the AGREEMENT.

As provided in the INSTRUCTIONS TO BIDDERS, the bidder hereby agrees that he will not withdraw this BID within 60 consecutive calendar days (not including weekends and holidays) after the actual date of the opening of Bids and that, if the Owner shall accept this BID, the bidder will duly execute and acknowledge the AGREEMENT and furnish, duly executed and acknowledged, the required CONTRACT BONDS within ten (10) days after notification that the AGREEMENT and other Contract Documents are ready for signature.

Should the bidder fail to fulfill any of his agreements as hereinabove set forth, the Owner shall have the right to retain as liquidated damages the amount of the bid check, which shall

BID 00301 -15 become the Owner's property. If a bid bond was given, it is agreed that the amount thereof shall be paid as liquidated damages to the Owner by the Surety.

This BID includes Addenda number \_\_\_\_\_\_ (To be filled in by Bidder if Addenda are issued.)

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.

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The attached CERTIFICATE OF NON-COLLUSION must be signed and submitted as part of the Bid Proposal.

(SEAL)	L.S.	By
(Name of Bidder)		(Signature and title of authorized
		representative)
(Telephone)		(Business address)
(Fax Number)		(City and State)

Date \_\_\_\_\_

The bidder is required to execute and return with its Submitted Bid the following sections:

- 1. Bid Bond or Certified Check in Amount of 5% of Bid (00430)
- 2. Certificate as to Corporate Bidder (00450)
- 3. List of References (Page 00301-9)
- 4. Certificate of Non-Collusion (Page 00301-10)
- 5. DEP Form 6100-4 'DBE Program Subcontractor Utilization Form'(00800-5)
- 6. DEP Form 6100–3, 'DBE Program Subcontractor Performance Form'(00800-6)

Failure to submit these items with the bid may be cause for rejection of bid by the Owner.

BID 00301 -17 The bidder is a corporation incorporated in the Commonwealth of Massachusetts - a partnership - an individual. (Bidder must add and delete as necessary to make this sentence read correctly.)

(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 address.)

The bidder is requested to state below what work of a similar character to that included in the proposed Contract he has done and to give references that will enable the Owner to judge his experience, skill, and business standing.

Project Name	Contact Name	Title	Telephone No.

Add supplementary page if necessary.

#### CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the work "person" shall mean any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals.

(Name of person signing bid or proposal

(Name of business)

END OF SECTION 00301

#### APPENDIX – B1

#### Contractor' Certification

A contractor will not be eligible for award of a contract unless such contractor has submitted the following certification, which is deemed a part of the resulting contract:

#### **CONTRACTOR'S CERTIFICATION**

Name of the General Contractor

Certifies that:

1. It intends to use the following listed construction trades in the work under contract:

- 2. Will comply with the minority workforce ratio and specific affirmative action steps contained herein: and
- 3. Will obtain from each of its subcontractors and submit to the contracting or administering agency prior to the award of any subcontract under this contract the subcontractor's certification required by these bid conditions.

Signature of Authorized Representative

# GENERAL CONTRACTOR CERTIFICATION FOR SRF 00313-1

## SECTION 00315 APPENDIX B - DIESEL RETROFIT PROGRAM

The Department of Environmental Protection ("DEP") has developed the Diesel Retrofit Program in response to increasing public health concerns with the emissions from diesel engines and vehicles.

## **Diesel Construction Equipment Standard**

All diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract (hereinafter "Diesel Construction Equipment") must have the following pollution control device installed unless exempt as provided below:

- 1. Emission control technology verified by U.S. Environmental Protection Agency ("EPA") or the California Air Resources Board ("CARB") for use with non-road engines;
- 2. Emission control technology verified by EPA or CARB for use with on-road engines provided that such equipment is operated with diesel fuel that has no more than 15 parts per million sulfur content (i.e. Ultra Low Sulfur Diesel fuel); or
- 3. Emission control technology certified by the manufacturer that such technology meets or exceeds the emission reductions provided by on-road or off-road emission control technology verified by EPA or CARB, i.e. that a Diesel Oxidation Catalyst is achieving the following minimum emission reductions: particulate matter 20%; carbon monoxide 40%; volatile organic compounds 50%; or a Diesel Particulate Filter is achieving a minimum of 85% emission reductions for particulate matter.

Emission control devices, such as oxidation catalysts or particulate filters, shall be installed on the exhaust system side of the Diesel Construction Equipment. The Contractor shall be responsible to insure that the emissions control technology is operated, maintained, and serviced as recommended by the manufacturer.

For the latest up-to-date list of EPA verified-technologies, see: https://www.epa.gov/verified-diesel-tech For the latest up-to-date list of CARB verified technologies, see: http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm

# **Exemptions**

The following Diesel Construction Equipment shall be exempt from the standard above. The Contractor shall include such Diesel Construction Equipment in the required recordkeeping:

- 1. Diesel Construction Equipment not owned by the Contractor and used in the performance of the work under this Contract for 30 calendar days (cumulative days but not necessarily consecutive) or less;
- 2. Unless otherwise exempt, additional Diesel Construction Equipment originally not anticipated to be used under the Contract or used as permanent replacement after the work under the Contract has commenced, for 15 calendars days from the date such Diesel Construction Equipment is brought on site;

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## APPENDIX B (cont.) DIESEL RETROFIT PROGRAM

- 3. Diesel Construction Equipment with an engine that meets the EPA particulate matter (PM) Tier emission standards in effect at the start of the Contract for non-road diesel engines for the applicable engine power group\_(e.g., as of January 1, 2009, a piece of Diesel Construction Equipment with a Tier 3 engine is exempt from meeting the standard until the piece of Diesel Construction Equipment is available with a Tier 4 engine) provided that if such emissions standards are superseded during the Contract then such Diesel Construction Equipment must be retrofitted in accordance with the standards above prior to the end of the Contract;
- 4. A large crane (e.g. a sky crane or link belt crane which is responsible for critical lift operations) if such device would adversely affect the operation of the crane provided the Contractor submits to the municipality's project engineer written technical justification documenting the adverse impact on operation; and
- 5. Diesel Construction Equipment that the project engineer has determined is necessary to control a compelling emergency including but not limited to, the need for rescue vehicles or other equipment to prevent harm to human beings or additional equipment required to address a catastrophic emergency such as structure collapse or imminent collapse. After the compelling emergency is controlled, such non-compliant equipment must be removed from the Contract site and may not be used in further performance of the work under this Contract. Meeting Contract deadlines is not a compelling emergency.

## **Contractor Certification**

Each bidder shall submit as part of its bid, the Statement of Intent to Comply. Within 10 days of being notified that it has been awarded a contract, the bidder and each of its Contractors and Subcontractors shall submit a Diesel Retrofit Program Contractor Certification. Each such Certification shall contain the following information for each piece of Diesel Construction Equipment:

- 1. Contractor or Subcontractor name;
- 2. Equipment type, make, model;
- 3. Vehicle Identification Number or VIN;
- 4. Engine model and year of manufacture;
- 5. Engine HP rating;
- 6. Emission Control Device (ECD) type (Diesel Oxidation Catalyst or Diesel Particulate Filter);
- 7. ECD make, model, and manufacturer;
- 8. ECD EPA or CARB Verification Number or manufacturer's certification that the DOC or DPF meets or exceeds emission reductions provided by similar emission control technology verified by EPA or CARB;
- 9. ECD installation date;
- 10. Type of fuel to be used; and
- 11. Whether the equipment is owned or rented.

## **Recordkeeping**

Each Contractor and Subcontractor shall maintain detailed records of all Diesel Construction Equipment used under the Contract, including the dates and duration times the Diesel Construction Equipment is

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## APPENDIX B (cont.) DIESEL RETROFIT PROGRAM

used at the Contract site. Records shall be available for inspection by DEP. Each Contractor and Subcontractor shall notify DEP within 48 hours of any new Diesel Construction Equipment brought onto the Contract site.

For Diesel Construction Equipment that has an emissions control device with a manufacturer's certification, the Contractor shall maintain records of all supporting emissions test data and test procedures. If upon review the emissions reductions are not supported by the test data and test procedures, then the emissions control device may need to be replaced with a compliant retrofit device.

#### **Project Regulatory Agreement**

The following language shall be included section 4 (Covenants of the Borrower) of the municipality's Project Regulatory Agreement if it receives funds from the State Revolving Fund:

The Borrower shall require each Contractor and Subcontractor to submit the Diesel Retrofit Program Contractor Certification to DEP and the Borrower prior to commencing work on the Project. The Borrower shall not allow any Contractor or Subcontractor to commence work at the Project site prior to submitting such Certification.

## APPENDIX B (cont.) DIESEL RETROFIT PROGRAM

## **STATEMENT OF INTENT TO COMPLY**

This form must be signed and submitted by the bidder as part of the bid.

Local Governmental Unit		SRF Project No.
Contract No.	Contact Title	
Bidder		

The undersigned, on behalf of the above-named Bidder, agrees that, if awarded the Contract:

- 1. the Bidder shall comply with the Massachusetts Department of Environmental Protection's ("MassDEP") Diesel Retrofit Program by ensuring that all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard;
- 2. the Bidder shall require all Subcontractors to comply with MassDEP's Diesel Retrofit Program by ensuring all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard; and
- 3. The Bidder shall submit and shall require each Subcontractor to submit a Diesel Retrofit Program Contractor Certification (form attached) with a Diesel Retrofit List to MassDEP Municipal Services and the Bidder within 10 days of the bidder being notified that it has been awarded the Contract. The Bidder shall require each Subcontractor to update such Certification and List within 2 days of using additional Diesel Construction Equipment on the project under the Contract.

(Signature of Bidder's Authorized Representative)

(Date)

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# APPENDIX B (cont.) DIESEL RETROFIT PROGRAM CONTRACTOR CERTIFICATION

Local ( Contra	Governmental Unit ct No.	SRF Project No	
Contra	ct No.	Contact Title	
		Contact Title	
Contra	ctor		
I,		, an authorized signatory for	
50 brak "Diesel particul accorda I am sul Equipm	e horsepower which v Construction Equipm ate filters, installed or nce with the Diesel R bmitting on behalf of_ tent, labeled "Diesel F	(1) be used in the performance of the work under the Contract (hereinafter ient") have pollution control devices, such as oxidation catalysts or a the exhaust system side of the diesel combustion engine equipment in etrofit Program Standard. <u>a list of all said Diesel Construction</u> Retrofit List," that will be used in connection with this Contract by <u>I hereby certify that the information on the attached Diesel Retrofit</u>	
List is c each pic	correct and accurate as	s of the date of signature. The List includes the following information for ction Equipment:	
1. 2.	Vehicle Identification	on Number or VIN:	
3.	Engine model and year of manufacture;		
4.	Engine HP rating;		
5	Emission Control Device ("ECD") type (Diesel Oxidation Catalyst or Diesel Particulate Filter);		
5. 6	FCD make model	and manufacturer.	
5. 6. 7.	ECD make, model, ECD EPA or CARE meets or exceeds en by EPA or CARB;	and manufacturer; 3 Verification Number or manufacturer's certification that the DOC or DPI nission reductions provided by similar emission control technology verified	
5. 6. 7. 8.	ECD make, model, ECD EPA or CARE meets or exceeds en by EPA or CARB; ECD installation da	and manufacturer; 3 Verification Number or manufacturer's certification that the DOC or DPI nission reductions provided by similar emission control technology verified te;	

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## APPENDIX B (cont.)

# **DIESEL RETROFIT PROGRAM CONTRACTOR CERTIFICATION**

shall notify DEP within 48 hours	of any new Diesel Construction Equipment		
brought onto the Contract site.	shall maintain detailed records of all		
Diesel Construction Equipment used at the Contract site, in	cluding the dates and duration times the		
Diesel Construction Equipment is used at the Contract site.	shall make such		
records available for inspection by DEP	shall ensure that the emissions control		
technology for each piece of Diesel Construction Equipment	it is operated, maintained, and serviced as		
recommended by the manufacturer.	shall retrofit prior to the end of the		
Contract any Diesel Construction Equipment no longer exer	mpt from meeting the Diesel Construction		
Equipment Standard under exemption 3 (because it had an engine that met the EPA particulate matter			
(PM) Tier emission standards currently in effect at the start	of the Contract for non-road diesel engines		
for the applicable engine power group and such emissions s	tandards were superseded during the		
Contract).			

I acknowledge that this certificate is being furnished as a requirement under this Contract and is subject to applicable State and federal laws, both criminal and civil. Signed under pains and penalty of perjury on this date\_\_\_\_\_.

Signature\_\_\_\_\_

Name: \_\_\_\_\_

Title:

# **BID BOND**

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

BID Bid Due Date: Project (Brief Description Including Location):

BOND Bond Number: Date (Not later than Bid due date): Penal sum

(Words)

(Figures)

(Seal)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

(Seal

Bidder's Name and Corporate Seal

By: \_\_\_\_\_\_ Signature and Title

Attest: Signature and Title Surety's Name and Corporate Seal

By:

SURETY

Signature and Title (Attach Power of Attorney)

Attest: \_\_\_\_\_\_Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

- 3. This obligation shall be null and void if:
  - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
  - 3.2. All Bids are rejected by Owner, or
  - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

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

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

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date. 7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

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

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

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

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

#### AGREEMENT

#### SECTION 00500A

## INDEX

- ARTICLE 1 WORK
- ARTICLE 2 ENGINEER
- ARTICLE 3 CONTRACT TIMES
- ARTICLE 4 CONTRACT PRICE
- ARTICLE 5 PAYMENT PROCEDURES
- ARTICLE 6 INTEREST
- ARTICLE 7 ASSURANCE
- ARTICLE 8 CONTRACTOR'S REPRESENTATIONS
- ARTICLE 9 CONTRACT DOCUMENTS
- ARTICLE 10 MISCELLANEOUS

## AGREEMENT

## SECTION 00500A

## TOWN OF WESTPORT, MASSACHUSETTS

## ROUTE 6 SEWER AND WATER EXTENSIONS

THIS AGREEMENT is dated as of the \_\_\_\_\_ day of \_\_\_\_\_ in the year 2024 by and between the Town of Westport, Massachusetts acting by and through its Board of Selectmen, duly authorized therefore, who acts herein solely for said Town and without personal liability to itself, (hereinafter called OWNER) and\_\_\_\_\_\_ (hereinafter called CONTRACTOR).

OWNER AND CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

## ARTICLE 1. WORK

CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is as described in SECTION 01010, SUMMARY OF WORK.

## ARTICLE 2. ENGINEER

The Project has been designed by Office of Kleinfelder, One Beacon Street, Suite 8100, Boston, MA 02108, who is hereinafter called ENGINEER and who is to act as OWNER'S representative, and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

## ARTICLE 3. CONTRACT TIMES

- 3.1 All work, other than final paving, will be completed within 540 consecutive calendar days after the date when the Notice to Proceed is issued, as provided in paragraph 2.03 of the General Conditions.
- 3.2 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER Two Thousand Dollars (\$2,000.00) for each day that expires after the time specified in paragraph 3.1 for Completion until the Work is complete.

## ARTICLE 4. CONTRACT PRICE

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the prices stipulated in the CONTRACTOR's BID attached to this Agreement.

As per MassDEP's Policy Memorandum #10 – the agreed upon DIRECT LABOR MARKUP (percentage for Change Orders on this project shall be \_\_\_\_\_percent.

4.1 This construction contract is subject to the following Davis Bacon wage rate requirements:

#### **Contract and Subcontract Provisions**

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2012 Appropriations Act, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in §5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein:

Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

- (ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
  - (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
  - (2) The classification is utilized in the area by the construction industry; and
  - (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or

working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

#### (3) Payrolls and basic records.

Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B)of the Davis- Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information

may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at

https://www.dol.gov/whd/forms/wh347.pdf or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA , the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section. (D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees--

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in

the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor. Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

- (5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.
- (6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.
- (7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.
- (8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
- Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.
- (1) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

#### **Contract Provisions for Contracts in Excess of \$100,000**

(b) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

- (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other

(c) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and

weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

#### **Compliance Verification**

The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c). The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d). The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to

apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at https://www.dol.gov/whd/whd district offices.pdf.

## ARTICLE 5. PAYMENT PROCEDURES

CONTRACTOR shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.

- 5.1 Progress Payments; Retainage. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended by ENGINEER, and in accordance with the applicable Massachusetts General Law during construction as provided in paragraphs 5.1.1 and 5.2 below. All such payments will be measured by the schedule of values established in paragraph 2.07 of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.
- 5.1.1 Progress payments will be made in an amount equal to 95 percent of Work completed (with the balance being retainage) but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 14.02.B.5 of the General Conditions.
- 5.1.2 Final Payment. Upon final completion and acceptance of the Work in accordance with paragraph 14.07 of the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER as provided in said paragraph 14.07. Retainage for the force main installation and associated structures shall be released by the OWNER following approval by the ENGINEER of the Contractors final inspections of that are part of this contract.

## ARTICLE 6. INTEREST

6.1 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston, Massachusetts.

ARTICLE 7. ASSURANCE

- 7.1 CONTRACTOR has familiarized himself with the nature and extent of the Contract Documents, Work, locality, and with all local conditions and Federal, State and local laws, ordinances, rules and regulations that in any manner may affect cost, progress or performance of the Work.
- 7.2 CONTRACTOR has made or caused to be made examinations, investigations and tests and studies of such reports and related data as CONTRACTOR deems necessary for the performance of the Work at the Contract Price within the Contract Time and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations, tests, reports or similar data are or will be required for such purposes.
- 7.3 CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.
- 7.4 CONTRACTOR has given ENGINEER written notice of any conflict, error or discrepancy that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.
- 7.5 CONTRACTOR agrees that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the Work.
- 7.6 The Contractor agrees that it will fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons). The Contractor shall not award any subcontracts or purchase any materials from suppliers that appear on the Excluded Parties List System (http://www.usgovxml.com/dataservice.aspx?ds=EPLS). The Contractor shall include this requirement in each subcontract and require it to be included in all subcontracts regardless of tier. The Contractor shall maintain reasonable records to demonstrate compliance with these requirements.

# ARTICLE 8. CONTRACTOR'S REPRESENTATIONS

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:

- 8.1 CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda listed in paragraph 9) and the other related data identified in the Bidding Documents including "technical data."
- 8.2 CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work.

- 8.3 CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.
- 8.4 CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the site that relates to the Work as indicated in the Contract Documents.
- 8.5 CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports, and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- 8.6 CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

## ARTICLE 9. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

- 9.1 Invitation to Bid.
- 9.2 Instructions to Bidders.
- 9.3 CONTRACTOR's Bid.
- 9.4 This Agreement.
- 9.5 Exhibits to this Agreement (pages \_\_\_\_\_ to \_\_\_\_, inclusive).
- 9.6 Performance, Payment, and other Bonds.
- 9.7 General Conditions EJCDC 2007 edition.
- 9.8 Supplementary Conditions.
- 9.9 Specifications as listed in table of contents thereof.
- 9.10 Drawings bearing the following general title: Contract 1 Gravity Sewer and Pump Stations.
- 9.11 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other

documents amending, modifying, or supplementing the Contract Documents pursuant to paragraph 3.04 of the General Conditions.

## ARTICLE 10. MISCELLANEOUS

- 10.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 10.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically, but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment with release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 10.3 OWNER and CONTRACTOR each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.
- 10.4 Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- 10.5 The fair share goals for disadvantaged business enterprise (DBE) participation for this contract are a minimum of 4.2 percent Disadvantaged Minority Business Enterprise (D/MBE) participation and 4.5 percent Disadvantaged Women Business Enterprise (D/WBE) participation, applicable to the total dollar amount paid for the construction contract. The Contractor <u>shall</u> take all affirmative steps necessary to achieve this goal, and shall provide reports documenting the portion of contract and subcontract dollars paid to DBEs, and its efforts to achieve the goals, with each invoice submitted or at such greater intervals as specified by the (<u>municipality</u>). The contractor <u>shall</u> require similar reports from its subcontractors.

The Contractor shall fill out and submit the Schedule for Subcontractor Participation Form included as Appendix H.

10.6 During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color,

religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

2. The contractor will, in all solicitations or advancements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin

3. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Comp., p. 684, EO 12086 of Oct. 5, 1978, 43 FR 46501, 3 CFR, 1978 Comp., p. 230.

6. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States." [Sec. 202 amended by EO 11375 of Oct. 13, 1967, 32 FR 14303, 3 CFR, 1966- 1970.

- 10.7 The contractor shall not participate in or cooperate with an international boycott, as defined in Section 999 (b)(3) and (4) of the Internal Revenue code 1986, as amended, or engage in conduct declared to be unlawful by Section 2 of Chapter 151E of the Massachusetts General Laws."
- The Contractor acknowledges to and for the benefit of the Town of Westport 10.8 ("Purchaser") and the Commonwealth of Massachusetts (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a)the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a thirdparty beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

IN WITNESS WHEREOF, OWNER AND CONTRACTOR have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR and ENGINEER. All portions of the Contract Documents have been signed, initialed or identified by OWNER and CONTRACTOR or identified by ENGINEER on their behalf.

This Agreement will be effective on	, 2024 (which is the Effective
Date of the Agreement).	

OWNER	Town of Westport, Massachusetts	CONTRACTOR	
By:		By:[CORPORATE SEAL]	
Attest		Attest	
Address for giving notices		Address for giving notices	
The propose	d expenditure is not in	License No.	
unexpended balance thereof. Pursuant to M.G.L. c.44, s31C, I certify that an appropriation has been made in the total amount of the contract.		Agent for service of process:	
Town Accou	intant	(If CONTRACTOR is a corporation, attach evidence of authority to sign.)	

END OF SECTION 00500A

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#### SECTION 00540

#### NOTICE OF AWARD

		Date:
TO		
(Bidder)		
ADDRESS:		
Contract:		
Project		
OWNERS Contract No		
You are notified that your B been considered and that you are the Contract.	id dated apparent successful bid	for the above Contract has der for the construction of the above
The Contract Price of your contract i	S	
•	Dollars (\$	)
You must comply with the father this Notice of Award, that is by	ollowing conditions pred	cedent within ten days of the date of
ý <b>j</b> <u> </u>	(Date)	

1. You must deliver to the OWNER three fully executed counterparts of the Agreement including all the Contract Documents. Each of the Contract Documents must bear your signature on the cover.

2. You must deliver with the executed Agreement the Contract Security (Bonds) and Insurance Certificate as specified in the Information for Bidders and General Conditions.

3. Submit certification that all employees who are to be employed on the work site have completed a 10-hour (minimum) construction safety and health course, in accordance with MGL Ch.30, Section 39M, as amended by Chapter 306 of the Acts of 2004.

Failure to comply with these conditions within the time specified will entitle OWNER to consider your bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within ten days after you comply with those conditions, OWNER will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

(Owner)

By: \_\_\_\_\_(Authorized Signature)

(Title)

Copy to ENGINEER

NOTICE OF AWARD 00540-2

Notice to Proceed

Dated \_\_\_\_\_

Project:	Owner:	Owner's Contract No.:
Route 6 Phase 1A Sewer	Town of Westport, MA	
Contract:		Engineer's Project No.: 20225081.001

Contractor:

Contractor's Address: [send Certified Mail, Return Receipt Requested]

You are notified that the Contract Times under the above contract will commence to run on \_\_\_\_\_\_. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the number of days to achieve Substantial Completion is \_\_\_\_, and the number of days to achieve readiness for final payment is \_\_\_\_.

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

(Contractor)	Owner
Received by:	Given by:
	Authorized Signature
(Title)	Title
(Date)	Date
Copy to Engineer	

# **PERFORMANCE BOND**

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT Date: Amount: Description (Name and Location):

BOND Bond Number: Date (Not earlier than Contract Date): Amount: Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL Company:		SURETY	
Signature: (S	Seal)		(Seal)
Name and Title:		Surety's Name and Corporate Seal	
		By:	
		Signature and Title	
		(Attach Power of Attorney)	
(Space is provided below for signatures of add parties, if required.)	litional		
		Attest:	
		Signature and Title	
CONTRACTOR AS PRINCIPAL		SURETY	
Company:			
Signature: (S	Seal)		(Seal)
Name and Title:		Surety's Name and Corporate Seal	
		By:	
		Signature and Title	
		(Attach Power of Attorney)	
		Attest:	
		Signature and Title:	

EJCDC No. C-610 (2002 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

- 3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
  - 3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
  - 3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and
  - 3.3. Owner has agreed to pay the Balance of the Contract Price to:
    - 1. Surety in accordance with the terms of the Contract;
    - 2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.

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

- 4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
- 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
- 4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
- 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
  - After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
  - 2. Deny liability in whole or in part and notify Owner citing reasons therefor.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

FOR INFORMATION ONLY – Name, Address and Telephone Surety Agency or Broker Owner's Representative (engineer or other party) 6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

- 6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;
- 6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and
- 6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or nonperformance of Contractor.

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

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

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

10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

- 12. Definitions.
  - 12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
  - 12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
  - 12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
  - 12.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

# PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

CONTRACT

Date: Amount: Description (Name and Location):

BOND

Bond Number: Date (Not earlier than Contract Date): Amount: Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL Company:		SURETY	
Signature:	(Seal)		(Seal)
Name and 1 itle:		Surety's Name and Corporate Seal	
		By:	
		Signature and Title	
(Space is provided below for signatur parties, if required.)	es of additional	(Attach Power of Attorney)	
1 , 1 ,		Attest:	
		Signature and Title	
CONTRACTOR AS PRINCIPAL Company:		SURETY	
Signature:	(Seal)		(Seal)
Name and Title:		Surety's Name and Corporate Seal	
		By:	
		Signature and Title	
		(Attach Power of Attorney)	
		Attest:	
		Signature and Title:	

EJCDC No. C-615 (2002 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, the American Institute of Architects, the American Subcontractors Association, and the Associated Specialty Contractors.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.

- 2. With respect to Owner, this obligation shall be null and void if Contractor:
  - 2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and
  - 2.2. Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

- 4. Surety shall have no obligation to Claimants under this Bond until:
  - 4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
  - 4.2. Claimants who do not have a direct contract with Contractor:
    - 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
    - Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
    - 3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.

6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:

- 6.1. Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
- 6.2. Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

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

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

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

**15. DEFINITIONS** 

- 15.1. Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's Subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
- 15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
- 15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone Surety Agency or Broker: Owner's Representative (engineer or other party):

#### **SECTION 00630**

#### **CERTIFICATE OF SUBSTANTIAL COMPLETION**

DATE OF ISSUANCE	
OWNER	
CONTRACTOR	
Contract:	
Project: <u>Route 6 Phase 1A Sewer</u>	
OWNER's Contract NoENGINEER's Project No	
This Certificate of Substantial Completion applies to all Work under the Contract Doc following specified parts thereof:	uments or to the
OWNER	
And To CONTRACTOR	
The Work to which this Certificate applies has been inspected by authorized represent CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantiall accordance with the Contract Documents on	atives of OWNER, y complete in
DATE OF SUBSTANTIAL COMPLETION	

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR within days of the above date of Substantial Completion.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees shall be as follows:

OWNER: \_\_\_\_\_

CONTRACTOR:

EJCDC No. 1910-8-D (1996 Edition)

Prepared by the Engineer's Joint Contract Documents Committee and endorsed by The Associated General Contractors of America and the Construction Specifications Institute.

The following documents are attached to and made a part of this Certificate:

[For items to be attached see definition of Substantial Completion as supplemented and other specifically noted conditions precedent to achieving Substantial Completion as required by Contract Documents.]

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the Work in accordance with the Contract Documents.

	Date		
	ENGINEER		
By:			
	(Authorized Signature)		
CONTRACTOR	accepts this Certificate of Substantial Completion on	<b></b>	
		Date	
	CONTRACTOR		
By:			
	(Authorized Signature)		
OWNER accepts	this Certificate of Substantial Completion on		
-	-	Date	
	OWNER		
	OWNER		

No.\_\_\_\_\_

Contract:

OWNER:

CONTRACTOR:

ENGINEER: Kleinfelder

ENGINEER's Project No: 20225081.001

Date of Issuance:

CONTRACTOR is directed to make the following changes in the Contract Documents.

- 1. Description of Work:
- 2. Purpose of Change Order:
- 3. Attachments: (List documents supporting change)

CHANGE IN CONTR	ACT PRICE	CHANGE IN CONTRACT TIME
Original Contract Price		Original Contract Time
\$		
		(days or date)
Previous Change Orders No	to No	Net change from previous Change Orders
\$		(days)
Contract Price prior to this Ch	ange Order	Contract Time prior to this Change Order
\$		(days or date)
Net (Increase/Decrease) of thi	s Change Order	Net (Increase/Decrease) of this Change Order
\$		(days)
Contract Price with all approv	ed Change Orders	Contract Time with all approved Change Orders
۵		(days or date)
RECOMMENDED:	APPROVED:	ACCEPTED:
By:	By:(Ox	By:
(Engineer)	(0)	
Date:	_ Date:	Date:

CHANGE ORDER FORM 00635-1

OWNER's Contract No.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

# ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by









AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE A Practice Division of the NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by



CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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# **ARTICLE 1 – DEFINITIONS AND TERMINOLOGY**

## 1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
  - 1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
  - 2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
  - 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
  - 4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
  - 5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
  - 6. *Bidder*—The individual or entity who submits a Bid directly to Owner.
  - 7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
  - 8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
  - 9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
  - 10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
  - 11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

- 12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
- 13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
- 14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
- 15. Contractor—The individual or entity with whom Owner has entered into the Agreement.
- 16. Cost of the Work—See Paragraph 11.01 for definition.
- 17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
- 18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- 19. *Engineer*—The individual or entity named as such in the Agreement.
- 20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
- 21. General Requirements—Sections of Division 1 of the Specifications.
- 22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
- 23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
- 24. *Laws and Regulations; 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 jurisdiction.
- 25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
- 26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

- 27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
- 28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
- 29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
- 30. PCBs—Polychlorinated biphenyls.
- 31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
- 32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
- 33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
- 34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
- 35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
- 36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.
- 37. *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.
- 38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
- 39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

- 40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
- 41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
- 42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
- 43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
- 44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
- 45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.
- 46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
- 47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
- 48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
- 49. Unit Price Work—Work to be paid for on the basis of unit prices.
- 50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
- 51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

# 1.02 Terminology

- A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. Intent of Certain Terms or Adjectives:
  - 1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.
- C. Day:
  - 1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

# D. *Defective:*

- 1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:
  - a. does not conform to the Contract Documents; or
  - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
  - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).
- E. Furnish, Install, Perform, Provide:

- 1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
- 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
- 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
- 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

# **ARTICLE 2 – PRELIMINARY MATTERS**

- 2.01 Delivery of Bonds and Evidence of Insurance
  - A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
  - B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.
- 2.02 *Copies of Documents* 
  - A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.
- 2.03 Commencement of Contract Times; Notice to Proceed
  - A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

## 2.04 *Starting the Work*

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

# 2.05 Before Starting Construction

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
  - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
  - 2. a preliminary Schedule of Submittals; and
  - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

# 2.06 Preconstruction Conference; Designation of Authorized Representatives

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

# 2.07 Initial Acceptance of Schedules

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
  - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of

the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

- 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
- 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

# ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

# 3.01 Intent

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

# 3.02 Reference Standards

A. Standards, Specifications, Codes, Laws, and Regulations

- 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- 2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

# 3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies:

- 1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
- 2. Contractor's Review of Contract Documents During Performance of Work: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
- 3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.
- B. Resolving Discrepancies:
  - 1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
    - a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
    - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

# 3.04 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
  - 1. A Field Order;
  - 2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

# 3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
  - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
  - 2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

# 3.06 Electronic Data

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

# ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

- 4.01 Availability of Lands
  - A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the

Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.
- 4.02 Subsurface and Physical Conditions
  - A. Reports and Drawings: The Supplementary Conditions identify:
    - 1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
    - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
  - B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
    - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
    - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
    - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.
- 4.03 Differing Subsurface or Physical Conditions
  - A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:
    - 1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
    - 2. is of such a nature as to require a change in the Contract Documents; or

- 3. differs materially from that shown or indicated in the Contract Documents; or
- 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

- B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.
- C. Possible Price and Times Adjustments:
  - 1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
    - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
    - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
  - 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
    - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
    - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
    - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
  - 3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other

professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

# 4.04 Underground Facilities

- A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
  - 1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
  - 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
    - a. reviewing and checking all such information and data;
    - b. locating all Underground Facilities shown or indicated in the Contract Documents;
    - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
    - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

# B. Not Shown or Indicated:

- 1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- 2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price

or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

# 4.05 *Reference Points*

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

# 4.06 Hazardous Environmental Condition at Site

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
  - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
  - 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
  - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by

Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

# **ARTICLE 5 – BONDS AND INSURANCE**

## 5.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.
- 5.02 Licensed Sureties and Insurers
  - A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.
- 5.03 *Certificates of Insurance* 
  - A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

- B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

# 5.04 *Contractor's Insurance*

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
  - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
  - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
  - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
    - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
    - b. by any other person for any other reason;
  - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
  - 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:

- 1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
- 2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
- 3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
- 4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
- 5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
- 6. include completed operations coverage:
  - a. Such insurance shall remain in effect for two years after final payment.
  - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

# 5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- 5.06 *Property Insurance* 
  - A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

- 1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
- 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
- 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
- 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
- 5. allow for partial utilization of the Work by Owner;
- 6. include testing and startup; and
- 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property

insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

# 5.07 Waiver of Rights

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:
  - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
  - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery
against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

## 5.08 Receipt and Application of Insurance Proceeds

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

## 5.09 Acceptance of Bonds and Insurance; Option to Replace

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

#### 5.10 Partial Utilization, Acknowledgment of Property Insurer

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by 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.

## **ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES**

#### 6.01 Supervision and Superintendence

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

#### 6.02 Labor; Working Hours

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

#### 6.03 Services, Materials, and Equipment

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

#### 6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
  - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
  - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

#### 6.05 Substitutes and "Or-Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.
  - 1. "Or-Equal" Items: If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that:
      - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
      - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
      - 3) it has a proven record of performance and availability of responsive service.
    - b. Contractor certifies that, if approved and incorporated into the Work:
      - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
      - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

- 2. Substitute Items:
  - a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
  - b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
  - c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.
  - d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
    - 1) shall certify that the proposed substitute item will:
      - a) perform adequately the functions and achieve the results called for by the general design,
      - b) be similar in substance to that specified, and
      - c) be suited to the same use as that specified;
    - 2) will state:
      - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
      - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
      - c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
    - 3) will identify:
      - a) all variations of the proposed substitute item from that specified, and
      - b) available engineering, sales, maintenance, repair, and replacement services; and

- 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

# 6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or

other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
  - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
  - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for 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 Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss 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, Contractor will obtain the same.

## 6.07 Patent Fees and Royalties

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

# 6.08 Permits

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

# 6.09 Laws and Regulations

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all

court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

## 6.10 Taxes

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.
- 6.11 Use of Site and Other Areas
  - A. Limitation on Use of Site and Other Areas:
    - 1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. 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.
    - 2. Should any claim be made by any such owner or occupant because of the performance of the Work, 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.
    - 3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.
  - B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
  - C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor

shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

# 6.12 *Record Documents*

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

## 6.13 Safety and Protection

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
  - 1. all persons on the Site or who may be affected by the Work;
  - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
  - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

#### 6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### 6.15 Hazard Communication Programs

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

#### 6.16 *Emergencies*

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

#### 6.17 Shop Drawings and Samples

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

- 1. Shop Drawings:
  - a. Submit number of copies specified in the General Requirements.
  - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.
- 2. Samples:
  - a. Submit number of Samples specified in the Specifications.
  - b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.
- B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. Submittal Procedures:
  - 1. Before submitting each Shop Drawing or Sample, Contractor shall have:
    - a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
    - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
    - c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
    - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
  - 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
  - 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop

Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

- D. Engineer's Review:
  - 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
  - 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
  - 3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.
- E. Resubmittal Procedures:
  - 1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
- 6.18 *Continuing the Work* 
  - A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.
- 6.19 *Contractor's General Warranty and Guarantee* 
  - A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
  - B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

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- 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
- 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  - 1. observations by Engineer;
  - 2. recommendation by Engineer or payment by Owner of any progress or final payment;
  - 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
  - 4. use or occupancy of the Work or any part thereof by Owner;
  - 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
  - 6. any inspection, test, or approval by others; or
  - 7. any correction of defective Work by Owner.

# 6.20 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor,

Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
  - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

## 6.21 Delegation of Professional Design Services

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

# **ARTICLE 7 – OTHER WORK AT THE SITE**

#### 7.01 Related Work at Site

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
  - 1. written notice thereof will be given to Contractor prior to starting any such other work; and
  - 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

#### 7.02 Coordination

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
  - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
  - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
  - 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

#### 7.03 Legal Relationships

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

#### **ARTICLE 8 – OWNER'S RESPONSIBILITIES**

- 8.01 Communications to Contractor
  - A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.
- 8.02 Replacement of Engineer
  - A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.
- 8.03 Furnish Data
  - A. Owner shall promptly furnish the data required of Owner under the Contract Documents.
- 8.04 *Pay When Due* 
  - A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.
- 8.05 Lands and Easements; Reports and Tests
  - A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.
- 8.06 Insurance
  - A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.
- 8.07 Change Orders
  - A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

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#### 8.08 Inspections, Tests, and Approvals

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.
- 8.09 Limitations on Owner's Responsibilities
  - A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- 8.10 Undisclosed Hazardous Environmental Condition
  - A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.
- 8.11 Evidence of Financial Arrangements
  - A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.
- 8.12 Compliance with Safety Program
  - A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

#### **ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION**

- 9.01 Owner's Representative
  - A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.
- 9.02 Visits to Site
  - A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits

and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

#### 9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

#### 9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

#### 9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

#### 9.06 Shop Drawings, Change Orders and Payments

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

## 9.07 Determinations for Unit Price Work

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

## 9.08 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

# 9.09 Limitations on Engineer's Authority and Responsibilities

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.
- 9.10 Compliance with Safety Program
  - A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

## ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

- 10.01 Authorized Changes in the Work
  - A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
  - B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.
- 10.02 Unauthorized Changes in the Work
  - A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

#### 10.03 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
  - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
  - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
  - 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

#### 10.04 Notification to Surety

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

#### 10.05 Claims

- A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. Notice: Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The

opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

- C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
  - 1. deny the Claim in whole or in part;
  - 2. approve the Claim; or
  - 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

# **ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

- 11.01 Cost of the Work
  - A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:
    - 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on

Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

- 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
- 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
- 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
- 5. Supplemental costs including the following:
  - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
  - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
  - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
  - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
  - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.
- B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:
  - 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
  - 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
  - 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
  - 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
  - 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.
- C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

#### 11.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. Cash Allowances:
  - 1. Contractor agrees that:
    - a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
    - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. Contingency Allowance:
  - 1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.
- 11.03 Unit Price Work
  - A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
  - B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
  - C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
  - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
  - 2. there is no corresponding adjustment with respect to any other item of Work; and
  - 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

# ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

- 12.01 Change of Contract Price
  - A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
  - B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
    - 1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
    - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
    - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
  - C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:
    - 1. a mutually acceptable fixed fee; or
    - 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
      - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
      - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

- c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
- d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

#### 12.02 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

# 12.03 Delays

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the

control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

# ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

- 13.01 Notice of Defects
  - A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.
- 13.02 Access to Work
  - A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.
- 13.03 *Tests and Inspections* 
  - A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
  - B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
    - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
    - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and
    - 3. as otherwise specifically provided in the Contract Documents.

- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.
- 13.04 Uncovering Work
  - A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
  - B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
  - C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
  - D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

#### 13.05 Owner May Stop the Work

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

# 13.06 Correction or Removal of Defective Work

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

## 13.07 Correction Period

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
  - 1. repair such defective land or areas; or
  - 2. correct such defective Work; or
  - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
  - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute

resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

#### 13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

#### 13.09 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of 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 Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

## **ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION**

- 14.01 Schedule of Values
  - A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.
- 14.02 Progress Payments

#### A. Applications for Payments:

- 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
- 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the

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Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

### B. Review of Applications:

- 1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
- 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
  - a. the Work has progressed to the point indicated;
  - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
  - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
- 3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
  - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
  - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
- 4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
  - a. to supervise, direct, or control the Work, or

- b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
- c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
- d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
- e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
- 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
  - a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
  - b. the Contract Price has been reduced by Change Orders;
  - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
  - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.
- C. Payment Becomes Due:
  - 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.
- D. *Reduction in Payment:* 
  - 1. Owner may refuse to make payment of the full amount recommended by Engineer because:
    - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
    - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
    - c. there are other items entitling Owner to a set-off against the amount recommended; or

- d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
- 2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.
- 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.
- 14.03 Contractor's Warranty of Title
  - A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.
- 14.04 Substantial Completion
  - A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
  - B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
  - C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
  - D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities

pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

## 14.05 Partial Utilization

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
  - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
  - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
  - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
  - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

#### 14.06 Final Inspection

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.
# 14.07 Final Payment

- A. Application for Payment:
  - 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
  - 2. The final Application for Payment shall be accompanied (except as previously delivered) by:
    - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
    - b. consent of the surety, if any, to final payment;
    - c. a list of all Claims against Owner that Contractor believes are unsettled; and
    - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
  - 3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.
- B. Engineer's Review of Application and Acceptance:
  - 1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.
- C. Payment Becomes Due:

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

# 14.08 Final Completion Delayed

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

# 14.09 Waiver of Claims

- A. The making and acceptance of final payment will constitute:
  - 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
  - 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

# ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

- 15.01 Owner May Suspend Work
  - A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.
- 15.02 Owner May Terminate for Cause
  - A. The occurrence of any one or more of the following events will justify termination for cause:

- 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
- 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
- 3. Contractor's repeated disregard of the authority of Engineer; or
- 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
  - 1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
  - 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
  - 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

# 15.03 Owner May Terminate For Convenience

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
  - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
  - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
  - 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
  - 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

# 15.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

# **ARTICLE 16 – DISPUTE RESOLUTION**

# 16.01 *Methods and Procedures*

- A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
  - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
  - 2. agrees with the other party to submit the Claim to another dispute resolution process; or
  - 3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

# **ARTICLE 17 – MISCELLANEOUS**

# 17.01 Giving Notice

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
  - 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
  - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

# 17.02 Computation of Times

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

# 17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

# 17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

# 17.05 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

# 17.06 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

# SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2007 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not specifically amended or supplemented hereby remain in full force and effect.

# ARTICLE 1. DEFINITIONS

SC-1.12

Add the following language at the beginning of the definition entitled "Contract Documents" in the General Conditions:

The Invitation to Bid, Instructions to Bidders

# ARTICLE 2. PRELIMINARY MATTERS

SC-2.01

Delete paragraph 2.01.B of the General Conditions in its entirety and insert the following in its place:

2.01.B Evidence of Insurance: Before any work at the site is started, CONTRACTOR shall deliver to OWNER, with a copy to ENGINEER, certificates of insurance (and other evidence of insurance requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with the requirements of Article 5.

2.01.B.1 Contractor shall include and identify on the certificate of insurance, indemnification as required by Article 6.20 of the General Conditions (Section 00700).

SC-2.03

Delete paragraph 2.03 of the General Conditions in its entirety and insert the following in its place to read as follows:

2.03.A The Contract Time will commence to run on the tenth day following the effective date of the Agreement.

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# ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

## SC-3.01

Add the following new paragraphs immediately after paragraph 3.01.A of the General Conditions which is to read as follows:

3.01.A.1 Each and every provision of law and clause required by law to be inserted in the Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though they were included herein. If through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

3.01.A.2 Sections of Division 1 - General Requirements govern the execution of the work of all sections of the specifications.

# ARTICLE 4. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

SC-4.02

The available subsurface information is provided in the boring logs included in the contract documents.

SC-4.06

Delete paragraph 4.06.G of the General Conditions in its entirety.

# ARTICLE 5. BONDS AND INSURANCE

SC-5.04

The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide the following coverages for not less than the following amounts or greater where required by Laws and Regulations:

5.04.A.1 and 5.04.A.2 Worker's Compensation, etc. under paragraphs 5.04.A.1 and 5.04.A.2 of the General Conditions:

(1)	Worker's Compensation	Statutory
(2)	Employer's Liability	\$1,000,000

5.04.A.3, 5.04.A.4, and 5.04.A.5 Contractor's Liability Insurance under paragraphs 5.04.A.3 through 5.04.A.5 of the General Conditions which shall also include completed operations

SUPPLEMENTARY CONDITIONS 00800A -2

and product liability coverages and eliminate the exclusion with respect to property under the care, custody, and control of Contractor:

(1)	General Aggregate	
	(Except ProductsCompleted Operations)	\$2,000,000
(2)	ProductsCompleted Operations Aggregate	\$1,000,000
(3)	Personal and Advertising Injury (Per Person/ Organization)	\$1,000,000
(4)	Each Occurrence (Bodily Injury and Property Damage)	\$1,000,000
(5)	Property Damage liability insurance including Collapse, and Underground coverages. If blasting is to be used, also include explosion coverage.	\$1,000,000
(6)	Excess Liability:	
	General Aggregate	\$5,000,000
	Each Occurrence	\$2,500,000
5.04	.A.6 Automobile Liability:	
(1)	Bodily Injury:	
	Each Person	\$1,000,000
	Each Accident	\$1,000,000
	Property Damage:	
	Each Accident	\$1,000,000
	or	

(2) Combined Single Limit

(Bodily Injury and Property Damage):

Each Accident \$2,000,000

SC-5.04.B.3 The Contractual Liability coverage required by paragraph 5.04.B.3 in the General Conditions shall provide coverage for not less than the following amounts:

(1)	General Aggregate	\$2,000,000
(2)	Each Occurrence (Bodily Injury and Property Damage)	\$1,000,000

SC-5.05

Delete paragraph 5.05 of the General Conditions in its entirety and insert the following in its place:

5.05.A CONTRACTOR shall purchase and maintain a separate Owner's Protective Liability policy, issued to OWNER at the expense of CONTRACTOR, including OWNER and ENGINEER as named insured. This insurance shall provide coverage for not less than the following amounts:

5.05.A.1 Bodily Injury:

Each Person	\$2,000,000
Each Occurrence	\$2,000,000
5.05.A.2 Property Damage:	
Each Occurrence	\$2,000,000
Annual Aggregate	\$2,000,000

#### SC-5.06

Delete paragraphs 5.06.A.1 through 5.06.A.7 of the General Conditions in their entirety and insert the following in its place:

5.06.A CONTRACTOR shall purchase and maintain Equipment Installation Insurance in the amount of the total insurable value of all equipment to be installed, this insurance shall:

5.06.A.1 Include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, and ENGINEER'S Consultants, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

# SUPPLEMENTARY CONDITIONS 00800A -4

5.06.A.2 Be written as Equipment Installation Insurance with an "All Risk" Installation Floater that shall at least include coverage for physical loss and damage to the equipment;

5.06.A.3 Include expenses incurred in the repair or replacement of any insured equipment (including but not limited to fees and charges of engineers and architects);

5.06.A.4 Cover materials and equipment in transit for incorporation in the Work or stored at the site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER; and

5.06.A.5 Be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.

The policies of insurance required to be purchased and maintained by CONTRACTOR in accordance with this paragraph 5.06 shall comply with requirements of GC-5.06.C.

SC-5.06.B

Delete paragraph 5.06.B of the General Conditions in its entirety.

# ARTICLE 6. CONTRACTOR'S RESPONSIBILITIES

SC-6.06.D

Add the following new subparagraph as follows:

6.06.D.1 OWNER or ENGINEER may furnish to any such Subcontractor, Supplier, or other person or organization, to the extent practicable, information about amounts paid to CONTRACTOR in accordance with CONTRACTOR's Applications for Payment on account of the particular Subcontractor's, Suppliers, other person's, or other organization's Work.

SC-6.17

Add the following new paragraph immediately after paragraph 6.17.E of the General Conditions, which is to read as follows:

6.17.F The accuracy of all such information submitted by the Contractor is the responsibility of the Contractor. In reviewing Shop Drawings, Samples and similar submittals, the Engineer shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

# ARTICLE 8. OWNER'S RESPONSIBILITIES

SC-8.06

Delete paragraph 8.06 of the General Conditions in its entirety.

# ARTICLE 10. CHANGES IN THE WORK; CLAIMS

#### SC-10.01A

Add the following new paragraph immediately after paragraph 10.01A of the General Conditions, which is to read as follows:

10.01.A.1 Upon request of the Owner or the Engineer, the Contractor shall, without cost to the Owner, submit to the Engineer, in such form as the Engineer may require, an accurate written estimate of the cost of any such proposed extra Work or change. The estimate shall indicate the quantity and unit cost of each item of materials, and the number of hours of work and hourly rate for each class of labor, as well as the description and amounts of all other costs chargeable under the terms of this Article. Unit labor costs for the installation of each item of materials shall be shown if required by the Engineer. The Contractor shall promptly revise and resubmit such estimate if the Engineer determines that it is not in compliance with the requirements of this Article, or that it contains errors of fact or mathematical errors. If required by the Engineer, in order to establish the exact cost of new Work added or previously required Work omitted, the Contractor shall obtain and furnish to the Engineer bona fide proposals from recognized suppliers for furnishing any material included in such Work. Such estimates shall be furnished promptly so as to occasion no delay in the Work, and shall be furnished at the Contractor's expense. The Contractor shall state in the estimate any extension of time required for the competition of the Work if the change or extra work is ordered.

# SC-10.01C

Add the following new paragraph immediately after paragraph 10.01B of the General Conditions, which is to read as follows:

#### 10.01C

All Change Orders shall be executed utilizing the form in the Bidding Documents. Refer to Section 00635. No other forms will be allowed unless otherwise required by Owner.

# ARTICLE 11. CHANGE OF CONTRACT PRICE

# SC-11.01

In the second sentence of paragraph 11.01.A.1 delete the word "superintendents".

# **ARTICLE 16. DISPUTE RESOLUTION**

### SC-16

Add the following new paragraph immediately after paragraph 16.01.C of the General Conditions to read as follows:

16.01.D CONTRACTOR shall carry on the Work and maintain the progress schedule during the dispute resolution proceedings unless otherwise agreed in writing by OWNER and CONTRACTOR.

### ARTICLE 17. MISCELLANEOUS

SC-17.07

Add the following new paragraphs immediately after paragraph 17.06 of the General Conditions as follows:

17.07 Legal Address of Contractor

17.07.A CONTRACTOR'S business address and his office at or near the site of the Work are both hereby designated as places to which communications shall be delivered. The depositing of any letter, notice, or other communication in a postpaid wrapper directed to the CONTRACTOR'S business address in a post office box regularly maintained by the Post Office Department or the delivery at either designated address of any letter, notice, or other communication by mail or otherwise shall be deemed sufficient service thereof upon CONTRACTOR, and the date of such service shall be the date of receipt. The first-named address may be changed at any time by an instrument in writing, executed and acknowledged by CONTRACTOR and delivered to ENGINEER. Service of any notice, letter, or other communication upon the CONTRACTOR personally shall likewise be deemed sufficient service.

END OF SECTION 00800B

### SUMMARY OF WORK

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 LOCATION OF WORK

A. The work of this Contract is located in the Town of Westport, Massachusetts, primarily along Route 6.

#### 1.3 SUMMARY

- A. Furnish all labor, materials, equipment, and incidentals for the purposes of installing new sanitary gravity sewer, water mains, force mains and related pumping facilities as indicated on the Drawings and specified herein.
- B. The Work includes, but is not necessarily limited to the following major items related to extending sewers to the project area:
  - 1. Furnish and install new water mains and services, gravity sewers, manholes, sewer services, sewer side street connections, force mains and pumping stations. Quantities for each shall be as indicated in the Bid. Installation of new pipes within Route 6 shall include removal and disposal of the existing concrete slab roadway underneath the surface asphalt.
  - 2. Connect new 6" PVC force main to existing 6" PVC force main discharging to the City of Fall River's collection system.
  - 3. Modify the existing Hebert Terrace drain at crossing with new gravity sewer.
  - 4. Furnish and install temporary, permanent and mill and overlay paving within Route 6. Quantities shall be as indicated in the Bid.
- C. The work shall also conform to such additional Drawings and addenda to these Specifications and Drawings as may be published or exhibited prior to the opening of bid proposals and to such drawings in explanation of details, or as may be furnished by the Engineer from time to time during the construction.
- D. Work and materials which are necessary in the construction, but which are

not specifically referred to in the Specification, or shown on the Drawings, but implied by the Contract shall be furnished by the Contractor at his own cost and expense and shall be such as will correspond with the general character of the work as may be determined by the Engineer, whose decisions as to the necessity for and character of such work and materials shall be final and conclusive. It is the intent of these Specifications to produce a complete, operational and finished project whether shown in every detail or not.

## 1.4 WORK SEQUENCE:

A. The Owner's ability to collect, convey and treat wastewater shall, at no time, be disrupted for the purposes of completing this Work, unless otherwise permitted in writing by the Owner, or by the Engineer acting with the authority of the Owner. The proposed sequence shall be in accordance with the approved schedule submitted by the Contractor.

### 1.5 CONTRACTOR'S USE OF PREMISES:

- A. Contractor shall limit the use of the premises for the performance of the Work and storage of materials and equipment.
- B. Contractor shall coordinate with Owner, access for normal maintenance requirements.
- C. Contractor shall assume full responsibility for security of all his and his subcontractors materials and equipment stored on the Work site.
- D. If directed by the Owner, Contractor shall move stored items which interfere with operations of Owner.
- E. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

#### 1.6 UNDERGROUND UTILITIES

- A. The underground utilities indicated on the drawings have been located primarily from information furnished by others and are considered approximate both as to size and location. There are additional utilities to be encountered that are not shown on the drawings, and it shall be the Contractor's responsibility to locate all existing utilities and to protect same from damage or harm. All utilities interfered with or damaged shall be properly restored, at the expense of the Contractor, to the satisfaction of its Owner.
- B. The following is a partial list of Owners of Utilities. Refer to the following link for the latest MassDOT utility contacts by District/Municipality:hwy.massdot.state.ma.us/webapps/utilities/select.asp?

### t=WESTPORT&d=5&c=335:

**Gas Company** Liberty Utilities 1-800-544-4944 Water Department 508-636-1004

Enbridge 508-938-7728

# **Power Company**

Eversource 1-800-592-2000 Highway Department 508-636-1020

National Grid 1-800-322-3223

**Telephone Company** Verizon 1-800-837-4966

**Dig Safe** 888-344-7233

#### 1.7 LIST OF DRAWINGS

- A. The location, general characteristics, and principal details of the work are indicated on a set drawings titled "ROUTE 6 SEWER AND WATER EXTENSIONS".
- B. The drawings listed above are the Contract Drawings, sometimes referred to herein as the "Drawings." Additional drawings showing details in accordance with which the work is to be done may be furnished from time to time by the Engineer, if found necessary, and shall then become a part of the Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

# END OF SECTION 01010

SUMMARY OF WORK 01010 - 3 THIS PAGE INTENTIONALLY LEFT BLANK

SUMMARY OF WORK 01010 - 4

#### PROJECT COORDINATION

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
  - 1. Coordination.
  - 2. Administrative and supervisory personnel.
  - 3. General installation provisions.
  - 4. Cleaning and protection.
- B. Progress meetings and preconstruction conferences are included in Section 01200 PROJECT MEETINGS.
- C. Requirements for the Contractor's Construction Schedule are included in Section 01300 SUBMITTAL PROCEDURES.

# PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

#### 3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Inspect the conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner, and at no additional cost to the Owner.
- B. Manufacturer's Written Instructions: Comply with manufacturer's written installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.

PROJECT COORDINATION 01040 - 1

- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items, and procure equivalent replacement items, at no additional cost to the Owner.
- D. Provide attachment and connection devices and methods for securing work. Secure work true to line and level. Allow for expansion and utility movement.
- E. Recheck measurements and dimensions before starting installation or erection.
- F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material to prevent deterioration.
- G. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

# 3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Install protective covering to ensure protection from damage or deterioration.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading.
  - 2. Excessive internal or external pressures.
  - 3. Excessively high or low temperatures.
  - 4. Air contamination or pollution.
  - 5. Water or ice.
  - 6. Solvents.
  - 7. Chemicals.
  - 8. Heavy traffic.
  - 9. Misalignment.
  - 10. Unprotected storage.
  - 11. Improper shipping or handling.
  - 12. Theft.
  - 13. Vandalism.

# END OF SECTION 01040

PROJECT COORDINATION 01040 - 2

#### FIELD ENGINEERING

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Examination of site and conditions of construction.
  - 2. Establishment of lines, grades, and easements.
  - 3. Connections to existing facilities.
  - 4. Restoration and protection of public and private property.

# 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. As-Built Drawings: The Contractor shall be responsible for maintaining two sets of redline "as-built locations and dimensions of work". The As-Built Drawings shall be submitted to the Owner at substantial completion of the project.
  - 2. The Contractor shall submit copies of field records and record drawings each month with project invoices. Field data shall be updated each month as applicable.

# 1.4 **PROJECT/SITE CONDITIONS:**

- A. Environmental Requirements:
  - 1. Unfavorable Construction Conditions:
    - a. During unfavorable weather, wet ground or other unsuitable construction conditions, confine operations to work which will not be affected adversely by such conditions.

FIELD ENGINEERING 01050 - 1

- b. No portion of Work shall be constructed under conditions which adversely affect quality or efficiency thereof, unless special means or precautions are taken to perform Work in manner acceptable to the Engineer.
- B. Field Measurements:
  - 1. Lines and Grades:
    - a. All Work shall be done to lines, grades, and elevations indicated on drawings or specified herein.
    - b. Basic vertical control points have been established or designated by the Engineer. Contractor shall be responsible for maintaining or subsequently replacing these controls to the satisfaction of the Engineer if these controls are disturbed. The Contractor shall be responsible for verifying all vertical control information that is used.
      - (1) Points shall be used as datum for work.
      - (2) Contractor shall be responsible for transferring all lines and grades from basic survey control points.
    - c. Contractor to perform all additional survey, layout, and measurement work.
      - (1) The Contractor shall provide survey work by a firm having successfully completed at least two projects of similar size and complexity within the last five years, and who shall employ experienced personnel and provide adequate supervision to satisfaction of the Engineer at all times when operations are in progress.
      - (2) Surveyor shall be a registered land surveyor in the location of the project.
    - d. Keep the Engineer informed, in writing, two weeks in advance, of times and places at which work is to be performed, so that horizontal and vertical control points may be established and any checking deemed necessary by the Engineer may be performed.
    - e. Remove and reconstruct Work which is improperly located as determined by the Engineer and at no additional cost to the Owner.
  - 2. Easements and Rights-of-Way:

- a. Easements and rights-of-way for utilities, if required, will be provided by the Owner.
- b. Confine construction operations within limits indicated on drawings and/or within limits of easements or public ways.
- c. Place construction tools, equipment, and pipeline materials and supplies, so as to cause the least possible damage to property and interference with traffic.

# PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Use new materials in restoration of existing facilities except where soil materials and plants may be reused, as appropriate.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examination of Site and Verification of Conditions:
  - 1. Before starting operations, examine site to become acquainted with conditions to be encountered.
  - 2. Verify exact locations of sewers, water mains, gas mains, above or below ground electrical wires, other utilities, conduits and structures which may interfere with work.
  - 3. Perform all test pit excavations shown on the drawings prior to any pipelaying operations. No pipe trenching will be allowed within 150 feet of a designated test pit until the test pit has been excavated. Contractor shall also perform test pit excavations in locations where he feels information is required to perform the work.

## 3.2 APPLICATION

- A. Connections to Existing Facilities:
  - 1. Make connections to existing facilities as indicated on drawings or as specified.
  - 2. Obtain permission from specific utility owners in writing prior to undertaking connections.

- a. Protect facilities against deleterious substances and damage.
- 3. Plan in advance all connections to existing facilities which are in service.
  - a. All equipment, materials, and labor shall be on hand at time of undertaking connections to existing facilities in service.
  - b. Work shall proceed continuously if necessary to complete connections within the time designated by the Engineer.
  - c. Existing water distribution systems to be connected to, shall not be taken out of service during periods of high demand; coordinate any disruptions to service with the Owner.
- 4. Operation of valves or other appurtenances on existing utilities, when required, shall be performed by respective utility personnel.
  - a. Owner's water distribution system valves shall be operated by Owner's Distribution Section personnel only.
    - A tight shutdown of existing Owner's or Community valves is not guaranteed; Contractor shall control leakage past valves to satisfaction of the Owner and Engineer and at no additional cost to the Owner.
  - b. Community water distribution system valves shall be operated by the community's water department personnel only. The Contractor shall give the local water department three working (3) days advance notice prior to performing any work requiring the operation of local water distribution system valves.
- B. Restoration and Protection of Public and Private Property:
  - 1. Protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by construction operations.
  - 2. Restore all public and private property including pavement, surfacing, curbs, walks, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and landscaping to their original condition or better, whether within or outside easements or public ways.

# 3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

END OF SECTION 01050

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### PERMITS AND REGULATORY REQUIREMENTS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 RELATED SECTIONS

- A. Section 00700 General Conditions
- B. Appendix MassDOT Permit
- B. Appendix Wetlands Permit

#### 1.3 REGULATORY AGENCIES

- A. Contractor shall comply with all laws, rules, regulations, and ordinances promulgated by any authority having jurisdiction over the Work.
- B. The Contractor shall be fully responsible for obtaining and paying for, at no additional cost to the Owner, the required permit(s) not already obtained. Additionally, the contractor shall ensure that all other necessary permits from regulatory agencies and/or inspectional authorities having jurisdiction including but not limited to wetland and riverfront protection, flood zone, NPDES construction permit, electrical, plumbing, blasting, road opening, buildings, pressure vessels, asbestos, etc. are obtained and paid for by the Contractor or its subcontractor(s) as appropriate and or required by the State Building code at no additional cost to the Owner. If the Work or portions of the Work is not covered by the State Building Code, Contractor shall obtain a written determination that no permit is required. Within five days of receipt of the permit or the determination that no permit is required. Contractor shall obtain a provide a copy of said permit or determination to the Engineer.

## 1.4 PERMITS OBTAINED BY THE CONTRACTOR

A. The Contractor or its subcontractor shall be responsible for obtaining and paying for, at no additional cost to the Owner, all permits, licenses, certifications or approvals required for the work of this contract. The Contractor's responsibility includes but is not limited to building, electrical, asbestos and other permits required for his equipment, work force, and of particular operations (such as transportation and storage of explosives, fuel,

> PERMITS AND REGULATORY REQUIREMENTS 01060-1

chemical or material storage and air emission) and the like in the performance of the work or facility construction (such as crossconnection/backflow preventers, above or below ground tanks and piping installation and/or removal and chemical handling). Proper equipment shall be installed, tested and maintained in accordance with local, state and federal requirements.

- B. Permits that the Contractor shall be responsible for obtaining the following (as necessary):
  - 1. Highway Opening Permit
  - 2. Road Opening Permit
  - 3. Building Permit
  - 4. Electrical Permit
  - 5. NPDES General Construction Permit (including NOI and Stormwater Pollution Prevention Plans, as required)

The Owner will pay the application cost of the permits.

C. The Contractor shall also be responsible for scheduling and coordinating inspections and receipt of local or state permits/approvals/certifications for any tanks, piping and associated appurtenances which are constructed, installed, tested or removed as part of this Contract. Receipt of approvals for storage and use of test chemicals/gasses will be the responsibility of the Contractor.

# 1.5 PERMITS OBTAINED BY THE OWNER

A. The Appendices contain permits that the Owner has obtained for this work. The contractor shall comply with the provisions of the permits.

# PART 2- PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

# END OF SECTION 01060

# ATTACHMENT 01060-A

# SCHEDULE OF PERMITS

PERMIT TITLE	ISSUING	REFERENCE
	AGENCY	
WPA Form 3 – Notice of	-Westport	Appendix C
Intent & Order of	Conservation	
Conditions	Commission	
Massachusetts Wetlands		
Protection Act M.G.L.		
Chapter 131, Section 40		
Application for Permit to	Massachusetts	Appendix C
Access State Highway	Department of	
	Transportation	
M.G.L. Chapter 81, Section		
21.		

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PERMITS AND REGULATORY REQUIREMENTS 01060-4

### MISCELLANEOUS REQUIREMENTS

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

A. The Contractor shall conform to all miscellaneous requirements as herein specified.

### 1.3 INTERFERENCE WITH EXISTING WORKS

A. The Contractor shall at all times conduct his operations so as to interfere as little as possible with existing works. The Contractor shall develop a program, in cooperation with the Engineer and interested officials, which shall provide for the construction and putting into service of the new works in the most orderly manner possible. This program shall be adhered to except as deviations therefrom are expressly permitted. 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 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 do all possible preparatory work and shall see that all tools, materials, and equipment are made ready and at hand.

The Contractor shall make such minor modifications in the work relating to existing structures as may be necessary, without additional compensation.

B. The Contractor shall have no claim for additional compensation by reason of delay or inconvenience in adapting his operations to meet the above requirements.

#### 1.4 MAINTAINING FLOWS

A. It is essential to the operation of the existing wastewater system that there be no interruption in the flow of sewage. To this end, the Contractor shall perform work in such a manner as to maintain sewage flows at all times. The Contractor shall maintain the operation of the pump stations as much as possible, and limit periods of shutdown or bypass to the extent possible.

B. If it is unavoidable to interrupt the flow of sewage, Contractor shall state the reasons therefore, in writing, and identify his planned means and methods to complete the Work. Interruption of the flow of sewage shall not be a basis for additional compensation.

# 1.5 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

# 1.6 WATERTIGHTNESS

A. All structures, pipes, and equipment which are to contain water shall be watertight under all operating conditions for which they are intended. The Contractor shall furnish all labor, materials and equipment and do all work required by the Engineer to make all such parts of the work watertight, or to replace them if, in the opinion of the Engineer, any leakage is excessive. All such parts of the work filled with water for testing watertightness shall be left filled as ordered by the Engineer.

# 1.7 CARE OF WATERCOURSES

A. The Contractor shall maintain the flow in all watercourses, whether open channels or in pipes, in all sewers and other pipes interfered with in the line of work and convey the flow to a suitable point of discharge so as not to flow upon the work or create a nuisance. In the discharge of water removed from excavations by pumping or by gravity, similar precautions shall be observed.

# 1.8 ACCESS TO HYDRANTS

A. Fire hydrants on or adjacent to the work shall be kept operational and accessible to fire-fighting equipment at all times.

# 1.9 WORK WITHIN ELECTRIC UTILITY EASEMENT

A. Contractor is notified that work is proposed within an existing utility easement owned by Central Maine Power. Contractor shall plan and execute his Work to comply with restrictions imposed by Central Maine Power.

B. Contractor shall be solely responsible for coordinating with National Grid and Eversource, and complying with restrictions imposed. Contractor agrees to pay any administrative, equipment, material or personnel fees incurred by National Grid and Eversource that National Grid and Eversource require reimbursement for, with no additional cost to the Owner.

# 1.10 COORDINATION WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

- A. Contractor is notified that work is proposed within the right-of-way of land owned by the Massachusetts Department of Transportation (MassDOT). By the time of public bidding this project or at some time during construction, this land may be transferred to the Massachusetts Turnpike Authority (Mass TA).
- B. Contractor shall plan and execute his Work to comply with restrictions imposed by MassDOT and Mass Turnpike Authority
- C. Contractor shall be solely responsible for coordinating with both MassDOT and Mass Turnpike Authority, and complying with restrictions imposed. Contractor agrees to pay any administrative, equipment, material or personnel fees incurred by MassDOT or Mass Turnpike Authority that MassDOT or Mass Turnpike Authority requires reimbursement for, with no additional cost to the Owner.

# PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

# END OF SECTION 01063

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### ABBREVIATIONS AND DEFINITIONS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- 1.2 RELATED SECTIONS:
  - A. Section 01090: Reference Standards

#### 1.3 ABBREVIATIONS:

- A. Where any of the following abbreviations are used in the Contract Documents, they shall have the meaning set forth opposite each. Abbreviations for trade associations and standards organizations are listed in section 01090 Reference Standards.
- AASHTO American Association of State Highway and Transportation Officials
- ACI American Concrete Institute
- AISC American Institute of Steel Construction
- ANSI American National Standards Institute
- ASCE American Society of Civil Engineers
- ASTM American Society for Testing and Materials
- AWWA American Water Works Association
- Fed. Spec. Federal Specifications issued by the Federal Supply Service of the General Services Administration, Washington, D. C.
- 125-lb. ANSI American National Standard Institute for Cast-iron 250-lb. ANSor Pipe Flanges and Flanged Fittings, Designation B16.1, for the250 lb. ANSI 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
USS Gage	United States Standard Gage
WOG	Water, Oil, Gas
WSP	Working steam pressure
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
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
CS	Commercial Standard

# ABBREVIATIONS AND DEFINITIONS 01080 - 2

IBR	Institute of Boiler and Radiator Manufacturers
IPS	Iron Pipe Size
JIC	Joint Industry Conference Standards
MassDOT	Massachusetts Department of Transportation
Mass Pike	Massachusetts Turnpike
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. ANSI or 250-lb. ANSI	American National Standard Institute for Cast-Iron Pipe Flanges and Flanged Fittings, Designation B16.1, 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

1.4 DEFINITIONS:

# ABBREVIATIONS AND DEFINITIONS 01080 - 3
- A. Wherever the words defined in this section or pronouns used in their stead occur in the Contract Documents, they shall have the meanings herein given.
- B. General: Basic Contract definitions are included in the Conditions of the Contract.
- C. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
- D. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Engineer, requested by the Engineer, and similar phrases.
- E. Approve: The term approved, when used in conjunction, with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- F. Regulation: The term regulations include laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- G. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- H. Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- I. Provide: The term provide means to furnish and install, complete and ready for the intended use.
  - 1. The term experienced, when used with the term Installer means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
  - 2. Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as

carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

- J. Project Site is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- L. 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 Engineer.
- M. 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 opinion of the Engineer, requires, for its removal, drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool. No soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel, no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere, and no rock exterior to the maximum limits of measurement allowed, which may fall into the excavation, will be measured or allowed as "rock."
- N. 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 above defined.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

### END OF SECTION 01080

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ABBREVIATIONS AND DEFINITIONS 01080 - 6

#### SECTION 01090

#### REFERENCE STANDARDS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- 1.2 QUALITY ASSURANCE:
  - A. Should specified reference standards conflict with the Contract Documents, refer to paragraph 3.3 of the General Conditions.
- 1.3 INDUSTRY STANDARDS (SCHEDULE OF REFERENCES):
  - A. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
    - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.
  - B. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed, but not assured, to be accurate and up to date as of the date of Contract Documents.

AA	Aluminum Association 1525 Wilson Boulevard, Suite 600 Arlington, VA 22209
AABC	Associated Air Balance Council 1518 K Street, N.W. Washington, DC 20005

AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 249 Washington, DC 20001
ACI	American Concrete Institute P. O. Box 9094 Farmington Hills, MI 48333-9094
ADC	Air Diffusion Council 1901 N. Roselle Road, Suite 800 Schaumburg, IL 60195
AFBMA	Antifriction Bearing Manufacturers Association 2025 M. Street, N.W., Suite 800 Washington, DC 20036
AGA	American Gas Association 400 North Capitol Street, N.W., Suite 400 Washington, DC 20001
AGC	Associated General Contractors of America 2300 Wilson Boulevard Suite 400 Arlington, VA 22201
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480
AIA	American Institute of Architects 1735 New York Avenue, N.W. Washington, DC 20006
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 700 Chicago, IL 60601
AISI	American Iron and Steel Institute 1140 Connecticut Avenue, NW Suite 705 Washington, DC 20036
AITC	American Institute of Timber Construction 7012 S. Revere Parkway, Suite 140 Centennial, CO 80112

AMCA	Air Movement and Control Association 30 W. University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 25 West 43 <sup>rd</sup> Street, 4 <sup>th</sup> Floor New York, NY 10036
АРА	The Engineered Wood Association (formerly: American Plywood Association) 7011 So. 19th Tacoma, WA 98466
API	American Petroleum Institute 1220 L Street, NW Washington, DC 20005-4070
ARI	Air-Conditioning and Refrigeration Institute 4100 North Fairfax Drive, Suite 200 Arlington, VA 22203
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990
ASPA	Turfgrass Producers International (formerly: American Sod Producers Association) 2 East Main Street East Dundee, IL 60118
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive P. O. Box C700 West Conshohocken, PA 19428-2959
AWI	Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165
	REFERENCE STANDARDS 01090 - 3

AWPA	American Wood-Preservers' Association P. O. Box 361784 Birmingham, AL 35236-1784
AWS	American Welding Society 550 N.W. LeJeune Road Miami, FL 33126
AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235
BIA	Brick Industry Association 1850 Centennial Park Drive, Suite 301 Reston, VA 20191
CDA	Copper Development Association 260 Madison Avenue, 16 <sup>th</sup> Floor New York, NY 10016
CFR	Code of Federal Regulations U. S. Government Printing Office 732 N. Capitol Street, NW Washington, DC 20401
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Road Suite B-215 Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173-4758
CSSB	Cedar Shake & Shingle Bureau (formerly: RCSHSB - Red Cedar Shingle and Handsplit Shake Bureau) P. O. Box 1178 Sumas, WA 98295-1178
DHI	Door and Hardware Institute 14150 Newbrook Drive, Suite 200 Chantilly, VA 20151

EJCDC	Engineers' Joint Contract Documents Committee National Society of Professional Engineers 1420 King Street Alexandria, VA 22314
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FM	FM Global (formerly: Factory Mutual System) 1301 Atwood Avenue P.O. Box 7500 Johnston, RI 02919
FS	Federal Specification U. S. General Services Administration Specifications and Consumer Information Distribution Section (WRSIS) 1800 F Street, N.W. Washington, DC 20405
GA	Gypsum Association 810 First St., N.E., #510 Washington, DC 20002
GAMA	Gas Appliance Manufacturer's Association (formerly: IBR - Institute of Boiler and Radiator Manufacturers a/k/a Hydronics Institute) 2107 Wilson Boulevard, Suite 600 Arlington, VA 22201
GANA	Glass Association of North America (formerly: FGMA - Flat Glass Marketing Association) 2945 SW Wanamaker Drive, Suite A Topeka, KS 66614
ICC	International Code Council (formerly: ICBO - International Conference of Building Officials) Los Angeles Basin Chapter 24320 Narbonne Avenue Lomita, CA 90717
IEEE	Institute of Electrical and Electronic Engineers 3 Park Avenue, 17 <sup>th</sup> Floor New York, NY 10016-5997

REFERENCE STANDARDS 01090 - 5

IMI	International Masonry Institute (formerly: IMIAC - International Masonry Industry All-Weather Council International Masonry Institute) The James Brice House 42 East Street Annapolis, MD 21401
ЛС	Joint Industrial Council c/o National Machine Tool Builders Association 79-1 Westpark Drive McLean, VA 22102
MBMA	Metal Buildings Manufacturer's Association 1300 Sumner Avenue Cleveland, OH 44115-2851
MHD	Massachusetts Highway Department 10 Park Plaza, Suite 3170 Boston, MA 02116
MIL	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 600 S. Federal Street, Suite 400 Chicago, Il 60605
MSS	Manufacturers Standardization Society of the Valve and Fitting Industry 127 Park Street, NE Vienna, VA 22180
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Road Building C, Suite 312 Glen Ellyn, IL 60137
NAPA	National Asphalt Pavement Association 5100 Forbes Boulevard Lanham, MD 20706
NCMA	National Concrete Masonry Association 13750 Sunrise Valley Drive Herndon, VA 20171-4662

REFERENCE STANDARDS 01090 - 6

NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877
NEC	National Electric Code
NEMA	National Electrical Manufacturers' Association 1300 North 17 <sup>th</sup> Street, Suite 1752 Rosslyn, VA 22209
NFPA	National Fire Protection Association One Batterymarch Park Quincy, MA 02169-7471
NFPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NSWMA	National Solid Wastes Management Association 4301 Connecticut Avenue, NW, Suite 300 Washington, DC 20008-2304
OSHA	Occupational Safety Hazard Administration 200 Constitution Avenue, N.W. Washington, DC 20210
РСА	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 209 W. Jackson Boulevard, #500 Chicago, IL 60606
PS	Product Standard U.S. Department of Commerce 1401 Constitution Avenue, N.W. Washington, DC 20230
RIS	Redwood Inspection Service 405 Enfrente Road, Suite 200 c/o California Redwood Association Novato, CA 94949-7201
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021
	REFERENCE STANDARDS

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SDI	Steel Door Institute c/o Wheery Associates 30200 Detroit Road Cleveland, OH 44145-1967
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Avenue Chicago, IL 60611
WDMA	Window and Door Manufacturer's Association (formerly: NTMA - National Woodwork Manufacturers Association) 1400 E. Touhy Avenue, Suite 470 Des Plaines, IL 60018
WSC	Water Systems Council National Programs Office 1101 30 <sup>th</sup> Street, NW, Suite 500 Washington, DC 20007

PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

## END OF SECTION 01090

### SECTION 01110

### ENVIRONMENTAL PROTECTION PROCEDURES

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SCOPE OF WORK:

- A. The work covered by this section consists of furnishing all labor materials and equipment and performing 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 Specification, 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 level of noise escaping the site, especially at night and on weekends.

#### 1.3 APPLICABLE REGULATIONS:

- A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.
- B. Contractor shall comply with the requirements of the Order of Conditions located in Appendix I. Contractor shall be responsible for paying for and meeting all conditions of the Order of Conditions.

### 1.4 NOTIFICATIONS:

The Engineer will notify the Contractor in writing of any non-compliance A. 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 Engineer, of any noncompliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action at the Contractor's expense. 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.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 – EXECUTION

### 3.1 PROTECTION OF LAND RESOURCES:

- A. Land resources within the project boundaries and outside the limits of permanent work shall be restored 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. The locations of the Contractor's storage and staging shall require written approval of the Engineer and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites. Drawings showing storage facilities shall be submitted for approval of the Engineer.

### 3.2 NOISE CONTROL:

A. The Contractor shall make every effort to minimize noises caused by his operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal (OSHA) regulations. If at any time construction noise is problematic, as determined by the Engineer or Owner, the Owner reserves the right to restrict working times without cause for an extension of contract times or additional compensation.

END OF SECTION 01110 ENVIRONMENTAL PROTECTION PROCEDURES 01110 - 2

#### SECTION 01150

#### MEASUREMENT AND PAYMENT

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Under the price specified to be paid for each item, the Contractor shall furnish all materials and equipment, furnish all labor and plant, and perform all operations to complete all work as indicated and specified. Provide all supervision, overhead items, protection and precautions, and all other costs, incidental to the construction work, complete, and as specified, are also included.
- B. A complete working job shall be produced whether or not any particular wording or direction is omitted or not clearly stated.
- C. Measurement for payment shall be by the Engineer, except where noted elsewhere in this specification. Measurement for payment for lump sum items shall be on the basis of percentage of work complete.
- D. Each price in the Bid shall constitute full compensation for each item of work completed.
- E. The prices for those items which involve excavation shall include compensation for disposal of surplus excavated material.
- F. The prices for all pipe items shall constitute full compensation for pipe, stone bedding, clearing and grubbing, filter fabric (where shown), filter fabric (as directed by Engineer), laying, jointing, and testing of pipe, excavation, backfill, compaction, gravel for paving sub-base, loam and seed, traffic control devices, and clean up.
- G. 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.
- H. Unit prices submitted for various items of work will be utilized for determining prices of any additional work that becomes necessary during construction.
- I. Requests for changes to the unit prices for the quantities indicated will not be considered unless the actual final quantity is less than 85% or more than 115% of the quantity of the bid. Requests for changes to the unit prices bid must be fully documented and justified by the party (Contractor or Owner) making the request to be considered.

#### 1.2 LUMP SUM ITEMS

- A. Payment for the lump sums shall be full compensation for all labor, materials and equipment required to furnish, install, construct, startup and test the work covered under that lump sum item, whether listed in the related Compensation subsection for each item or not. All supervision; overhead items including but not limited to bonds, insurance, and labor burden; and profit are also included.
- B. Payment shall fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the Work.

### 1.3 UNIT PRICE ITEMS

- A. Unit prices shall be full compensation for all labor, materials and equipment required to furnish, install, construct, startup and test the work covered under that unit price item, whether listed in the related Compensation subsection for each item or not. All supervision; overhead items including but not limited to bonds, insurance, and labor burden; and profit are also included.
- B. Payment shall fully compensate the Contractor for any other work which is not specified or shown, but which is necessary to complete the Work.

### 1.4 BASE BID ITEM DESCRIPTIONS

- A. Item 1, Mobilization/Demobilization (up to 5% of bid):
  - 1. Under the lump sum price bid for this item, the Contractor shall move his equipment to and from the site and prepare to begin construction and perform final site cleanup. This shall also include providing temporary facilities and utilities necessary for the resident engineer.
  - 2. Mobilization costs are the costs of initiating the Contract, exclusive of the cost of materials. Costs shall also include acquisition of permits, permit fees, project signs and all other related project costs.
  - 3. Traffic Management is to be paid for under the Traffic Management bid item. Police Details shall be paid for by the Contractor under the associated allowance bid item.
  - 4. Payment for mobilization will be at the lump sum price bid for this item and will be limited to 75% of the lump sum amount of this item until the work is complete and the contractor has completely demobilized. The initial payment of 75% mobilization costs shall be payable when the Contractor is operational on site. Operational shall mean the substantial commencement of work on site, not prior to commencement. The lump sum price bid for mobilization/ demobilization shall not exceed 5 percent of the total of all items excluding this item.

## B. Item 2a and 2b, Constructing Sewer Pump Stations:

- 1. Bid Items 2a and 2b consist of the following Bid Items:
  - a. Item 2a Pump Station and Flow Meter Vault 35 State Road

- b. Item 2b Pump Station 287-291 State Road
- 2. The Measurement and Payment of Bid Items 2a and 2b, shall be as described in the following paragraphs:
  - The lump sum price will constitute full compensation for all a. labor, materials, tools, and equipment necessary for the Contractor to complete, furnish, and install the following: pavement removal and disposal; tree, plant and shrub clearing and grubbing; stripping and stockpiling; removal of existing fences or gates; design and install all temporary excavation support systems, including steel sheeting or other shoring materials: design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; wetland and tree protection; traffic management devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; pre-construction photographs and/or video; excavation and backfill; material handling and stockpiling; disposal of surplus material; furnish and install the precast concrete wet well, including cast-in-place concrete mats and access manways; leakage test of wet well (using same procedure as for leakage testing sewer manholes); furnish and install the complete, pre-engineered, pre-fabricated pump station including new pumps, motors, interconnecting piping, control valves, isolation valves, fittings, instruments, control panel, lighting, alarm systems, remote alarm transmission, and other equipment and appurtenances, within a manufacturer-supplied enclosure; materials and installation of items to ensure floodproofing of the installed station and equipment including raised equipment, concrete pads, access stairs, and items to maintain water tightness of station and prevent groundwater or flood water infiltration; flow measurement system; furnish and install the pump station bypass and drain infrastructure, complete and functional, as detailed on the Drawings; provide spare parts as specified; furnish and install external connecting piping and manholes to the influent sewers and force main to make a complete working installation; furnish and install flow meter vault per Drawings, furnish and install force main, bends, fittings, and restrained joints; coordinate and make the connection of the proposed force main to the existing force main including but not limited to cutting and disassembling the existing force main, bypass pumping, and coordinating with other active pump stations; furnish and install gravity sewer and sewer manholes, including connections to sewers or manholes, bedding material, and filter fabric; leakage testing of the completed sewer; furnishing and placing the compacted gravel base on backfilled trenches; coordinate work

with utility companies, including payment of required utilities fees; install and connect all utilities and appurtenances as required and as shown in the drawings; furnish and install complete and functional control panel and standby generator system, including cast-in-place concrete pads, generator and control equipment, and all associated conduit and wiring; test station, and all components; train Owner's personnel on operation and maintenance; provide operation and maintenance manuals; clean inside of enclosure and wet well; provide site paving, site grading, curb cuts; remove temporary site fencing; provide fencing, landscaping, including loam and seed, provide access driveway; and provide all other items of work incidental to the Pump Station work, complete as specified and not included for payment under other bid items.

- b. The cost of all force main, gravity sewer and manhole(s) and all other miscellaneous work within the Limits of Work is also included in the price bid under this Bid Item.
- c. The entire cost to provide power to the pump station shall be included in this lump sum bid item regardless if physical work to do so lies beyond the Limit of Work shown on the Drawings.
- d. The limit of payment under this Bid Item shall be as defined on the Construction Drawings as the Limit of Work. Unless noted otherwise, work outside the identified Limit of Work shall be paid for under other Bid Items.
- e. This bid item explicitly does not include the cost for rock removal. Rock removal costs associated with installing the pump stations shall be covered under the appropriate bid item.
- f. Measurement and payment for the length of gravity sewer and force main that resides within the Pay Limits for Bid Items 2a & 2b shall be paid for within these respective Bid Items.
- g. Measurement for payment will be on the basis of percentage of work completed.
- C. Item 3, Constructing Sanitary Gravity Sewers:
  - 1. Bid Items 3a, 3b, 3c and 3d consists of the following Bid Items:
    - a. Item 3a 8" PVC Sanitary Sewer Gravity Pipe
    - b. Item 3b 12" PVC Sanitary Sewer Gravity Pipe
    - c. Item 3c 15" PVC Sanitary Sewer Gravity Pipe
    - d. Item 3d 18" PVC Sanitary Sewer Gravity Pipe

- 2. The Measurement and Payment of Bid Items3a, 3b, 3c and 3d, shall be as described in the following paragraphs:
  - a. The unit prices for constructing gravity sewers will constitute full compensation for all labor, materials, tools, and equipment necessary for the Contractor to furnish and install the following: Provide labor and materials required to furnish and install gravity sewer pipe, fittings, wyes, tee branches and make all required transitions between sewers of different materials, classes, nominal diameters, and restrained joints; provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt on top of concrete slabs; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; provide and install select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and place 3/4-inch crushed stone bedding; filter fabric; install pipe insulation, where indicated on Drawings; restore the trench surface to grade including, furnishing, backfilling, and compacting: compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.
  - b. Measurement for payment under the appropriate subdivision of this Item shall be measured by the linear foot along the horizontal projection of the centerline of the completed sewer from the center of manhole to the center of manhole. Depth of pipe will be measured from the top of existing grade at the centerline prior to excavation,

to the invert of the pipe. The lengths of gravity sewer that resides with the Pay Limits for Bid Items 2a and 2b shall be paid for within those individual Bid Items.

- D. Item 4, Constructing Sewer Manholes:
  - 1. Bid Items 4a, and 4b consists of the following Bid Items:
    - a. Item 4a 4-Foot Diameter Sanitary Sewer Manholes
    - b. Item 4b 6-Foot Diameter Sanitary Sewer Manholes
  - 2. Item 4a, 4-Foot Diameter Sewer Manholes:
    - a. Under the unit price bid, the Contractor shall furnish and install 4-foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or riser rings under frames. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit price for this Item.
    - b. Measurement for payment will be by the vertical foot from the invert of the manhole at its center to the existing ground elevation prior to excavation.
  - 4. Item 4b, 6-Foot Diameter Sewer Manholes:
    - a. Under the unit price bid, the Contractor shall furnish and install 6-foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or riser rings under frames. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit

price for this Item.

- b. Measurement for payment will be by the vertical foot from the invert of the manhole at its center to the existing ground elevation prior to excavation.
- E. Item 5, Constructing Sewer Force Mains:
  - 1. Bid Item 5a, & 5b consist of the following Bid Items:
    - a. Item 5a 4" & 12" PVC Sanitary Sewer Force Main (parallel in the shared trench)
    - b. Item 5b-6" PVC Sanitary Sewer Force Main
  - 2. The Measurement and Payment of Bid Item 5a & 5b shall be as described in the following paragraphs:
    - a. The unit prices shall constitute full compensation for constructing sewer force mains. The unit prices shall include furnishing and installing sewer force mains, bends, and fittings at each vertical and horizontal change in direction; testing of the completed force main as specified. The unit prices shall include furnishing and installing restrained caps and plugs at the ends of sewer force mains constructed for future use, as specified. The unit price shall also include all labor and materials required to make all required transition couplings between the sewers of different materials, classes, nominal diameters, restrained joints; provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt;; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under Item 14); furnish and place 3/4-inch crushed stone bedding; install pipe insulation, where indicated on Drawings; filter fabric; restore the trench surface to grade including, furnishing, backfilling, and compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of

any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- b. Material excavated outside of the pay limits indicated on the Contract Drawings shall be done at the Contractor's expense, at no additional cost to the Owner.
- c. Measurement for payment will be by the linear foot of force mains installed as measured by the Engineer along the horizontal projection to ground surface of the centerline of the completed force main. The length of force main that resides within the Pay Limits for Bid Items 2a, 2b, & 3 shall be paid for within those individual Bid Items.
- F. Item 6, Constructing Sanitary Sewer Services:
  - 1. Under the unit price bid for Item 6, the Contractor shall furnish and install 6- and 8-inch PVC property service connections from the sewer main to the property line as shown on the drawings or as directed by the engineer. This unit price bid item shall provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures: straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and install sewer service connection between the sewer main and property line, including connecting pipe to Y-branch or chimney on sewer main; furnish and install transition couplings as necessary including at connections to existing sewer services; installation of a cap on the end of the pipe at the property line, survey and record location of the end of the service on as-

built drawings; furnish and install a house connection marker at the end of the service; furnish and place 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, restore the trench surface to grade including, furnishing, backfilling, and compacting; install pipe insulation, where indicated on Drawings; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures: permit compliance: coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- 2. Measurement for payment will be on the basis of length of pipe installed. Length will be measured from the centerline of the sewer main to the end cap, along the horizontal projection of the centerline of the pipe.
- G. Item 7, Utility Support and Coordination:
  - 1. Payment for Utility Support and Coordination will be based on the bid for this item in the proposal. Under the lump sum bid for this item, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required to maintain continuity of storm drains, sanitary sewers, gas, telephone, electric, telecommunications, cable TV, water, and all privately owned utilities. The work includes all service, trunk, supply, transmission, and main lines impacted by the work. Under the lump sum bid for this item, the Contractor shall also furnish all labor, materials, tools, equipment and incidentals to coordinate and/or temporarily support all utility poles required to facilitate the excavation and for the installation of the Work; submission of all utility coordination and support work plans and shop drawings; coordinate the protection of and protect all overhead utilities; and perform all coordination with the utility companies for the relocation, protection, support, and other work required to facilitate the completion of the project. This Item further includes utility location (Dig Safe); coordination of construction with existing utility owners and operators; providing access for utility owners and operators to their respective utilities; and communicating with affected homeowners and residents.
  - 2. Measurement for payment for Utility Support and Coordination shall be on a percent of the lump sum complete, as determined by the Contractor's approved Schedule of Values for this item.

- 3. Note that the Engineer is not specifically dictating what methods to use for protection and coordination of existing utilities. Therefore, the Contractor's bid amount under this item is what will ultimately be paid and Contractor shall not have a claim for additional compensation.
- H. Item 8, Exploratory Excavations:
  - 1. Under the unit price bid, the Contractor shall excavate and backfill as necessary and as approved by the Engineer to locate pipe, utilities, foundations, and possible obstructions. Included under the unit price is payment for traffic management devices, excavation and backfill, dewatering, wetlands protection, erosion and sedimentation control, compaction, furnishing and placing 12-inch gravel sub-base under paved areas, landscaping restoration, restoring pavement, and all labor, services and equipment necessary for exploratory excavations.
  - 2. Measurement for payment will be based on the actual cubic yards of material excavated, as measured and approved by the engineer.
- I. Item 9, Rock Excavation:
  - 1. Under the unit price bid, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required for the Contractor to excavate, remove, and dispose of rock from trenches and excavated areas. Included in the price bid per cubic yard shall be related costs such as preblast surveys completed (whether by Contractor or by Engineer's direction), compliance with permit conditions, drilling, blasting, and replacement with suitable material per the Typical Trench Detail, and transportation and disposal of materials.
  - 2. The unit price bid for this item shall be in addition to the cost of excavating earth, and no deduction will be made in the amount for earth excavation.
  - 3. Measurement for payment will be on the basis of cubic yards of rock excavated, removed and disposed of within the Pay Limit, as measured by the Engineer in-place prior to removal. Depth of rock in pipe trenches will be measured from the rock surface to 6-inches below the invert of the pipe and the maximum width shall be determined as outlined on the Typical Trench Detail. Any rock excavated to a depth or width greater than the above shall be removed and disposed of from the site and its remaining void shall be backfilled with suitable material per the Typical Trench Detail at the Contractor's expense. The pay limit width for rock removal outside manholes and pump station wet wells will be one foot outside the widest dimension of the structure or shall be the maximum trench width, whichever is greater. The pay limit for depth of rock removal outside manholes and wet wells shall 1-foot below the bottom

of the structure.

- 4. Any rock excavated to a depth or width greater than that as shown on the Drawings, as directed by the Engineer or herein specified shall not be paid for and shall be backfilled with suitable material per the Typical Trench Detail at the Contractor's expense.
- 5. The unit price for Item 9 shall be fixed and shall apply to all rock excavation eligible for payment on the project as described in paragraphs a through d above.
- J. Item 10, Excavation of Unsuitable Material Below Grade:
  - 1. Under the unit price bid for this Item, the Contractor shall remove clay or other unsuitable material below the grade of the pipe, when and as directed by the Engineer; load, transport, and legally dispose of such material; furnish and place approved common fill in the place of material removed; furnish and place approved filter fabric material in perimeter of the trench as shown on the trench detail.
  - 2. Measurement for payment will be on the basis of cubic yards of material excavated within the authorized width and depth limits of unsuitable material in pipe trenches, as measured by the Engineer. The authorized depth shall be measured from 6-inches below the invert of the pipe to a maximum depth of 3-feet below the invert of the pipe. The authorized width of unsuitable material and replacement shall be as measured by the Engineer, but shall not exceed 3-feet in width.
- K. Item 11, Removal of Abandoned 39" PCCP Water Aqueduct Coordination:
  - 1. Under the unit price bid, the Contractor shall furnish all labor, tools, materials, and equipment to properly remove, and dispose of a section of the PCCP 39" water aqueduct pipeline and bulkhead the ends in order to allow new pipe installation.
  - 2. Measurement for removal and disposal of water aqueduct including bulkheading will be made on the basis of each location and approved by the Engineer.
  - 3. Work includes excavation, backfill, dewatering, shoring, saw cutting, removal, and disposal of the pipe section as well as bulkheading the pipe ends with concrete or brick and mortar to prevent the entrance of soil into the pipe. Pipe installation shall be paid under the appropriate bid items.
- L. Item 12, Miscellaneous Concrete:
  - 1. Under the unit price bid, the Contractor shall furnish and place concrete for

encasements, cradles, and at other miscellaneous locations. Included in this cost will be excavation and backfill, formwork, tie-rods, reinforcing steel and all materials, equipment and services necessary to satisfactorily place concrete. Concrete used for the encasement of drop inlets, chimneys, and sidewalk and driveway replacement for sewer construction and house connections is included under other items and is not included for payment under this Item.

- 2. Measurement for payment will be on the basis of cubic yards measured in place by the Engineer.
- M. Item 13, Pavement:
  - 1. Bid Items 13a, 13b, 13c and 13d consists of the following Bid Items:
    - a. Item 13a Temporary Pavement (3")
    - b. Item 13b Permanent Pavement on State Roads (7")
    - c. Item 13c Mill & Overlay Pavement on State Roads (2")
    - d. Item 13d Permanent Pavement on Town Roads (2")
  - 2. Item 13a, Temporary Pavement (3")
    - a. Temporary pavement shall be installed where directed by the Engineer, and in accordance with the MassDOT permit for State Roads in the MassDOT right of way and Town roads. The quantities of temporary pavement to be measured for payment under this Item will be measured by the actual tonnage of pavement delivered and installed less the quantity placed beyond specified thickness or outside the specified payment limits. Payment limit will be measured along the centerline of the new sewer including service trench paving measured from the edge of the main line paving to the edge of the existing pavement. Paving for sidewalk and driveway restoration is paid for under the pipe and service bid items.
    - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.

- c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- 3. Item 13b, Permanent Pavement on State Roads (7" Thickness)
  - a. Permanent pavement shall be installed where directed by the Engineer in accordance with the MassDOT permit. The quantities of permanent pavement to be measured for payment under the appropriate subdivisions of this Item will be measured by the actual tonnage of pavement delivered less the quantity placed beyond specified thickness or outside the payment limits. Payment limit will be measured along the centerline of the new sewer including service trench paving measured from the edge of the main line paving to the edge of the existing pavement. Payment for sidewalk and driveway restoration is paid for under the pipe and service bid items.
  - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.
  - c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- 4. Item 13c, Mill & Overlay Pavement on State Roads (2")
  - a. Milling and overlay pavement shall be installed where directed by the Engineer in accordance with the MassDOT permit. The unit price for this Bid Item will constitute full compensation for milling and overlay pavement as described in the Contract Documents or as directed by the Engineer. Under the unit price for this item, the

Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide traffic control devices; mill 2" depth of existing pavement placed under this Item; install hot mix asphalt to the depth and width indicated within the payment limits, complete, as shown in the Contract Documents or at the direction of the Engineer. The work includes, but is not limited to the following; raising and resetting existing structures, including those that are currently paved over; installation and compaction of bituminous concrete top course to the depth and width and in the area specified; hand placement and compaction of bituminous concrete around structures, aprons, driveways and as directed; compaction testing; power sweeping; saw cutting pavement for keyways and other jointing between new and existing asphalt; placing loam and seed along pavement edges (without curbs); furnish and place tack coat on all edges and over existing pavements; furnishing and applying all pavement markings; installing electrical wire and cable for traffic signals to restore preconstruction conditions, and all incidental work not included for payment elsewhere, and providing a three-year guarantee.

- b. Measurement for payment will be the actual tons of overlay pavement delivered and properly placed and compacted. Additional payment will not be made for any paving that the Contractor has already installed, such as at service wyes.
- 5. Item 13d, Permanent Pavement on Town Roads (2" Thickness)
  - a. Permanent pavement overlay (2 inches) shall be installed outside of the MassDOT right of way limits, where directed by the Engineer. The quantities of permanent pavement to be measured for payment under the appropriate subdivisions of this Item will be measured by the actual tonnage of pavement delivered less the quantity placed beyond specified thickness or outside the payment limits. Payment limit will be five (5) feet beyond the end of the service trenches.
  - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required

tonnage.

- c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- N. Item 14, Roadway Concrete Slab Removal:
  - 1. Under the unit price bid, the Contractor shall remove and dispose of portions or whole segments of reinforced concrete roadway slabs. Included in this cost will be excavation and backfill, disposal, equipment and services necessary to remove and dispose of concrete slabs.
  - 2. Measurement for payment will be on the basis of cubic yards measured in place by the Engineer up to the maximum width indicated on the drawings. The asphalt on top of the concrete slabs shall be paid for under the pipe bid items.
  - 3. Adjust service locations in the field as needed to minimize the removal of the existing concrete slab roadway underneath the surface asphalt. Where feasible, contractor shall align services with the edges of the existing concrete roadway slabs and avoid leaving small sections of floating concrete slabs disconnected from the original concrete slab.
- O. Item 15, Police Details Allowance:
  - 1. Under this allowance, the Contractor shall provide police details as warranted to complete the Work in the Contract. This allowance shall only be used for the direct payments to the Police Department for the police detail. Allowance does not include payment for administrative coordination and scheduling of police detail for traffic control.
  - 2. Contractor to schedule all traffic control details through the Police Department or the Massachusetts State Police. All invoices will be sent to the Contractor who shall pay them directly.
  - 3. Contractor shall be responsible for developing a police detail schedule. Schedule to be pre-approved by the Owner. All time in excess of 8 hours per day of construction shall be pre-approved by the Owner. Contractor will be responsible to pay for any police details that have not been preapproved without compensation by the Owner.
  - 4. The Contractor shall provide documentation such as police detail invoices with Contractor's application for payment to receive reimbursement for police costs.

- 5. The cost of police details ordered by the Contractor but not utilized due to cancellation of work crews shall be the responsibility of the Contractor and not paid under this item.
- 6. Markups on the cost of police details will not be allowed.
- 7. The Contractor will be paid at the actual hourly rate charged by the Police Department and shall make payment to the Police Department within five days of receipt of payment from the Owner.
- P. Item 16, Unforeseen Conditions Allowance:
  - a. The allowance price for this item established in the Bid is an estimated figure to facilitate comparison of bids. The intent of this bid item is to compensate the contractor for unforeseen conditions that may occur during the project, not including non-qualifying costs.
  - b. For the purposes of this item, non-qualifying costs shall be defined as those costs incurred as a result of non-reimbursable costs, delays caused by the Contractor, or the need for emergency repairs as caused by the Contractor's own actions, means and methods. Non-qualifying costs shall be paid by the Contractor and shall not be reimbursed by the Owner.
  - a. Measurement for payment under this allowance bid item shall be determined in accordance with Article 12 of the General Conditions.
- Q. Item 17, Traffic Management:
  - 1. Measurement for payment shall be based on a lump sum. Contractor shall furnish all safety signing fabricated and furnished as indicated by the Contract Documents and the MassDOT permit, and approved or requested by the Owner, and/or Engineer and as measured by the Engineer. Additionally, this item includes Variable Message Board(s) as may be required by MassDOT.
- R. Item 18, 100-pound Bags of Calcium Chloride:
  - 1. The unit price bid shall be considered full compensation for all labor, materials, equipment and incidental work required for application of calcium chloride.
  - 2. Calcium chloride will be measured as the actual number of 100-pound bags, or major fraction thereof, applied to the site as recorded by the Engineer. Dust control by use of water is considered to be incidental to

the work and included in other bid items and described herein.

- S. Item 19, Hydrant Relocation:
  - 1. Hydrants shall be measured per hydrant installed, including: removal, relocation, and installation of the hydrant, tapping sleeve, valves, and appurtenances, excavation and backfill, placing drain stone, pressure testing, disinfection, removal of excess excavated material, clean up and all else incidental thereto for the satisfactory completion of the work.
  - 2. Hydrant relocation shall be paid at the lump sum price under the item.
  - 3. The cost of making connections to existing mains, and the cost of joint restraints, tapping sleeve on the existing main, blind flanges, valve boxes, couplings and concrete backing shall be considered incidental to the cost of this bid item.
- T. Item 20, Water Services:
  - 1. Under the unit price bid for Item 20, the Contractor shall furnish and install new water service connections from the water main to locations indicated in the contract drawings. Payment for Water Services will be based on the per linear foot unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new water services at locations indicated on the drawings, at all depths, complete from the water main to the property line as shown on the Contract Drawings, or as required by the Engineer. The work shall include, but is not limited to furnishing, installing, and/or performing the following: tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway/sidewalks for trenches; removal and disposal of surface asphalt; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); survey and record location of the end of the service on as-built drawings; furnish and install a house connection marker at the end of the service; furnish and place 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of

any utility lines broken and/or conflicting with construction, restore the trench surface to grade including, furnishing, backfilling, and compacting; install pipe insulation, where indicated on Drawings; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed pipe; removal of groundwater from the trench; handling groundwater recharged back to the soil; water service pipe, fittings, couplings, adapters, appurtenances, curb stops, corporation stops, extension tubing, surface access boxes, and joints; connections to existing and proposed pipes; flushing/cleaning and testing; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of asphalt and concrete sidewalk and driveways; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; restoration of private property clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- 2. Measurement for payment for Water Service will be based on the actual linear feet of service pipe installed, tested, and accepted, at all depths, and the actual number of connections to existing completed and accepted complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the service from the main to the property line.
- U. Item 21, Reconfigure Hebert Terrace Drain Culvert Crossing:
  - 1. Payment for The Measurement and Payment of Bid Item 21, shall be as described in the following paragraphs:
    - a. The lump sum price will constitute full compensation for all labor, materials, tools, and equipment necessary for the Contractor to furnish and install the following: tree, plant and shrub clearing and grubbing; stripping and stockpiling; demolition & removal of pipes, manholes, and/or unsuitable materials; design and install all temporary excavation support systems, including design and provide dewatering system in conformance with regulations; temporary flow management and bypass of drain flows as necessary; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; wetland and tree protection; traffic management devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; pre-construction photographs and/or video; excavation

and backfill; material handling and stockpiling; disposal of surplus material; furnish and install the barrel block drain manhole, drain manhole; drain infrastructure, complete and functional, as detailed on the Drawings including drain pipe, connections to existing drainage, concrete collar connections, flexible couplings, removal and disposal of portions of existing drain culvert and barrel block MH as detailed on the drawings; furnishing and placing the compacted gravel base on backfilled trenches; coordinate work with utility companies, including payment of required utilities fees; install and connect all utilities, signage and appurtenances as required and as shown in the drawings; furnish and install complete and functional detectable warning pad; site paving; provide and remove temporary site fencing; provide landscaping, including loam, seed, provide access driveway complete as specified and not included for payment under other bid items, restoration of private property; repair and/or relocation of any utility lines broken and/or conflicting with construction; protection of existing trees; curbing restoration not included for payment elsewhere; landscaping restoration not included for payment elsewhere; removal, protection, resetting, and required repairs to existing signs, posts, walls and other features to pre-construction conditions; returning physical features to their original condition; clean up.

b. Measurement for payment will be on the basis of percentage of work completed.

#### 1.5 ALTERNATE BID A ITEM DESCRIPTIONS

- A. Item A-1, Mobilization/Demobilization (up to 5% of total bid for Alternate A bid items):
  - 1. Under the lump sum price bid for this item, the Contractor shall move his equipment to and from the site and prepare to begin construction and perform final site cleanup. This shall also include providing temporary facilities and utilities necessary for the resident engineer.
  - 2. Mobilization costs are the costs of initiating the Contract, exclusive of the cost of materials. Costs shall also include acquisition of permits, permit fees, project signs and all other related project costs.
  - 3. Traffic Management is to be paid for under the Traffic Management bid item. Police Details shall be paid for by the Contractor under the associated allowance bid item.
  - 4. Payment for mobilization will be at the lump sum price bid for this item and will be limited to 75% of the lump sum amount of this item until the work is complete and the contractor has completely demobilized. The initial payment of 75%

mobilization costs shall be payable when the Contractor is operational on site. Operational shall mean the substantial commencement of work on site, not prior to commencement. The lump sum price bid for mobilization/ demobilization shall not exceed 5 percent of the total of all items excluding this item.

- B. Item A-2, Constructing Sewer Pump Stations (833 State Road):
  - 1. The Measurement and Payment of Bid Items A-2, shall be as described in the following paragraphs:
    - The lump sum price will constitute full compensation for all labor, a. materials, tools, and equipment necessary for the Contractor to complete, furnish, and install the following: pavement removal and disposal; tree, plant and shrub clearing and grubbing; stripping and stockpiling; removal of existing fences or gates; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations: provide dust control measures: straw wattles/bales and all other erosion and sedimentation control devices; wetland and tree protection; traffic management devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; pre-construction photographs and/or video; excavation and backfill; material handling and stockpiling; disposal of surplus material; furnish and install the precast concrete wet well, including cast-in-place concrete mats and access manways; leakage test of wet well (using same procedure as for leakage testing sewer manholes); furnish and install the complete, pre-engineered, pre-fabricated pump station including new pumps, motors and VFD drives (if required), interconnecting piping, control valves, isolation valves, fittings, instruments, control panel, lighting, alarm systems, remote alarm transmission, and other equipment and appurtenances, within a manufacturer-supplied enclosure; materials and installation of items to ensure floodproofing of the installed station and equipment including raised equipment, concrete pads, access stairs, and items to maintain water tightness of station and prevent groundwater or flood water infiltration; flow measurement system; furnish and install the pump station bypass and drain infrastructure, complete and functional, as detailed on the Drawings; provide spare parts as specified; furnish and install external connecting piping and manholes to the influent sewers and force main to make a complete working installation; furnish and install flow meter vault per Drawings, furnish and install force main, bends, fittings, and restrained joints; coordinate and make the connection of the proposed force main to the existing force main including but not limited to cutting and disassembling the existing force main, bypass pumping, and coordinating with other active pump stations; furnish and install gravity sewer and sewer manholes, including connections to sewers or manholes, bedding material, and filter fabric; leakage testing of the completed sewer; furnishing and placing the compacted gravel base on backfilled trenches; coordinate work with

utility companies, including payment of required utilities fees; install and connect all utilities and appurtenances as required and as shown in the drawings; furnish and install complete and functional control panel and standby generator system, including cast-in-place concrete pads, generator and control equipment, and all associated conduit and wiring; test station, and all components; train Owner's personnel on operation and maintenance; provide operation and maintenance manuals; clean inside of enclosure and wet well; provide site paving, site grading, curb cuts; remove temporary site fencing; provide fencing, landscaping, including loam and seed, provide access driveway; and provide all other items of work incidental to the Pump Station work, complete as specified and not included for payment under other bid items.

- b. The cost of all force main, gravity sewer and manhole(s) and all other miscellaneous work within the Limits of Work is also included in the price bid under this Bid Item.
- c. The entire cost to provide power to the pump station shall be included in this lump sum bid item regardless if physical work to do so lies beyond the Limit of Work shown on the Drawings.
- d. The limit of payment under this Bid Item shall be as defined on the Construction Drawings as the Limit of Work. Unless noted otherwise, work outside the identified Limit of Work shall be paid for under other Bid Items.
- e. This bid item explicitly does not include the cost for rock removal. Rock removal costs associated with installing the pump stations shall be covered under the appropriate bid item.
- f. Measurement and payment for the length of gravity sewer and force main that resides within the Pay Limits for Bid Items A-2 shall be paid for within these respective Bid Items.
- g. Measurement for payment will be on the basis of percentage of work completed.
- C. Item A-3, Constructing Sanitary Gravity Sewers:
  - 1. Bid Items A-3a, A-3b, A-3c A-3d, and A-3e consists of the following Bid Items:
    - a. Item A-3a 8" PVC Sanitary Sewer Gravity Pipe (<12' Deep)
    - b. Item A-3b 8" PVC Sanitary Sewer Gravity Pipe (>12' Deep)
    - c. Item A-3c 12" PVC Sanitary Sewer Gravity Pipe
    - d. Item A-3d 15" PVC Sanitary Sewer Gravity Pipe
    - e. Item A-3e Sanitary Sewer Gravity Chimneys

- 2. The Measurement and Payment of Bid Items A-3a, A-3b, A-3c, A-3d, and A-3e, shall be as described in the following paragraphs:
  - The unit prices for constructing gravity sewers will constitute full a. compensation for all labor, materials, tools, and equipment necessary for the Contractor to furnish and install the following: Provide labor and materials required to furnish and install gravity sewer pipe, fittings, wyes, tee branches and make all required transitions between sewers of different materials, classes, nominal diameters, and restrained joints; provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt on top of concrete slabs; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; provide and install select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and place 3/4-inch crushed stone bedding; filter fabric; install pipe insulation, where indicated on Drawings; restore the trench surface to grade including, furnishing, backfilling, and compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.
  - b. Measurement for payment under the appropriate subdivision of this Item shall be measured by the linear foot along the horizontal projection of the centerline of the completed sewer from the center of manhole to the center of manhole. Depth of pipe will be measured from the top of existing grade at the centerline prior to excavation,

to the invert of the pipe. The lengths of gravity sewer that resides with the Pay Limits for Bid Items A-2 shall be paid for within those individual Bid Items.

- c. For Item A-3e, Contractor shall furnish and install chimneys including pipe, fittings, and stone or concrete encasement as shown in the Contract Drawings.
- d. Measurement and payment for Item A-3e be shall be for each chimney installed and approved by the Engineer.
- D. Item A-4, Constructing Sewer Manholes:
  - 1. Bid Items A-4a, and A-4b consists of the following Bid Items:
    - a. Item A-4a 4-Foot Diameter Sanitary Sewer Manholes
    - b. Item A-4b 5-Foot Diameter Sanitary Sewer Manholes
  - 2. Item A-4a, 4-Foot Diameter Sewer Manholes:
    - 1. Under the unit price bid, the Contractor shall furnish and install 4foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or riser rings under frames. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit price for this Item.
    - b. Measurement for payment will be by the vertical foot from the invert of the manhole at its center to the existing ground elevation prior to excavation.
  - 3. Item A-4b, 5-Foot Diameter Sewer Manholes:
    - a. Under the unit price bid, the Contractor shall furnish and install 5foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or riser rings under frames. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone
bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit price for this Item.

- b. Measurement for payment will be by the vertical foot from the invert of the manhole at its center to the existing ground elevation prior to excavation.
- E. Item A-5, Constructing Sewer Force Mains:
  - 1. Bid Item A-5a, & A-5b consist of the following Bid Items:
    - a. Item A-5a 12" PVC Sanitary Sewer Force Main
    - b. Item A-5b Force Main Air Release Valve Manhole
  - 2. The Measurement and Payment of Bid Item A-5a & A-5b shall be as described in the following paragraphs:
    - a. The unit prices for Item A-5a shall constitute full compensation for constructing sewer force mains. The unit prices shall include furnishing and installing sewer force mains, bends, and fittings at each vertical and horizontal change in direction; testing of the completed force main as specified. The unit prices shall include furnishing and installing restrained caps and plugs at the ends of sewer force mains constructed for future use, as specified. The unit price shall also include all labor and materials required to make all required transition couplings between the sewers of different materials, classes, nominal diameters, restrained joints; provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt;; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under Item 14); furnish and place 3/4-inch crushed stone bedding; install pipe insulation, where indicated on Drawings; filter fabric; restore the trench surface to grade including, furnishing, backfilling, and

compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- b. Material excavated outside of the pay limits indicated on the Contract Drawings shall be done at the Contractor's expense, at no additional cost to the Owner.
- c. Measurement for payment for Item A-5a will be by the linear foot of force mains installed as measured by the Engineer along the horizontal projection to ground surface of the centerline of the completed force main. The length of force main that resides within the Pay Limits for Bid Items A-2, & A-3 shall be paid for within those individual Bid Items.
- d. Under the unit prices for Item A-5b, the Contractor shall furnish and install 5-foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or riser rings under frames, manhole boots, air release mechanism, pipe supports. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit price for this Item.
- e. Measurement for payment for Items A-5b shall be for each structure installed and approved by the Engineer.
- F. Item A-6, Constructing Sanitary Sewer Services:
  - Under the unit price bid for Item A-6, the Contractor shall furnish and install 6- and 8-inch PVC property service connections from the sewer main to the property line as shown on the drawings or as directed by the engineer. This

unit price bid item shall provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill: removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and install sewer service connection between the sewer main and property line, including connecting pipe to Y-branch or chimney on sewer main: furnish and install transition couplings as necessary including at connections to existing sewer services; installation of a cap on the end of the pipe at the property line, survey and record location of the end of the service on as-built drawings: furnish and install a house connection marker at the end of the service; furnish and place 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, restore the trench surface to grade including, furnishing, backfilling, and compacting; install pipe insulation, where indicated on Drawings; compaction testing; furnish and place 12inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- 2. Measurement for payment will be on the basis of length of pipe installed. Length will be measured from the centerline of the sewer main to the end cap, along the horizontal projection of the centerline of the pipe.
- G. Item A-7, Utility Support and Coordination:
  - 1. Payment for Utility Support and Coordination will be based on the bid for this item in the proposal. Under the lump sum bid for this item, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required to maintain continuity of storm drains, sanitary sewers, gas,

telephone, electric, telecommunications, cable TV, water, and all privately owned utilities. The work includes all service, trunk, supply, transmission, and main lines impacted by the work. Under the lump sum bid for this item, the Contractor shall also furnish all labor, materials, tools, equipment and incidentals to coordinate and/or temporarily support all utility poles required to facilitate the excavation and for the installation of the Work; submission of all utility coordination and support work plans and shop drawings; coordinate the protection of and protect all overhead utilities; and perform all coordination with the utility companies for the relocation, protection, support, and other work required to facilitate the completion of the project. This Item further includes utility location (Dig Safe); coordination of construction with existing utility owners and operators; providing access for utility owners and operators to their respective utilities; and communicating with affected homeowners and residents.

- 2. Measurement for payment for Utility Support and Coordination shall be on a percent of the lump sum complete, as determined by the Contractor's approved Schedule of Values for this item.
- 3. Note that the Engineer is not specifically dictating what methods to use for protection and coordination of existing utilities. Therefore, the Contractor's bid amount under this item is what will ultimately be paid and Contractor shall not have a claim for additional compensation.
- H. Item A-8, Exploratory Excavations:
  - 1. Under the unit price bid, the Contractor shall excavate and backfill as necessary and as approved by the Engineer to locate pipe, utilities, foundations, and possible obstructions. Included under the unit price is payment for traffic management devices, excavation and backfill, dewatering, wetlands protection, erosion and sedimentation control, compaction, furnishing and placing 12-inch gravel sub-base under paved areas, landscaping restoration, restoring pavement, and all labor, services and equipment necessary for exploratory excavations.
  - 2. Measurement for payment will be based on the actual cubic yards of material excavated, as measured and approved by the engineer.
- I. Item A-9, Rock Excavation:
  - a. Under the unit price bid, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required for the Contractor to excavate, remove, and dispose of rock from trenches and excavated areas. Included in the price bid per cubic yard shall be related costs such as pre-blast surveys completed (whether by Contractor or by Engineer's direction), compliance with permit conditions, drilling, blasting, and replacement with suitable material per the Typical Trench Detail, and transportation and disposal of

materials.

- b. The unit price bid for this item shall be in addition to the cost of excavating earth, and no deduction will be made in the amount for earth excavation.
- c. Measurement for payment will be on the basis of cubic yards of rock excavated, removed and disposed of within the Pay Limit, as measured by the Engineer in-place prior to removal. Depth of rock in pipe trenches will be measured from the rock surface to 6-inches below the invert of the pipe and the maximum width shall be determined as outlined on the Typical Trench Detail. Any rock excavated to a depth or width greater than the above shall be removed and disposed of from the site and its remaining void shall be backfilled with suitable material per the Typical Trench Detail at the Contractor's expense. The pay limit width for rock removal outside manholes and pump station wet wells will be one foot outside the widest dimension of the structure or shall be the maximum trench width, whichever is greater. The pay limit for depth of rock removal outside manholes and wet wells shall 1-foot below the bottom of the structure.
- d. Any rock excavated to a depth or width greater than that as shown on the Drawings, as directed by the Engineer or herein specified shall not be paid for and shall be backfilled with suitable material per the Typical Trench Detail at the Contractor's expense.

The unit price for Item A-9 shall be fixed and shall apply to all rock excavation eligible for payment on the project.

- J. Item A-10, Excavation of Unsuitable Material Below Grade:
  - 1. Under the unit price bid for this Item, the Contractor shall remove clay or other unsuitable material below the grade of the pipe, when and as directed by the Engineer; load, transport, and legally dispose of such material; furnish and place approved common fill in the place of material removed; furnish and place approved filter fabric material in perimeter of the trench as shown on the trench detail.
  - 2. Measurement for payment will be on the basis of cubic yards of material excavated within the authorized width and depth limits of unsuitable material in pipe trenches, as measured by the Engineer. The authorized depth shall be measured from 6-inches below the invert of the pipe to a maximum depth of 3-feet below the invert of the pipe. The authorized width of unsuitable material and replacement shall be as measured by the Engineer, but shall not exceed 3-feet in width.
- K. Item A-11, Removal of Abandoned 39" PCCP Water Aqueduct:
  - 1. Bid Item A-11a, & A-11b consist of the following Bid Items:

- a. Item A-11a Removal of Abandoned 39" PCCP Water Aqueduct Short Sections
- b. Item A-11b Removal of Abandoned 39" PCCP Water Aqueduct Long Sections
- 2. For Item A-11a, under this unit price bid, the Contractor shall furnish all labor, tools, materials, and equipment to properly remove and abandon short sections of the 39" PCCP water aqueduct pipeline and bulkhead the ends in order to allow new pipe installation.
- 3. For Item A-11b, under this unit price bid, the Contractor shall furnish all labor, tools, materials, and equipment to properly remove and abandon long sections of the 39" PCCP water aqueduct pipeline and bulkhead the ends in order to allow new pipe installation.
- 4. For Item A-11a, measurement for removal and disposal of water aqueduct including bulkheading will be made on the basis of each location and approved by the Engineer.
- 5. For Item A-11b, measurement for removal and disposal of water aqueduct including bulkheading will be on the basis of linear feet measured in place by the Engineer.
- 6. Work includes excavation, backfill, dewatering, shoring, saw cutting, removal, and disposal of the pipe section as well as bulkheading the pipe ends with concrete or brick and mortar to prevent the entrance of soil into the pipe. Pipe installation shall be paid under the appropriate bid items.
- L. Item A-12, Miscellaneous Concrete:
  - 1. Under the unit price bid, the Contractor shall furnish and place concrete for encasements, cradles, and at other miscellaneous locations. Included in this cost will be excavation and backfill, formwork, tie-rods, reinforcing steel and all materials, equipment and services necessary to satisfactorily place concrete. Concrete used for the encasement of drop inlets, chimneys, and sidewalk and driveway replacement for sewer construction and house connections is included under other items and is not included for payment under this Item.
  - 2. Measurement for payment will be on the basis of cubic yards measured in place by the Engineer.
- M. Item A-13, Pavement:
  - 1. Bid Items A-13a, A-13b, A-13c and A-13d consists of the following Bid Items:

- a. Item A-13a Temporary Pavement (3")
- b. Item A-13b Permanent Pavement on State Roads (7")
- c. Item A-13c Mill & Overlay Pavement on State Roads (2")
- d. Item A-13d Permanent Pavement on Town Roads (2")
- 2. Item A-13a, Temporary Pavement (3")
  - a. Temporary pavement shall be installed where directed by the Engineer, and in accordance with the MassDOT permit for State Roads in the MassDOT right of way and Town roads. The quantities of temporary pavement to be measured for payment under this Item will be measured by the actual tonnage of pavement delivered and installed less the quantity placed beyond specified thickness or outside the specified payment limits. Payment limit will be measured along the centerline of the new sewer including service trench paving measured from the edge of the main line paving to the edge of the existing pavement. Paving for the sidewalk and driveway restoration is paid for under the pipe and service bid items.
  - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.
  - c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
  - d. The temporary trench paving in town roads shall be left in place permanently.
- 3. Item A-13b, Permanent Pavement on State Roads (7" Thickness)
  - a. Permanent pavement shall be installed where directed by the Engineer in accordance with the MassDOT permit. The quantities of permanent pavement to be measured for payment under the

appropriate subdivisions of this Item will be measured by the actual tonnage of pavement delivered less the quantity placed beyond specified thickness or outside the payment limits. Payment limit will be measured along the centerline of the new sewer including service trench paving measured from the edge of the main line paving to the edge of the existing pavement. Payment for sidewalk and driveway restoration is paid for under the pipe and service bid items.

- b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.
- c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- 4. Item A-13c, Mill & Overlay Pavement on State Roads (2")
  - a. Milling and overlay pavement shall be installed where directed by the Engineer in accordance with the MassDOT permit. The unit price for this Bid Item will constitute full compensation for milling and overlay pavement as described in the Contract Documents or as directed by the Engineer. Under the unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide traffic control devices; mill 2" depth of existing pavement placed under this Item; install hot mix asphalt to the depth and width indicated within the payment limits, complete, as shown in the Contract Documents or at the direction of the Engineer. The work includes, but is not limited to the following; raising and resetting existing structures, including those that are currently paved over; installation and compaction of bituminous concrete top course to the depth and width and in the area specified; hand placement and compaction of bituminous concrete around structures, aprons, driveways and as directed; compaction testing; power sweeping; saw cutting pavement for

keyways and other jointing between new and existing asphalt; placing loam and seed along pavement edges (without curbs); furnish and place tack coat on all edges and over existing pavements; furnishing and applying all pavement markings; installing electrical wire and cable for traffic signals to restore preconstruction conditions, and all incidental work not included for payment elsewhere, and providing a three-year guarantee.

- b. Measurement for payment will be the actual tons of overlay pavement delivered and properly placed and compacted. Additional payment will not be made for any paving that the Contractor has already installed, such as at service wyes.
- 5. Item A-13d, Permanent Pavement Overlay on Town Roads (2" Thickness)
  - a. Permanent pavement overlay (2 inches) shall be installed outside of the MassDOT right of way limits, where directed by the Engineer. The quantities of permanent pavement to be measured for payment under the appropriate subdivisions of this Item will be measured by the actual tonnage of pavement delivered less the quantity placed beyond specified thickness or outside the payment limits. Payment limit will be five (5) feet beyond the end of the service trenches.
  - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.
  - c. Included for payment under this Item is overlay paving and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- N. Item A-14, Roadway Concrete Slab Removal:
  - 1. Under the unit price bid, the Contractor shall remove and dispose of portions or whole segments of reinforced concrete roadway slabs.

Included in this cost will be excavation and backfill, disposal, equipment and services necessary to remove and dispose of concrete slabs.

- 2. Measurement for payment will be on the basis of cubic yards measured in place by the Engineer up to the maximum width indicated on the drawings. The asphalt on top of the concrete slabs shall be paid for under the pipe bid items.
- 3. Adjust service locations in the field as needed to minimize the removal of the existing concrete slab roadway underneath the surface asphalt. Where feasible, contractor shall align services with the edges of the existing concrete roadway slabs and avoid leaving small section s of floating concrete slabs disconnected from the original concrete slab.
- O. Item A-15, Police Details Allowance:
  - 1. Under this allowance, the Contractor shall provide police details as warranted to complete the Work in the Contract. This allowance shall only be used for the direct payments to the Police Department for the police detail. Allowance does not include payment for administrative coordination and scheduling of police detail for traffic control.
  - 2. Contractor to schedule all traffic control details through the Police Department or the Massachusetts State Police. All invoices will be sent to the Contractor who shall pay them directly.
  - 3. Contractor shall be responsible for developing a police detail schedule. Schedule to be pre-approved by the Owner. All time in excess of 8 hours per day of construction shall be pre-approved by the Owner. Contractor will be responsible to pay for any police details that have not been preapproved without compensation by the Owner.
  - 4. The Contractor shall provide documentation such as police detail invoices with Contractor's application for payment to receive reimbursement for police costs.
  - 5. The cost of police details ordered by the Contractor but not utilized due to cancellation of work crews shall be the responsibility of the Contractor and not paid under this item.
  - 6. Markups on the cost of police details will not be allowed.
  - 7. The Contractor will be paid at the actual hourly rate charged by the Police Department and shall make payment to the Police Department within five days of receipt of payment from the Owner.
- P. Item A-16, Unforeseen Conditions Allowance:

- 1. The allowance price for this item established in the Bid is an estimated figure to facilitate comparison of bids. The intent of this bid item is to compensate the contractor for unforeseen conditions that may occur during the project, not including non-qualifying costs.
- 2. For the purposes of this item, non-qualifying costs shall be defined as those costs incurred as a result of non-reimbursable costs, delays caused by the Contractor, or the need for emergency repairs as caused by the Contractor's own actions, means and methods. Non-qualifying costs shall be paid by the Contractor and shall not be reimbursed by the Owner.
- 3. Compensation under this allowance bid item shall be determined in accordance with Article 12 of the General Conditions.
- Q. Item A-17, Traffic Management:
  - 1. Measurement for payment shall be based on a lump sum. Contractor shall furnish all safety signing fabricated and furnished as indicated by the Contract Documents and the MassDOT permit, and approved or requested by the Owner, and/or Engineer and as measured by the Engineer. Additionally, this item includes Variable Message Board(s) as may be required by MassDOT.
- R. Item A-18, 100-pound Bags of Calcium Chloride:
  - 1. The unit price bid shall be considered full compensation for all labor, materials, equipment and incidental work required for application of calcium chloride.
  - 2. Calcium chloride will be measured as the actual number of 100-pound bags, or major fraction thereof, applied to the site as recorded by the Engineer. Dust control by use of water is considered to be incidental to the work and included in other bid items and described herein.
- S. Item A-19, Hydrants (new):
  - 1. Payment for furnishing and installing hydrants will be made for each installed under this Item. Payment will also be considered full compensation for furnishing all labor, equipment, and materials required for excavation and backfill, placing drain stone, pressure testing, disinfection, removal of excess excavated material, clean up and all else incidental thereto for the satisfactory completion of the work. All valve 6-inch gate valves and boxes, 6-inch DI pipe, couplings, and mechanical joint restraints required for hydrant installation will be included for payment under their respective Items.
  - 2. The cost of making connections to existing mains, and the cost of joint

restraints, tapping sleeve on the existing main, blind flanges, valve boxes, couplings and concrete backing shall be considered incidental to the cost of this bid item.

- 3. This item shall also include payment for furnishing safety flange repair kits, and furnishing and installing hydrant extension kits. Payment will be considered full compensation for furnishing all labor, equipment, and materials and appurtenances, and the cost of all labor and materials required to install the safety flange repair and extension kits where directed by the Engineer.
- T. Item A-20, Water Services:
  - 1. Under the unit price bid for Item A-20, the Contractor shall furnish and install new water service connections from the water main to locations indicated in the contract drawings. Payment for Water Services will be based on the per linear foot unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new water services at locations indicated on the drawings, at all depths, complete from the water main to the property line as shown on the Contract Drawings, or as required by the Engineer. The work shall include, but is not limited to furnishing, installing, and/or performing the following: tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway/sidewalks for trenches; removal and disposal of surface asphalt; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); survey and record location of the end of the service on as-built drawings; furnish and install a house connection marker at the end of the service; furnish and place 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, restore the trench surface to grade including, furnishing, backfilling, and compacting; install pipe insulation, where indicated on Drawings; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed pipe; removal of groundwater from the trench; handling

groundwater recharged back to the soil; water service pipe, fittings, couplings, adapters, appurtenances, curb stops, corporation stops, extension tubing, surface access boxes, and joints; connections to existing and proposed pipes; flushing/cleaning and testing; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of asphalt and concrete sidewalk and driveways; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; restoration of private property clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- 2. Measurement for payment for Water Service will be based on the actual linear feet of service pipe installed, tested, and accepted, at all depths, and the actual number of connections to existing completed and accepted complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the service from the main to the property line.
- U. Item A-21, Constructing Water Mains:
  - 1. Bid Items A-21a, A-21b, and A-21c consists of the following Bid Items:
    - a. Item A-21a 6" DI Water Main
    - b. Item A-21b 8" DI Water Main
    - c. Item A-21c 12" DI Water Main
  - 2. Under the unit prices for this item, the Contractor shall furnish all labor, equipment, materials, tools and services for furnishing and installing water main pipe. The unit prices shall also include all labor and materials required to make connections to existing mains and hydrants where required; couplings not included for payment elsewhere; fittings, valves and all services and appurtenances within proposed trench limits and as shown on Contract Documents; furnishing and installing Utility Marker Tape; leakage testing of the completed water main; tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt

on top of concrete slabs; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; provide and install select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and place 3/4-inch crushed stone bedding; filter fabric; install pipe insulation, where indicated on Drawings; restore the trench surface to grade including, furnishing, backfilling, and compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; lean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- 3. The unit prices shall also include pressure testing; disinfection as specified; sampling; laboratory analyses; returning physical features to their original condition; clean up; and all else incidental thereto, for which separate payment is not provided under other items in the Bid Proposal.
- 4. Water main pipe will be measured for payment by the linear foot of water main installed, complete and accepted in place. Measurement will be along the water main centerline without deduction for valves and fittings. Hydrant branch lines will be measured from the center of the main line tee to the centerline of the hydrant.
- V. Item A-22, Fittings, Couplings, and Restraints
  - 1. Bid Items A-22a, A-22b consist of the following Bid Items:
    - a. Item A-22a Fittings and Couplings
    - b. Item A-22b Restraints
  - 2. The unit price bid for Item A-22a shall be considered full compensation for furnishing all labor, equipment, materials and services for the satisfactory completion of the work.
  - 3. Measurement of payment for Item A-22a including fittings, including solid sleeves and couplings, will be measured for payment by the

pound actually installed in the completed project and accepted by the Engineer. Weight shall be based upon manufacturer catalog data and shipping weight slips furnished from the supplier to the Contractor. No payment will be allowed for weight of cement linings. No payment will be allowed for standard mechanical joint glands and accessories that are not used due to installation of restrained joints.

- 4. The number of mechanical and push on restrained joints to be paid for under Item A-22b will be the number of restraints installed and accepted by the Engineer. Restraints installed for Contractor convenience shall not be paid for under this Item but are included for payment under the applicable division of Item A-21 of the proposal. Payment shall include costs of all labor and materials required for installing restrained joints. No additional payment will be made for restrained joints. Payment for furnishing and installing additional fittings required to do the work shall be paid for under the unit price bid in Item A-22a.
- W. Item A-23, Water Valves and Boxes
  - 1. Bid Items A-23a, A-23b, and A-23c consist of the following Bid Items:
    - a. Item A-23a -6" Gate Valve and Gate Box
    - b. Item A-23b 8" Gate Valve and Gate Box
    - c. Item A-23c 12" Gate Valve and Gate Box
  - 2. The unit prices bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work.
  - 3. Measurement for payment for furnishing and installing valves with boxes will be made for each installed under these items.
- X. Item A-24, Water Main Manual Air Release Valve
  - 1. The unit prices bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work. This item includes the valve, standpipe, piping, handle, cap, and gate valve frame and cover as indicated on the Contract Drawings.
  - 2. Measurement for payment for furnishing and installing valves with boxes will be made for each installed under these items.
- Y. Item A-25, Water Main Blow Off Connection
  - 1. The unit prices bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or

incidental for the satisfactory completion of the work. This item includes the check valve, coring, corporation stop, precast meter pit with frame and cover, flow meter, bed fittings, roadway box, and piping as indicated on the Contract Drawings.

- 2. Measurement for payment for furnishing and installing valves with boxes will be made for each installed under these items.
- Z. Item A-26, Pressure Reducing Valves and Access Vault
  - 1. The lump sum price bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work. This item includes a precast concrete vault, watertight access hatch, tees, fittings, pipe, joints, wall sleeves, pipe connectors, pressure reducing valves, reducers, and pipe supports as indicated on the Contract Drawings.
  - 2. Measurement for payment for furnishing and installing pressure reducing valves within a precast vault will be made for lump sum under this item.

## 1.6 ALTERNATE BID B ITEM DESCRIPTIONS

- A. Item B-1, Mobilization/Demobilization (up to 5% of the total bid for Alternate B bid items):
  - 1. Under the lump sum price bid for this item, the Contractor shall move his equipment to and from the site and prepare to begin construction and perform final site cleanup. This shall also include providing temporary facilities and utilities necessary for the resident engineer.
  - 2. Mobilization costs are the costs of initiating the Contract, exclusive of the cost of materials. Costs shall also include acquisition of permits, permit fees, project signs and all other related project costs.
  - 3. Traffic Management is to be paid for under the Traffic Management bid item. Police Details shall be paid for by the Contractor under the associated allowance bid item.
  - 4. Payment for mobilization will be at the lump sum price bid for this item and will be limited to 75% of the lump sum amount of this item until the work is complete and the contractor has completely demobilized. The initial payment of 75% mobilization costs shall be payable when the Contractor is operational on site. Operational shall mean the substantial commencement of work on site, not prior to commencement. The lump sum price bid for mobilization/ demobilization shall not exceed 5 percent of the total of all items excluding this item.

- B. Item B-2, Constructing Sewer Pump Stations (1115 State Road):
  - 1. The Measurement and Payment of Bid Items B-2, shall be as described in the following paragraphs:
    - The lump sum price will constitute full compensation for all labor, a. materials, tools, and equipment necessary for the Contractor to complete, furnish, and install the following: pavement removal and disposal; tree, plant and shrub clearing and grubbing; stripping and stockpiling; removal of existing fences or gates; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations: provide dust control measures: straw wattles/bales and all other erosion and sedimentation control devices; wetland and tree protection; traffic management devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; pre-construction photographs and/or video; excavation and backfill; material handling and stockpiling; disposal of surplus material; furnish and install the precast concrete wet well, including cast-in-place concrete mats and access manways; leakage test of wet well (using same procedure as for leakage testing sewer manholes): furnish and install the complete, pre-engineered, pre-fabricated pump station including new pumps, motors and VFD drives (if required), interconnecting piping, control valves, isolation valves, fittings, instruments, control panel, lighting, alarm systems, remote alarm transmission, and other equipment and appurtenances, within a manufacturer-supplied enclosure; materials and installation of items to ensure floodproofing of the installed station and equipment including raised equipment, concrete pads, access stairs, and items to maintain water tightness of station and prevent groundwater or flood water infiltration; flow measurement system; furnish and install the pump station bypass and drain infrastructure, complete and functional, as detailed on the Drawings; provide spare parts as specified; furnish and install external connecting piping and manholes to the influent sewers and force main to make a complete working installation; furnish and install flow meter vault per Drawings, furnish and install force main, bends, fittings, and restrained joints; coordinate and make the connection of the proposed force main to the existing force main including but not limited to cutting and disassembling the existing force main, bypass pumping, and coordinating with other active pump stations; furnish and install gravity sewer and sewer manholes, including connections to sewers or manholes, bedding material, and filter fabric; leakage testing of the completed sewer; furnishing and placing the compacted gravel base on backfilled trenches; coordinate work with utility companies, including payment of required utilities fees; install and connect all utilities and appurtenances as required and as shown in the drawings; furnish and install complete and functional control panel and standby generator system, including cast-in-place concrete pads, generator and control equipment, and all associated conduit and wiring;

test station, and all components; train Owner's personnel on operation and maintenance; provide operation and maintenance manuals; clean inside of enclosure and wet well; provide site paving, site grading, curb cuts; remove temporary site fencing; provide fencing, landscaping, including loam and seed, provide access driveway; and provide all other items of work incidental to the Pump Station work, complete as specified and not included for payment under other bid items.

- b. The cost of all force main, gravity sewer and manhole(s) and all other miscellaneous work within the Limits of Work is also included in the price bid under this Bid Item.
- c. The entire cost to provide power to the pump station shall be included in this lump sum bid item regardless if physical work to do so lies beyond the Limit of Work shown on the Drawings.
- d. The limit of payment under this Bid Item shall be as defined on the Construction Drawings as the Limit of Work. Unless noted otherwise, work outside the identified Limit of Work shall be paid for under other Bid Items.
- e. This bid item explicitly does not include the cost for rock removal. Rock removal costs associated with installing the pump stations shall be covered under the appropriate bid item.
- f. Measurement and payment for the length of gravity sewer and force main that resides within the Pay Limits for Bid Items B-2 shall be paid for within these respective Bid Items.
- g. Measurement for payment will be on the basis of percentage of work completed.
- C. Item B-3, Constructing Sanitary Gravity Sewers:
  - 1. Bid Items B-3a, B-3b, B-3c B-3d, and B-3e consists of the following Bid Items:
    - a. Item B-3a 8" PVC Sanitary Sewer Gravity Pipe
    - b. Item B-3b 12" PVC Sanitary Sewer Gravity Pipe
    - c. Item B-3c 15" PVC Sanitary Sewer Gravity Pipe (<12' Deep)
    - d. Item B-3d 15" PVC Sanitary Sewer Gravity Pipe (>12' Deep)
    - e. Item B-3e Sanitary Sewer Gravity Chimneys
  - 2. The Measurement and Payment of Bid Items A-3a, A-3b, A-3c, A-3d, and A-3e, shall be as described in the following paragraphs:
    - a. The unit prices for constructing gravity sewers will constitute full compensation for all labor, materials, tools, and equipment necessary

for the Contractor to furnish and install the following: Provide labor and materials required to furnish and install gravity sewer pipe, fittings, wyes, tee branches and make all required transitions between sewers of different materials, classes, nominal diameters, and restrained joints; provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt on top of concrete slabs; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; provide and install select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and place 3/4-inch crushed stone bedding; filter fabric; install pipe insulation, where indicated on Drawings; restore the trench surface to grade including, furnishing, backfilling, and compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- b. Measurement for payment under the appropriate subdivision of this Item shall be measured by the linear foot along the horizontal projection of the centerline of the completed sewer from the center of manhole to the center of manhole. Depth of pipe will be measured from the top of existing grade at the centerline prior to excavation, to the invert of the pipe. The lengths of gravity sewer that resides with the Pay Limits for Bid Items B-2 shall be paid for within those individual Bid Items.
- c. For Item B-3e, Contractor shall furnish and install chimneys

including pipe, fittings, and stone or concrete encasement as shown in the Contract Drawings.

- d. Measurement and payment for Item B-3e be shall be for each chimney installed and approved by the Engineer.
- D. Item B-4, Constructing Sewer Manholes:
  - 1. Item B-4, 4-Foot Diameter Sewer Manholes:
    - a. Under the unit price bid, the Contractor shall furnish and install 4foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or riser rings under frames. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit price for this Item.
    - b. Measurement for payment will be by the vertical foot from the invert of the manhole at its center to the existing ground elevation prior to excavation.
- E. Item B-5, Constructing Sewer Force Mains:
  - 1. Bid Item B-5a, & B-5b consist of the following Bid Items:
    - a. Item B-5a 8" PVC Sanitary Sewer Force Main
    - b. Item B-5b Force Main Air Release Valve Manhole
  - 2. The Measurement and Payment of Bid Item B-5a & B-5b shall be as described in the following paragraphs:
    - a. The unit prices for Item B-5a shall constitute full compensation for constructing sewer force mains. The unit prices shall include furnishing and installing sewer force mains, bends, and fittings at each vertical and horizontal change in direction; testing of the completed force main as specified. The unit prices shall include furnishing and installing restrained caps and plugs at the ends of sewer force mains constructed for future use, as specified. The unit price shall also include all labor and materials required to make all required transition couplings between the sewers of different materials, classes, nominal diameters, restrained joints; provide all

labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt;; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill: removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under Item 14); furnish and place 3/4-inch crushed stone bedding; install pipe insulation, where indicated on Drawings; filter fabric; restore the trench surface to grade including, furnishing, backfilling, and compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- b. Material excavated outside of the pay limits indicated on the Contract Drawings shall be done at the Contractor's expense, at no additional cost to the Owner.
- c. Measurement for payment for Item B-5a will be by the linear foot of force mains installed as measured by the Engineer along the horizontal projection to ground surface of the centerline of the completed force main. The length of force main that resides within the Pay Limits for Bid Items B-2, & B-3 shall be paid for within those individual Bid Items.
- d. Under the unit prices for Item B-5b, the Contractor shall furnish and install 5-foot diameter manholes of reinforced precast concrete sections, complete, including concrete bases, riser sections, cones or top slabs, brick invert, landing platforms, steps, standard and/or watertight frames and covers, inside drops, pipe sleeves and brick or

riser rings under frames, manhole boots, air release mechanism, pipe supports. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, connecting sewer piping, furnishing and applying dampproofing, testing for leakage, clean up and raising manholes to grade under the unit price for this Item.

- e. Measurement for payment for Items B-5b shall be for each structure installed and approved by the Engineer.
- F. Item B-6, Constructing Sanitary Sewer Services:
  - a. Under the unit price bid for Item B-6, the Contractor shall furnish and install 6- and 8-inch PVC property service connections from the sewer main to the property line as shown on the drawings or as directed by the engineer. This unit price bid item shall provide all labor and materials required for tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and install sewer service connection between the sewer main and property line, including connecting pipe to Y-branch or chimney on sewer main; furnish and install transition couplings as necessary including at connections to existing sewer services; installation of a cap on the end of the pipe at the property line, survey and record location of the end of the service on as-built drawings; furnish and install a house connection marker at the end of the service; furnish and place 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, restore the trench surface to grade including, furnishing, backfilling, and compacting; install pipe insulation, where indicated on Drawings; compaction testing; furnish and place 12-inches of

compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

- 2. Measurement for payment will be on the basis of length of pipe installed. Length will be measured from the centerline of the sewer main to the end cap, along the horizontal projection of the centerline of the pipe.
- G. Item B-7, Utility Support and Coordination:
  - 1. Payment for Utility Support and Coordination will be based on the bid for this item in the proposal. Under the lump sum bid for this item, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required to maintain continuity of storm drains, sanitary sewers, gas, telephone, electric, telecommunications, cable TV, water, and all privately owned utilities. The work includes all service, trunk, supply, transmission, and main lines impacted by the work. Under the lump sum bid for this item, the Contractor shall also furnish all labor, materials, tools, equipment and incidentals to coordinate and/or temporarily support all utility poles required to facilitate the excavation and for the installation of the Work; submission of all utility coordination and support work plans and shop drawings; coordinate the protection of and protect all overhead utilities; and perform all coordination with the utility companies for the relocation, protection, support, and other work required to facilitate the completion of the project. This Item further includes utility location (Dig Safe); coordination of construction with existing utility owners and operators; providing access for utility owners and operators to their respective utilities; and communicating with affected homeowners and residents.
  - 2. Measurement for payment for Utility Support and Coordination shall be on a percent of the lump sum complete, as determined by the Contractor's approved Schedule of Values for this item.
  - 3. Note that the Engineer is not specifically dictating what methods to use for protection and coordination of existing utilities. Therefore, the Contractor's bid amount under this item is what will ultimately be paid and Contractor shall not have a claim for additional compensation.

- H. Item B-8, Exploratory Excavations:
  - 1. Under the unit price bid, the Contractor shall excavate and backfill as necessary and as approved by the Engineer to locate pipe, utilities, foundations, and possible obstructions. Included under the unit price is payment for traffic management devices, excavation and backfill, dewatering, wetlands protection, erosion and sedimentation control, compaction, furnishing and placing 12-inch gravel sub-base under paved areas, landscaping restoration, restoring pavement, and all labor, services and equipment necessary for exploratory excavations.
  - 2. Measurement for payment will be based on the actual cubic yards of material excavated, as measured and approved by the engineer.
- I. Item B-9, Rock Excavation:
  - a. Under the unit price bid, the Contractor shall furnish all labor, materials, tools, equipment and incidentals required for the Contractor to excavate, remove, and dispose of rock from trenches and excavated areas. Included in the price bid per cubic yard shall be related costs such as pre-blast surveys completed (whether by Contractor or by Engineer's direction), compliance with permit conditions, drilling, blasting, and replacement with suitable material per the Typical Trench Detail, and transportation and disposal of materials.
  - b. The unit price bid for this item shall be in addition to the cost of excavating earth, and no deduction will be made in the amount for earth excavation.
  - c. Measurement for payment will be on the basis of cubic yards of rock excavated, removed and disposed of within the Pay Limit, as measured by the Engineer in-place prior to removal. Depth of rock in pipe trenches will be measured from the rock surface to 6-inches below the invert of the pipe and the maximum width shall be determined as outlined on the Typical Trench Detail. Any rock excavated to a depth or width greater than the above shall be removed and disposed of from the site and its remaining void shall be backfilled with suitable material per the Typical Trench Detail at the Contractor's expense. The pay limit width for rock removal outside manholes and pump station wet wells will be one foot outside the widest dimension of the structure or shall be the maximum trench width, whichever is greater. The pay limit for depth of rock removal outside manholes and wet wells shall 1-foot below the bottom of the structure.
  - d. Any rock excavated to a depth or width greater than that as shown on the Drawings, as directed by the Engineer or herein specified shall not be paid for and shall be backfilled with suitable material per the Typical Trench Detail at the Contractor's expense.
  - e. The unit price for Item A-9 shall be fixed and shall apply to all rock

excavation eligible for payment on the project as described in paragraphs a through d above.

- J. Item B-10, Excavation of Unsuitable Material Below Grade:
  - 1. Under the unit price bid for this Item, the Contractor shall remove clay or other unsuitable material below the grade of the pipe, when and as directed by the Engineer; load, transport, and legally dispose of such material; furnish and place approved common fill in the place of material removed; furnish and place approved filter fabric material in perimeter of the trench as shown on the trench detail.
  - 2. Measurement for payment will be on the basis of cubic yards of material excavated within the authorized width and depth limits of unsuitable material in pipe trenches, as measured by the Engineer. The authorized depth shall be measured from 6-inches below the invert of the pipe to a maximum depth of 3-feet below the invert of the pipe. The authorized width of unsuitable material and replacement shall be as measured by the Engineer, but shall not exceed 3-feet in width.
- K. Item B-11, Removal of Abandoned 39" PCCP Water Aqueduct:
  - 1. Bid Item B-11a, & B-11b consist of the following Bid Items:
    - a. Item B-11a Removal of Abandoned 39" PCCP Water Aqueduct Short Sections
    - b. Item B-11b Removal of Abandoned 39" PCCP Water Aqueduct Long Sections
  - 2. For Item B-11a, under this unit price bid, the Contractor shall furnish all labor, tools, materials, and equipment to properly remove and abandon short sections of the 39" PCCP water aqueduct pipeline and bulkhead the ends in order to allow new pipe installation.
  - 3. For Item B-11b, under this unit price bid, the Contractor shall furnish all labor, tools, materials, and equipment to properly remove and abandon long sections of the 39" PCCP water aqueduct pipeline and bulkhead the ends in order to allow new pipe installation.
  - 4. For Item B-11a, measurement for removal and disposal of water aqueduct including bulkheading will be made on the basis of each location and approved by the Engineer.
  - 5. For Item B-11b, measurement for removal and disposal of water aqueduct including bulkheading will be on the basis of linear feet measured in place by the Engineer.
  - 6. Work includes excavation, backfill, dewatering, shoring, saw cutting,

removal, and disposal of the pipe section as well as bulkheading the pipe ends with concrete or brick and mortar to prevent the entrance of soil into the pipe. Pipe installation shall be paid under the appropriate bid items.

- L. Item B-12, Miscellaneous Concrete:
  - 1. Under the unit price bid, the Contractor shall furnish and place concrete for encasements, cradles, and at other miscellaneous locations. Included in this cost will be excavation and backfill, formwork, tie-rods, reinforcing steel and all materials, equipment and services necessary to satisfactorily place concrete. Concrete used for the encasement of drop inlets, chimneys, and sidewalk and driveway replacement for sewer construction and house connections is included under other items and is not included for payment under this Item.
  - 2. Measurement for payment will be on the basis of cubic yards measured in place by the Engineer.
- M. Item B-13, Pavement:
  - 1. Bid Items B-13a, B-13b, B-13c and B-13d consists of the following Bid Items:
    - a. Item B-13a Temporary Pavement (3")
    - b. Item B-13b Permanent Pavement on State Roads (7")
    - c. Item B-13c Mill & Overlay Pavement on State Roads (2")
    - d. Item B-13d Permanent Pavement on Town Roads (2")
  - 2. Item B-13a, Temporary Pavement (3")
    - a. Temporary pavement shall be installed where directed by the Engineer, and in accordance with the MassDOT permit for State Roads in the MassDOT right of way and Town roads. The quantities of temporary pavement to be measured for payment under this Item will be measured by the actual tonnage of pavement delivered and installed less the quantity placed beyond specified thickness or outside the specified payment limits. Payment limit will be measured along the centerline of the new sewer including service trench paving measured from the edge of the main line paving to the edge of the existing pavement. Paving for the sidewalk and driveway restoration is paid for under the pipe and service bid items.
    - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons

per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.

- c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- d. The temporary trench paving in town roads shall be left in place permanently.
- 3. Item B-13b, Permanent Pavement on State Roads (7" Thickness)
  - a. Permanent pavement shall be installed where directed by the Engineer in accordance with the MassDOT permit. The quantities of permanent pavement to be measured for payment under the appropriate subdivisions of this Item will be measured by the actual tonnage of pavement delivered less the quantity placed beyond specified thickness or outside the payment limits. Payment limit will be measured along the centerline of the new sewer including service trench paving measured from the edge of the main line paving to the edge of the existing pavement. Payment for sidewalk and driveway restoration is paid for under the pipe and service bid items.
  - b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.

- c. Included for payment under this Item is paving for the mainline and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- 4. Item B-13c, Mill & Overlay Pavement on State Roads (2")
  - a. Milling and overlay pavement shall be installed where directed by the Engineer in accordance with the MassDOT permit. The unit price for this Bid Item will constitute full compensation for milling and overlay pavement as described in the Contract Documents or as directed by the Engineer. Under the unit price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to provide traffic control devices; mill 2" depth of existing pavement placed under this Item; install hot mix asphalt to the depth and width indicated within the payment limits, complete, as shown in the Contract Documents or at the direction of the Engineer. The work includes, but is not limited to the following; raising and resetting existing structures, including those that are currently paved over; installation and compaction of bituminous concrete top course to the depth and width and in the area specified; hand placement and compaction of bituminous concrete around structures, aprons, driveways and as directed; compaction testing; power sweeping; saw cutting pavement for keyways and other jointing between new and existing asphalt; placing loam and seed along pavement edges (without curbs); furnish and place tack coat on all edges and over existing pavements; furnishing and applying all pavement markings; installing electrical wire and cable for traffic signals to restore preconstruction conditions, and all incidental work not included for payment elsewhere, and providing a three-year guarantee.
  - b. Measurement for payment will be the actual tons of overlay pavement delivered and properly placed and compacted. Additional payment will not be made for any paving that the Contractor has already installed, such as at service wyes.
- 5. Item B-13d, Permanent Overlay Pavement on Town Roads (2" Thickness)
  - a. Permanent pavement overlay (2 inches) shall be installed outside of the MassDOT right of way limits, where directed by the Engineer. The quantities of permanent pavement to be measured for payment under the appropriate subdivisions of this Item will be measured by the actual tonnage of pavement delivered less the quantity placed beyond specified thickness or outside the payment limits. Payment limit will be five (5) feet beyond the end of the service trenches.

- b. The Contractor shall submit to the Engineer weight slips for bituminous concrete delivered and placed. The Engineer will measure pavement placed within specified pay limits and multiply the area by the specified thickness by the coefficient of 0.0747 tons per cubic foot to obtain the tonnage of bituminous concrete. Payment will be made based on the number of tons obtained using the measured in place method or the weight slips, whichever is less. The required tonnage shall be determined by the following equation: (area of pavement, in square feet) x (required thickness, in feet) x (0.0747 tons per cubic foot). Limits of width will be measured as specified in the pavement detail. Extra compensation will not be made for tonnage placed in excess of the required tonnage.
- c. Included for payment under this Item is overlay paving and the services, labor, equipment and materials required to furnish, place and remove steel plates, replace pavement markings and/or adjust existing valve, gas and service boxes, castings and structures, not included for payment elsewhere, where required.
- N. Item B-14, Roadway Concrete Slab Removal:
  - 1. Under the unit price bid, the Contractor shall remove and dispose of portions or whole segments of reinforced concrete roadway slabs. Included in this cost will be excavation and backfill, disposal, equipment and services necessary to remove and dispose of concrete slabs.
  - 2. Measurement for payment will be on the basis of cubic yards measured in place by the Engineer up to the maximum width indicated on the drawings. The asphalt on top of the concrete slabs shall be paid for under the pipe bid items.
  - 3. Adjust service locations in the field as needed to minimize the removal of the existing concrete slab roadway underneath the surface asphalt. Where feasible, contractor shall align services with the edges of the existing concrete roadway slabs and avoid leaving small section s of floating concrete slabs disconnected from the original concrete slab.
- O. Item B-15, Police Details Allowance:
  - 1. Under this allowance, the Contractor shall provide police details as warranted to complete the Work in the Contract. This allowance shall only be used for the direct payments to the Police Department for the police detail. Allowance does not include payment for administrative coordination and scheduling of police detail for traffic control.
  - 2. Contractor to schedule all traffic control details through the Police

Department or the Massachusetts State Police. All invoices will be sent to the Contractor who shall pay them directly.

- 3. Contractor shall be responsible for developing a police detail schedule. Schedule to be pre-approved by the Owner. All time in excess of 8 hours per day of construction shall be pre-approved by the Owner. Contractor will be responsible to pay for any police details that have not been preapproved without compensation by the Owner.
- 4. The Contractor shall provide documentation such as police detail invoices with Contractor's application for payment to receive reimbursement for police costs.
- 5. The cost of police details ordered by the Contractor but not utilized due to cancellation of work crews shall be the responsibility of the Contractor and not paid under this item.
- 6. Markups on the cost of police details will not be allowed.
- 7. The Contractor will be paid at the actual hourly rate charged by the Police Department and shall make payment to the Police Department within five days of receipt of payment from the Owner.
- P. Item B-16, Unforeseen Conditions Allowance:
  - 1. The allowance price for this item established in the Bid is an estimated figure to facilitate comparison of bids. The intent of this bid item is to compensate the contractor for unforeseen conditions that may occur during the project, not including non-qualifying costs.
  - 2. For the purposes of this item, non-qualifying costs shall be defined as those costs incurred as a result of non-reimbursable costs, delays caused by the Contractor, or the need for emergency repairs as caused by the Contractor's own actions, means and methods. Non-qualifying costs shall be paid by the Contractor and shall not be reimbursed by the Owner.
  - 3. Compensation under this allowance bid item shall be determined in accordance with Article 12 of the General Conditions.
- Q. Item B-17, Traffic Management:
  - 1. Measurement for payment shall be based on a lump sum. Contractor shall furnish all safety signing fabricated and furnished as indicated by the Contract Documents and the MassDOT permit, and approved or requested by the Owner, and/or Engineer and as measured by the Engineer. Additionally, this item includes Variable Message Board(s) as may be

required by MassDOT.

- R. Item B-18, 100-pound Bags of Calcium Chloride:
  - 1. The unit price bid shall be considered full compensation for all labor, materials, equipment and incidental work required for application of calcium chloride.
  - 2. Calcium chloride will be measured as the actual number of 100-pound bags, or major fraction thereof, applied to the site as recorded by the Engineer. Dust control by use of water is considered to be incidental to the work and included in other bid items and described herein.
- S. Item B-19, Hydrants (new):
  - 1. Payment for furnishing and installing hydrants will be made for each installed under this Item. Payment will also be considered full compensation for furnishing all labor, equipment, and materials required for excavation and backfill, placing drain stone, pressure testing, disinfection, removal of excess excavated material, clean up and all else incidental thereto for the satisfactory completion of the work. All 6-inch gate valves and boxes, 6-inch DI pipe, couplings, and mechanical joint restraints required for hydrant installation will be included for payment under their respective Items.
  - 2. The cost of making connections to existing mains, and the cost of joint restraints, tapping sleeve on the existing main, blind flanges, valve boxes, couplings and concrete backing shall be considered incidental to the cost of this bid item.
  - 3. This item shall also include payment for furnishing safety flange repair kits, and furnishing and installing hydrant extension kits. Payment will be considered full compensation for furnishing all labor, equipment, and materials required for removing and disposing of existing fire hydrants and appurtenances, and the cost of all labor and materials required to install the safety flange repair and extension kits where directed by the Engineer.
- T. Item B-20, Water Services:
  - 1. Under the unit price bid for Item B-20, the Contractor shall furnish and install new water service connections from the water main to locations indicated in the contract drawings. Payment for Water Services will be based on the per linear foot unit price bid for this item in the proposal. Under the linear foot price for the item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new water services at locations indicated on the drawings, at all depths, complete from the water main to the property line as shown on the

Contract Drawings, or as required by the Engineer. The work shall include, but is not limited to furnishing, installing, and/or performing the following: tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway/sidewalks for trenches; removal and disposal of surface asphalt; removal and replacement of asphalt and concrete sidewalk and driveways: excavation and backfill of soils: material handling and stockpiling; removal and disposal of excess soil; select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); survey and record location of the end of the service on as-built drawings; furnish and install a house connection marker at the end of the service; furnish and place 3/4-inch crushed stone bedding; filter fabric; repair and/or relocation of any utility lines broken and/or conflicting with construction, restore the trench surface to grade including, furnishing, backfilling, and compacting; install pipe insulation, where indicated on Drawings; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed pipe; removal of groundwater from the trench; handling groundwater recharged back to the soil; water service pipe, fittings, couplings, adapters, appurtenances, curb stops, corporation stops, extension tubing, surface access boxes, and joints; connections to existing and proposed pipes; flushing/cleaning and testing; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of asphalt and concrete sidewalk and driveways; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; restoration of private property clean up and all other appurtenant materials and work incidental thereto and not specifically included for payment under other items.

3. Measurement for payment for Water Service will be based on the actual linear feet of service pipe installed, tested, and accepted, at all depths, and the actual number of connections to existing completed and accepted complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer along the centerline of the service from the main to the property line.

- U. Item B-21, Constructing Water Mains:
  - 1. Bid Items B-21a, B-21b, and B-21c consists of the following Bid Items:
    - a. Item B-21a 6" DI Water Main
    - b. Item B-21b 8" DI Water Main
    - c. Item B-21c 12" DI Water Main
  - 2. Under the unit prices for this item, the Contractor shall furnish all labor, equipment, materials, tools and services for furnishing and installing water main pipe. The unit prices shall also include all labor and materials required to make connections to existing mains and hydrants where required; couplings not included for payment elsewhere; fittings, valves and all services and appurtenances within proposed trench limits and as shown on Contract Documents; furnishing and installing Utility Marker Tape; leakage testing of the completed water main; tree, plant and shrub clearing and grubbing; stripping and stockpiling; design and install all temporary excavation support systems, including steel sheeting or other shoring materials; design and provide dewatering system in conformance with regulations; provide dust control measures; straw wattles/bales and all other erosion and sedimentation control devices; developing and submitting a stormwater pollution prevention plan (SWPPP) if required by permit; wetland and tree protection; traffic management devices; pre-construction photographs and/or video; saw cutting the roadway for trenches; removal and disposal of surface asphalt on top of concrete slabs; removal and replacement of asphalt and concrete sidewalk and driveways; excavation and backfill of soils; material handling and stockpiling; removal and disposal of excess soil; provide and install select borrow, structural fill and/or fill; removal and disposal of unsuitable material as directed by the Engineer up to 6" below the outside of the pipe (depth beyond 6" below the outside of the pipe is included for payment under the appropriate bid item); furnish and place 3/4-inch crushed stone bedding; filter fabric; install pipe insulation, where indicated on Drawings; restore the trench surface to grade including, furnishing, backfilling, and compacting; compaction testing; furnish and place 12-inches of compacted gravel sub-base on backfilled trenches under paved areas; leakage testing of the completed sewer; repair and/or relocation of any utility lines broken and/or conflicting with construction; removal and replacement of bituminous concrete curbs; removal and resetting of granite curbs; removal and replacement of asphalt and concrete sidewalk and driveways; protection and support of existing utilities and structures; permit compliance; coordination of work with utility companies, including payment of required utilities fees; landscaping restoration including but not limited to loam and seed; restoration of site to pre-construction conditions; lean up and all other appurtenant materials and work incidental thereto and not specifically

included for payment under other items.

- 3. The unit prices shall also include pressure testing; disinfection as specified; sampling; laboratory analyses; returning physical features to their original condition; clean up; and all else incidental thereto, for which separate payment is not provided under other items in the Bid Proposal.
- 4. Water main pipe will be measured for payment by the linear foot of water main installed, complete and accepted in place. Measurement will be along the water main centerline without deduction for valves and fittings. Hydrant branch lines will be measured from the center of the main line tee to the centerline of the hydrant.
- V. Item B-22, Fittings, Couplings, and Restraints
  - 1. Bid Items B-22a, B-22b consist of the following Bid Items:
    - a. Item B-22a Fittings and Couplings
    - b. Item B-22b Restraints
  - 2. The unit price bid for Item B-22a shall be considered full compensation for furnishing all labor, equipment, materials and services for the satisfactory completion of the work.
  - 3. Measurement of payment for Item B-22a including fittings, including solid sleeves and couplings, will be measured for payment by the pound actually installed in the completed project and accepted by the Engineer. Weight shall be based upon manufacturer catalog data and shipping weight slips furnished from the supplier to the Contractor. No payment will be allowed for weight of cement linings. No payment will be allowed for standard mechanical joint glands and accessories that are not used due to installation of restrained joints.
  - 4. The number of mechanical and push on restrained joints to be paid for under Item B-22b will be the number of restraints installed and accepted by the Engineer. Restraints installed for Contractor convenience shall not be paid for under this Item but are included for payment under the applicable division of Item B-21 of the proposal. Payment shall include costs of all labor and materials required for installing restrained joints. No additional payment will be made for restrained joints. Payment for furnishing and installing additional fittings required to do the work shall be paid for under the unit price bid in Item B-22a.

- W. Item B-23, Water Valves and Boxes
  - 1. Bid Items B-23a, B-23b, and B-23c consist of the following Bid Items:
    - a. Item B-23a 6" Gate Valve and Gate Box
    - b. Item B-23b 8" Gate Valve and Gate Box
    - c. Item B-23c 12" Gate Valve and Gate Box
  - 2. The unit prices bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work.
  - 3. Measurement for payment for furnishing and installing valves with boxes will be made for each installed under these items.
- X. Item B-24, Water Main Manual Air Release Valve
  - 1. The unit prices bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work. This item includes the valve, standpipe, piping, handle, cap, and gate valve frame and cover as indicated on the Contract Drawings.
  - 2. Measurement for payment for furnishing and installing valves with boxes will be made for each installed under these items.
- Y. Item B-25, Water Main Blow Off Connection
  - 1. The unit prices bid for these items shall consider full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work. This item includes the check valve, coring, corporation stop, precast meter pit with frame and cover, flow meter, bed fittings, roadway box, and piping as indicated on the Contract Drawings.
  - 2. Measurement for payment for furnishing and installing valves with boxes will be made for each installed under these items.
- Z. Item B-26, Catch Basin Demolition and Replacement
  - b. The lump sum price bid for this item shall be considered full compensation for furnishing all labor, equipment, materials, and services required or incidental for the satisfactory completion of the work. This item includes demolition, disposal and replacement of catch basins including new piping connections as indicated on the Contract Drawings. Under the lump sum price bid, the Contractor shall furnish and install 4-foot diameter catch basins of reinforced precast concrete sections, complete, including concrete bases, riser

sections, cones or top slabs, steps, standard inlet frames and brick or riser rings under frames. The Contractor shall also perform all excavation and backfill, removal and disposal of surface asphalt, removing excess material from the job, furnishing and placing 3/4inch crushed stone bedding; repair and/or relocation of any utility lines broken and/or conflicting with construction, dewatering, furnishing and connecting drainage piping, clean up and raising frames to grade under the unit price for this Item.

- 1.
- 2. Measurement for payment will be made for each installed under this item.

## END OF SECTION 01150
#### **PROJECT MEETINGS**

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 PRE-BID CONFERENCE

A. Prior to the opening of the bids, a site conference shall be held with prospective bidders at the time and place listed in the Instructions to Bidders. All prospective bidders are urged to attend.

#### 1.3 PRECONSTRUCTION CONFERENCE

- A. A preconstruction conference will be held between the Contractor, the Engineer, the Owner, and applicable agency representatives to review the Contractor's proposed methods of complying with the requirements of the Contract Documents.
- B. Contractor will be notified of the time, date and place where the preconstruction conference will be held.

#### 1.4 PROGRESS MEETINGS WITH ENGINEER

In addition to other regular project meetings for other purposes (as indicated A. elsewhere in the Contract Documents), hold general progress meetings each month according to a schedule established at the pre-construction conference. Require every entity then involved in the planning, coordination or performance of work to be properly represented at each meeting. Include (when applicable) consultants, separate contractors (if any), principal subcontractors, suppliers/ manufacturers/fabricators, governing authorities, insurers, special supervisory personnel and others with an interest or expertise in the progress of the work. Review each entity's present and future needs including interface requirements, time, sequence, deliveries, access, site utilization, temporary facilities and services, hours of work, hazards and risks, housekeeping, submittals, change orders, and documentation of information for payment requests. Discuss whether each element of current work is ahead of schedule. Determine how behind-time work will be expedited, and secure commitments from the entities involved in doing so. Discuss whether schedule revisions are required to ensure that current work

PROJECT MEETINGS 01200 - 1

and subsequent work will be completed within the Contract Time. Review everything of significance which could affect the progress of the work, including proposed or pending changes to the work.

B. Within five days after each progress meeting date, the Engineer will forward copies of the minutes-of-the-meeting, to the Owner and the Contractor.

PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

## SUBMITTAL PROCEDURES

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section specifies the general methods and requirements of submissions applicable to the following work-related submittals.
  - 1. Shop Drawings.
  - 2. Product Data.
  - 3. Samples.
  - 4. Construction or Submittal Schedules.
  - 5. Or equal submittals.
- B. Additional general submission requirements are contained in the General Conditions.
- C. Detailed submittal requirements will be specified in the technical specifications section.

### 1.3 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

- A. Shop Drawings:
  - 1. Shop drawings, as defined in the General Conditions, and as specified in individual work sections include, but are not necessarily limited to: custom-prepared data such as piping layout, schedule information, setting diagrams, actual shopwork manufacturing instructions, custom templates, and coordination drawings.

- 2. All shop drawings shall be submitted using a transmittal form approved by the Engineer. Submittal form shall include identification of transmittal number and specification section number.
- 3. All shop drawings submitted by subcontractors for review shall be sent directly to the Contractor for approval. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
- 4. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy themself 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 thereof.
- B. Product Data:
  - 1. 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 printed installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances including certificates of compliance and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications and recommended spareparts listing, and printed product warranties, as applicable to the Work.
- C. Samples:
  - 1. Samples specified in individual sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

# 1.4 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall review shop drawings, product data and samples, 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
- B. Each shop drawing, sample, and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in. x 17-in. and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the Engineer a copy of each submittal transmittal form for shop drawings, product data and samples at the time of submittal of said drawings, product data and samples to the Engineer.
  - 1. Submittals received "WITHOUT" Certification Statement shall not be reviewed.
- C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished by the Engineer and provide a description of the deviations in a letter attached to the submittal.
- D. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from their responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will not have responsibility therefor.
- E. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased, or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk.

The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

- F. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.
  - 1. Manufacturer's printed installation instructions, a part of product data submitted to the Engineer will not be reviewed and are for informational purposes <u>only</u>.

# 1.5 "OR EQUAL"

- A. Should the Contractor seek approval of a product other than the brand or brands named in these specifications, it shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. Where the specified requirements involve conformance to recognized codes or standards the Contractor shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and baring an authorized signature.
- B. Manufacturers' standard data and catalog cut sheets will not be considered sufficient in themselves, and the Engineer will not be responsible for seeking further data from the manufacturer, or for otherwise researching the product. Failure to provide complete data will be cause for rejection of the product.
- C. The Contractor shall be responsible for all additional costs including license fees, foundation, piping and electrical work necessary to accommodate the proposed "or equal" equipment. Items which result in a cost reduction shall be presented and a change order reflecting 65% of the cost savings will be prepared and the contract price modified. Contractor shall prepare an itemized detailed cost savings breakdown and provide all backup and documentation to allow the Engineer to review the proposed savings. Engineer shall have final authority in determining the cost savings value.

# 1.6 SUBMISSION REQUIREMENTS

- A. 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.
- B. All complete submittals shall be submitted sufficiently in advance of construction requirements to provide no less than fifteen (15) days, excluding Saturdays, Sundays and legal holidays for review from the time received at the Engineer's reviewing office. For submittals of major equipment, that require more than fifteen (15) days to review, due to its sheer complexity and

amount of detail and also requiring review by more than one engineering discipline, a letter will be sent by the Project Manager or his/her designee to the Contractor informing him/her of the circumstances and the date it is expected the submittal will be returned to the Contractor.

- C. Number of submittals required:
  - 1. Shop Drawings: Unless otherwise stated in the respective Specifications Sections, submit one (1) digital copy consisting of a PDF file.
  - 2. Product Data: Unless otherwise stated in the respective Specifications submit one (1) digital copy consisting of a PDF file.
  - 3. Samples: Submit the number stated in the respective Specification Sections.
- D. Submittals shall contain:
  - 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. An 8-in. x 3-in. blank space for Contractor and Engineer stamps.

E. Each shipment of drawings shall be accompanied by a transmittal form furnished by the Engineer giving a list of the drawing numbers and the names mentioned above.

# 1.7 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The Engineer's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract plans and specifications or from departures therefrom. 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.
- B. The review of shop drawings, data, and samples will be general. 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 Engineer, except as otherwise provided herein.
- C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which the Engineer 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 Engineer may return the reviewed drawings without noting an exception.
- D. One digital copy of shop drawings or product data will be returned to the Contractor. Samples will not be returned.
- E. Submittals will be returned to the Contractor under one of the action codes indicated and defined on the transmittal form furnished by the Engineer.
- F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type

revision that is not in accordance to the Contract Documents as may be required by the Engineer.

- G. Partial submittals may not be reviewed. The Engineer 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 "Rejected" until resubmitted. The Engineer may at their option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.
- 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 Engineer at least seven working days prior to release for manufacturer.
- I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

# 1.8 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 resubmittal (if required), coordination with other submittals, inspection, testing (off-site and on-site), 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.

# 1.9 CERTIFICATION FORMS

A. If specified in other sections of these Specifications, the Contractor shall submit the applicable certification form for each item required, and in the form attached to this section, completely filled in and stamped.

# 1.10 CERTIFICATES OF COMPLIANCE

- A. Certificates of Compliance specified in the specifications shall include and mean certificates, manufacturer's certificates, certifications, certified copies, letters of certification and certificate of materials.
- B. The Contractor shall be responsible for providing Certificates of Compliance requested and specified in the technical specifications. Certificates are required for demonstrating proof of compliance with specification

requirements and shall be executed in one digital copy unless otherwise specified. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the Supplier, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Supplier from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

# 1.11 PERMITS

A. The Contractor shall obtain necessary permits to construct as required by the Town. A copy of the permits shall be provided to the Engineer.

PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

# PART4 – ATTACHMENTS

# 01300A – CERTIFICATE OF DESIGN

#### 01300A CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state

of	and that he/she has been employed by (Name of Contractor)	
	to design	in accordance with

Specifications Section \_\_\_\_\_ for the (Name Project) \_\_\_\_\_\_

The undersigned further certifies that he/she has performed similar designs previously and

has performed the design of the \_\_\_\_\_\_; and regulations and professional practice standards; that his/her signature and Professional Engineer (P.E.) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to the Town of Bellingham (Owner) or Owner's representative within seven days following written request therefore by the Owner.

P.E. Name

Contractor's Name

Signature

Signature

Title

Title

SUBMITTAL PROCEDURES 01300 - 9 Address

Address

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SUBMITTAL PROCEDURES 01300 - 11

#### CONSTRUCTION PROGRESS SCHEDULES

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. CONTRACTOR shall prepare and submit to ENGINEER for review within 10 days after Notice to Proceed, a construction progress schedule.
- B. CONTRACTOR shall be prepared to review and discuss construction progress schedule at the Preconstruction Conference (see Section 01200).
- C. No work shall be done between 3:30 p.m. and 7 a.m. nor on Sundays or legal holidays without written permission of OWNER. However, emergency work may be done without prior permission.
- D. Night work may be established by CONTRACTOR as regular procedure with written permission of OWNER. Such permission, however, may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for proper prosecution and control of work at night.

#### 1.3 FORM OF SCHEDULES

- A. Prepare schedules in form of a horizontal bar chart.
  - 1. Provide separate horizontal bar for each trade or operation.
  - 2. Horizontal time Scale: Weekly. Identify first work date of each week.
  - 3. Scale and spacing to allow space for notations and future revisions.
- B. Format of Listings: Chronological order of start of each item of work.
- C. Identification of Listings: By major specification section numbers.

#### 1.4 CONTENT OF SCHEDULES

- A. Construction Progress Schedule:
  - 1. Show complete sequence of construction by activity.
  - 2. Show dates for beginning and completion of each major element of construction and installation dates for major terms of equipment. Elements shall include, but not limited to, the following:
    - a. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer.
    - b. Material and equipment order, manufacturer, delivery and installation, and checkout.
    - c. Performance tests and supervisory services activity.
    - d. Piping, duct work, and wiring installation.
    - e. Construction of various facilities.
    - f. Concrete pour sequence.
    - g. Structural steel erection.
    - h. Precast concrete erection.
    - i. Backfilling, grading, seeding, sodding, landscaping, fence construction and paving.
    - j. Electrical work activity.
    - k. Plumbing work activity.
    - 1. Sewer installation (list streets, locations).
    - m. Connection to exiting sewers (list streets, locations).
    - n. Winter Periods limiting certain types of work.
    - o. Subcontractor's items of work.
    - p. Final cleanup.
    - q. Allowance for inclement weather.
    - r. Demolition.
    - s. Miscellaneous concrete placement.
  - 3. Show projected percentage of completion for each item as of first day of each month.

#### 1.5 SCHEDULE REVISIONS

- A. Every 30 days CONTRACTOR shall revise construction schedule to reflect changes in progress of work. The lack of an updated construction schedule may be cause for withholding payment to the Contractor.
- B. Indicate progress of each activity at date of submittal.
- C. Show changes occurring since previous submittal of schedule.
  - 1. Major changes in scope.
  - 2. Activities modified since previous submittal.

# CONSTRUCTION PROGRESS SCHEDULES 01310 - 2

- 3. Revised projects of progress and completion.
- 4. Other identifiable changes.
- D. Provide a narrative report as needed to define.
  - 1. Problem areas, anticipated delays, and impact on schedule.
  - 2. Corrective action recommended and its effect.
  - 3. Effect of changes on schedules of other CONTRACTORS.

# 1.6 SUBMITTAL REQUIREMENTS

A. For initial submittal of construction schedule and subsequent revisions thereof, furnish electronic copies of schedule to ENGINEER.

# PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

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### AS-BUILT DRAWINGS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. As-Built Drawings:
  - 1. The Contractor shall maintain and keep a record copy of as-built drawings and shall complete all updates to the Contract Drawings using AutoCAD computer aided drafting software. The drawings shall show all materials as installed. For utility projects, a minimum of two (2) swingties to permanent structures shall be shown for all fittings, valves, corporation stops, sewer services and any other item which will be backfilled upon completion of the work. As-built drawings shall be kept current and will be reviewed monthly. Failure to maintain current as-built drawings will be cause to delay progress payments. As-built drawings shall be available to the Engineer at all times during the life of the Contract. Upon request, the Owner will provide one set of reproducibles of the original Contract Drawings and a sample record drawing showing required style and quality, for this purpose.
  - 2. General Contractor shall be responsible for coordinating, collecting and updating as-built drawings from subcontractors.
  - 3. All drawings shall be made a part of the record drawings and shall include the following:
    - a. Contract Drawings: Contractor is to Annotate or redraft, as required, to show all revisions, substitutions, variations, omissions and discrepancies made or discovered during construction concerning location and depth of utilities, piping, ductbanks, conduits, manholes, pumps, valves, vaults and other equipment. Revisions shall be made and shown on all drawing views with actual dimensions established to permanent points.
    - b. Working Drawings: Same as a) above, when working drawings are required. Include, for example, actual layouts of conduit runs between various items or electrical equipment for power, control and instrumentation; wire sizes, numbers and functions; configuration of conduits; piping layouts; and duct layouts. Sections and details shall be added as required, for clarity. Drawings and switchgear, motors, control centers and other equipment shall be revised to show actual installations.
  - 4. Prior to preliminary inspection, furnish a reproducible of the record drawings. At the completion of the Contract and before final payment is made, furnish the Engineer one set

of reproducibles of the finally approved record drawings as well as a complete set of updated AutoCAD files reflecting all revisions herein described.

PART 2 - PRODUCTS (NOT USED)

PART 3- EXECUTION (NOT USED)

#### SCHEDULE OF VALUES

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Provide schedule of values covering each lump sum bid item.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Schedule of values.
    - a. Revise and resubmit schedule until acceptable to the Engineer.
  - 2. Itemize separate line items and costs for work involving each lump sum item.
    - a. Ensure that the sum of the items listed in the schedule of values for each lump sum item equals the price bid for the respective lump sum item. As a minimum, itemize costs for: subcontractors; submittals; materials, equipment; installation; testing and training (where appropriate).
    - b. For "Mobilization and Demobilization", items such as Bond premium and temporary construction facilities may be listed separately in the schedule, provided amounts can be substantiated.
  - 3. Breakdown installed costs into:
    - a. Delivered cost of product.
    - b. Total installed cost with overhead and profit.
      - 1. Do not list overhead and profit as separate items.
  - 4. An unbalanced schedule of values providing for overpayment on items of

SCHEDULE OF VALUES 01370 - 1 work performed first will not be accepted.

# 1.4 SEQUENCING AND SCHEDULING

- A. Prepare schedule of values covering each lump sum item after review of tentative schedule at preconstruction conference, but before submission of first application for payment.
- B. Before submitting any application for payment, obtain the Engineer's approval of the Schedule of Values.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

### CONSTRUCTION PHOTOGRAPHS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. Digital photography taken by Contractor during the work shall be the property of the Owner. Upon request by Engineer, submit digital construction photographs pertinent to the Contract work during the Contract period.
- B. A pre-construction survey of the project area is required as specified under Section 01390. This may require separate digital photography and/or videography that is not covered under this Section.

### 1.3 SUBMITTALS

- A. Provide two (2) DVD copies of digital photographs taken during the course of the work.
- C. Submittal of digital photographs shall be made upon request by the Engineer and shall not be required to be made at a particular frequency or interval, unless so otherwise directed by Engineer.

#### PART 2 - PRODUCTS

# 2.1 DIGITAL PHOTOGRAPHY DVD

- A. Photographer shall use digital media with a resolution of not less than 8 megapixels.
- B. Digital files shall be JPEG, BMP, TIFF or other readily accessible and readable file type. Proprietary file types requiring purchase of additional software shall be not allowed.

# PART 3 – EXECUTION – NOT USED

#### END OF SECTION 01380

# CONSTRUCTION PHOTOGRAPHS 01380 - 1

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# PRE-CONSTRUCTION SURVEY

## PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division I Specification Sections, apply to the work of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

### 1.2 SUMMARY

- A. This section specifies the performance of pre-construction surveys of the existing conditions to be conducted by the Contractor.
- B. Pre-construction surveys shall be completed for exterior areas of the adjacent structures, buildings and areas affected by the project work.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. The pre-construction survey shall document the existing conditions of the project area within the street right-of-way and abutting properties (as can be viewed from the right-of-way), and within the extent of temporary construction easements afforded to the Contractor for this project. The Contractor shall not be required to cross onto private property, or cross outside of temporary construction easements provided, for the purpose of documenting existing conditions.
- B. The pre-construction survey shall include, but not be limited to, documenting the following existing conditions: Exterior of buildings and structures; driveways; trees, shrubs, bushes; landscaping and plantings; signage; mailboxes; sidewalks; granite and bituminous curbing; utility poles and overhead wiring; open water bodies; wetlands and streams.
- C. The pre-construction survey shall be recorded and submitted no earlier than

four (4) weeks before construction begins in the area.

- D. The pre-construction survey may be phased over several areas in connection with the Contractor's planned sequence of the work.
- E. Detailed examination and video inspection of areas longitudinally along the pipe route and perpendicularly from the centerline of the pipe.
- E. Documentation shall be in the form of a detailed video inspection the project area; and color digital photographs keyed to specific locations of the work by referencing stationing of the contract drawings and/or house numbers and streets.

# 1.4 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTALS.
  - 1. Two (2) copies of the draft preconstruction report shall be submitted to the Engineer for review and acceptance prior to the start of construction. Each report shall include as a minimum the following:
    - a. results of visual inspection (on DVD) including video and photographic documents of project area; and
    - b. sketches as required to convey the location of the documentation.
  - 2. The Engineer shall review the draft reports, and may indicate additional information that is required. This information shall be included in the final report.
  - 3. Two (2) copies of the final report shall be submitted.

# PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

### QUALITY ASSURANCE

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section covers Quality Assurance requirements for this contract.
- B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors, and suppliers and for assuring the quality specified in the Technical Specifications is achieved.
- C. Refer to the Article 6 Contractor's Responsibilities, paragraphs 6.01 6.02, 6.03, of the GENERAL CONDITIONS.

#### 1.3 TESTING LABORATORY SERVICES

- A. All tests that require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing laboratory engaged by the Contractor and acceptable to the Engineer. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: Unless otherwise specified, the Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. Quality Control Testing Services: Perform all quality control tests in the field or in the laboratory on concrete, asphalt mixtures, moisture-density (Proctor) and gradation tests on structural and embankment fills, and backfill materials, in-place field density tests on structural and embankment fills, and other materials and equipment, during and after their incorporation in the Work.

QUALITY ASSURANCE 01400 - 1 Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.

- D. Arrangements for delivery of samples and test specimens to the testing laboratory will be made by the Contractor. The laboratory tests shall be performed within a reasonable time consistent with the specified standards. Furnish a written report of each test to the Engineer.
- E. Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, interrupting the Work when necessary. When sampling or testing activities are performed in the field, the Contractor shall furnish personnel and facilities to assist in the activities.
- F. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- G. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.
- H. The testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel in the field or laboratory to the Contractor. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the Owner, and one copy for the Contractor within three days after each test is completed.
- I. Contractor shall pay the costs for all testing required by the Contract Documents, inducing the costs for retesting due to failure and nonconformance.

# 1.4 QUALITY ASSURANCE

A. Codes and Standards: Refer to Article 3 - Contract Documents, Intent, Amending, Reuse, paragraph 3.02 of the General Conditions.

- B. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer.
- C. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. Material and equipment shall not be used by the Contractor for any purpose other than that intended or specified unless such use is authorized by the Engineer.
- D. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

# 1.5 OFFSITE INSPECTION

- A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by an independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.
- B. The Contractor shall give appropriate written notice to the Engineer not less than 30 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.
- C. The inspection organization shall submit a written report to the Contractor who shall provide copies to the Engineer.

# 1.6 MATERIALS AND EQUIPMENT

- A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.
- B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and operation. Should circumstances occur where the contract documents are more stringent than the manufacturer's printed instructions, the Contractor shall comply with the specifications. In

cases where the manufacturer's printed instructions are more stringent than the contract documents, the Contractor shall advise the Engineer of the disparity and conform to the manufacturer's printed instructions. In either case, the Contractor is to apply the more stringent specification or recommendation, unless approved otherwise by the Engineer.

## 1.7 SHOP AND FIELD TESTING

- A. The Contractor is also responsible for providing the shop and field testing specified in the technical specification sections.
- B. The Contractor and its Subcontractor shall perform inspections, tests, and other services as required by the Contract Documents.
- C. Contractor shall provide twenty one (21) days notice to the Engineer so that the Engineer may witness Contractor and/or Subcontractors off site and on site tests. The Engineer's witnessing of tests does not relieve the Contractor and/or Subcontractors of their obligation to comply with the requirements of the Contract Documents.

# 1.8 MANUFACTURER'S FIELD SERVICES

- A. When specified in the technical specifications sections, the Contractor shall arrange for and provide technical representation from manufacturer's of respective equipment, items or components. The manufacturer's representative shall be a factory trained service engineer/technician with the type and length of experience specified in the technical specifications.
- B. Services Furnished Under This Contract: An experienced, competent, and authorized factory trained service engineer/technician representative of the manufacturer of each item of equipment for which field services are indicated in the specifications shall visit the site of the Work and inspect, operate, test, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's service representative shall be present when the equipment is placed in operation. The manufacturer's service representative shall problems are corrected and the equipment installation and operation are satisfactory to the Engineer.
- C. Refer to Section 01730 Operation and Maintenance Data for additional requirements.

# 1.9 CERTIFICATION FORMS AND CERTIFICATES

A. The Contractor shall be responsible for submitting the certification forms and certificates in conformance with the requirements specified in Section 01300 - Submittals.

# PART 2 - PRODUCTS (NOT USED)

QUALITY ASSURANCE 01400 - 5

# PART 3 – EXECUTION

## 3.1 QUALITY CONTROL

- A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.
- B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, instrument calibration, surveying) shall be maintained in the Contractor's field office, available for inspection by the Engineer. Copies will be made available to the Engineer upon request.
- C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer or Owner to supersede or void that responsibility.

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QUALITY ASSURANCE 01400 - 7

## TEMPORARY FACILITIES AND CONTROLS

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. Environmental Permits may require temporary provisions. Refer to Appendix C for permit requirements.

#### 1.2 HOURS OF CONSTRUCTION

- A. Furnish plant and equipment which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the Contract Time. If at any time such plant appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the plant equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.
- B. Work hours will be governed by the terms of the MassDOT permit. See MassDOT permit requirements for work hour restrictions. Work outside those time periods will be permitted only on an emergency basis and only with the approval of the Owner.
- C. No work shall take place on holidays without prior permission of the Owner and the Engineer.

#### 1.3 OCCUPYING PRIVATE LAND

A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, 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 Engineer, prior to entering or occupying private property.

B. When occupying private land, for which written consent has been documented, Contractor shall limit his occupancy of the private land to the limits established by the Contract Drawings.

# 1.4 PIPE LOCATIONS

A. Where small diameter 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.

# 1.5 DIMENSION OF EXISTING STRUCTURES

A. Where the dimensions and locations of existing structures 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.

# 1.6 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights, and other means to prevent accidents to persons and damage to property. 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 excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.
- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.
- C. Costs incurred for safety personnel to address unsafe conditions shall be the responsibility of the Contractor.
- D. Costs incurred as a result of unsafe conditions related to open excavations shall be the responsibility of the Contractor.

# 1.7 TEST PITS

- A. Test pits for the purpose of locating underground pipeline, conduit or structures in advance of the construction shall be excavated and backfilled by the Contractor at locations shown on the drawings, or as indicated by the Engineer, or in areas where the Contractor deems it necessary to obtain subsurface information. Test pits shall be conducted well in advance of pipeline and structure installation. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.
- B. Contractor shall furnish to the Engineer a dimensioned plan and elevation drawing of the information gathered during the test pit exploration. Elevation information shall be survey grade accurate using the same vertical datum as the Contract Drawings.

# 1.8 INTERFERENCE WITH AND PROTECTION OF STREETS

- A. Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits 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 therefore.
- C. The Contractor shall, at least 48 hours in advance, notify the Town and its Police, Fire and School Departments in writing, with a copy to the Engineer, 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.
- D. Contractor shall coordinate and pay for all Police Traffic Details required to provide safe and accessible public and private ways.

# 1.9 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed Work shall be carefully protected in a manner approved by the Engineer. All portions damaged shall be reconstructed, repaired, or replaced by the Contractor at its own expense.
- B. If, in the final inspection of the Work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for

the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein for at least the guarantee period described in the Contract Documents.
C. The Contractor shall take all necessary precautions to prevent damage to all elements of the Work during and after construction and until such Work is accepted and taken over by the Owner.

# 1.10 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.
- B. Along the location of this work, all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in their original location or as indicated on the Drawings as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be graded and seeded.
- C. If the Contractor claims the direct or indirect damage was not caused by Contractor or sub-contractors, Contractor shall furnish written, irrefutable evidence thereto. If any damage was present prior to the start of construction, it is the Contractor's responsibility to have documented said damage as part of his pre-construction survey, as required by Section 01390.

# 1.11 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, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.

- C. Protection of existing utilities and structures shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Total Price Bid in the Bid Form.
- D. The Contractor shall notify all utility companies at least 72 hours (excluding Saturdays, Sundays, and Legal holidays) before excavating in any public way. Contractor shall also notify Dig Safe (1-888-DIGSAFE) at least 72 hours prior to start of work.

# 1.12 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 Engineer 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 Engineer in ample time so that the necessary arrangements for the inspection can be made.

# 1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or persons authorized to perform any work under this Contract shall cooperate with the General Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.

## 1.14 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 as neat a condition as is possible. He 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, all at his expense.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor 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.

## 1.15 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at its own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor at his own expense and to the satisfaction of the Engineer.
- C. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein for at least the guarantee period described in the Contract Documents.
- D. The Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

## 1.16 INSTALLATION OF EQUIPMENT

- A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to the pumps and electric drives. 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. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been approved by the Engineer, 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, and under no circumstances, will "pipe springing" be allowed.
- 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.

# 1.17 TEMPORARY UTILITIES

- A. Sanitary Provisions: The Contractor shall provide and maintain sanitary accommodations for the use of his employees and the Engineer, as may be necessary to comply with the requirements and regulations of the local and state departments of health.
- B. Maintaining Operation of the Existing Facilities:
  - 1. The Contractor shall be responsible for careful consideration of the construction scheduling and anticipation of potential interference with existing utilities, operations and structures. The Contractor shall maintain close communications with the Engineer and provide the Engineer with a detailed description of each proposed activity sufficiently in advance of its commencement for review and comments to be made.
  - 2. Temporary facilities that may be required include, but are not limited to, electrical power; lighting; heating; cooling; ventilating; telephone; potable water; fire protection; drainage; sanitary facilities; trench covers; protection of existing utilities; structures; streams; trees and shrubs; access roads; sewage conveyance; piping; pumping and sludge disposal. Except where otherwise specified herein to be provided by the Owner, the Contractor shall provide the temporary facilities.
  - 3. The Town will provide, at no cost to the contractor, electric power for small tools, lighting, heating, and other items that can be powered by utilizing existing facilities in the pumping stations or by using receptacles in the pumping stations. The Town will also provide, at no cost to the contractor, electric power for operating the new sewage pumps when they are installed and operational, including power for start-up and testing or the new pumps when the new pumps are operational.

## 1.18 WATER SUPPLY

- A. Water will be made available to the Contractor for his use during construction at the Contractor's expense. To obtain access to water, the Contractor shall contact the Water Department/District and meet their requirements, including for metering, backflow prevention, and payment for the cost of the water. The Contractor shall furnish all piping or hose extensions to conduct the water to the points of use.
- B. Regardless of the source of the water, the Contractor shall exercise due care not to waste water. The Contractor shall not contaminate the water supply and shall comply with all applicable regulations and code requirements.

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## 1.19 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 Commonwealth of Massachusetts and the Federal Government and by the Engineers.
- B. The Contractor shall furnish the Engineer 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.

## 1.20 POLLUTION CONTROL

- A. The Contractor shall conduct clean-up and disposal operations, as necessary, to comply with state and local ordinances and anti-pollution laws.
- B. Outdoor burning of rubbish and waste material on the site will not be permitted.
- C. Disposal of volatile fluid wastes (such as mineral spirits, oil, gasoline, or paint thinner) in storm or sanitary sewer systems or into streams or waterways is not permitted.

## 1.21 ENGINEER'S FIELD OFFICE

- A. The Contractor shall provide and maintain, for the duration of the contract, a separate office building or trailer, minimum interior dimensions of 10 feet x 24 feet for the exclusive use of the Engineer. Location of the trailer shall be as directed and approved by the Owner. The plans and construction of the office shall be approved by the Engineer.
- B. The office shall be equipped with electric lights, heating facilities, air conditioner, water, telephone service, and sanitary conveniences (flush toilet). Doors and windows shall be equipped with locks and the windows shall have security screens and horizontal blinds. Trailer shall have a skirt installed around the lower perimeter. The office shall be equipped with the following furniture and accessories:
  - 1. (1) flat top desk with drawers
  - 2. (1) desk lamp
  - 3. (1) table at least 2 feet 8-inches wide and 6 feet long
  - 4. (1) drafting table with lamp
  - 5. (3) desk chairs and (1) stool
  - 6. (4) folding chairs
  - 7. (1) wall clock

- 8. (1) 4-section lockable, fireproof file case
- 9. (1) locker for survey equipment
- 10. (2) 5000 BTU air conditioners
- 11. (1) cordless telephone with answering machine with time and date stamp
- 12. (1) 4-cubic foot refrigerator
- 13. (1) 5-pound fire extinguisher
- 14. (1) industrial type first aid kit
- (1) photocopy machine equal to Toshiba Model e-studio 150 capable of 25% 400% zoom ratio, copying up to 15 copies per minute and full color scan and transmit to e-mail or fax features.
  - a. Contractor shall provide compatible ink cartridges upon the request of the Engineer.
- 16. Shelving, closets and plan racks as may be required
- 17. Automatic electric calculator with printer
- 18. Broom, dust pan, wastepaper baskets, paper towels, and cleaning supplies as required
- 19. (1) potable water cooler
- 20. (1) NEW digital camera with the following requirements:
  - a. Minimum of 10 megapixels
  - b. Minimum of 8 GB memory
  - c. Provide user selectable flash control for ON/OFF/AUTO
  - d. Cables for downloading photographs to computer.
- 21. (1) NEW Computer and (1) NEW printer meeting the following minimum requirements:
  - a. Computer shall be NEW Lenovo ThinkPad T520 and meet the following minimum requirements
    - i. Intel Core i5-2520M (2.50GHz, 3MB L3 cache)
    - ii. NTFS File System for all Operating Systems
    - iii. Memory: 4 GB DDR3 1333MHz
    - iv. Intel HD Graphics 3000
    - v. 320 GB Hard Disk Drive, 7200 RPM
    - vi. DVD-RW Drive
    - vii. Operating System: Genuine Windows 7 Professional, 64bit.
    - viii. 15.6" display (15" or larger acceptable for alternates)
    - ix. Minimum 2 USB interface ports
    - x. Integrated g/n wireless adapter
    - xi. Integrated mobile broadband compatible
    - xii. Multimedia card reader supporting at least SD, SDHC, and SDXC
    - xiii. Keyboard and mouse
    - xiv. Include all cables, manuals, chargers (Type A or Type B standard North American plug) and associated equipment. Manufacturer on-site warranty shall cover the time period of the contract.

- b. Printer shall be NEW All-in-one type printer and meet the following minimum requirements:
  - i. 8-1/2"x11" flatbed scanner
  - ii. Color and black-and-white printing capability
  - iii. Contractor to supply ink cartridges as required by engineer.
  - iv. Standard USB Interface and Type A or Type B (standard North American Plug) compatible power cord.
  - v. Include all cables, manuals, and associated equipment. Manufacturer on-site warranty shall cover the time period of the contract.
- C. The Contractor shall maintain the office during construction and remove it upon completion of the work. The cost for operation of the Engineer's field office shall be the responsibility of the Contractor and included into his Bid price. Operation and maintenance shall be construed at a minimum, to include: supplying toilet paper, paper towels, liquid hand soap, FAX paper, copying paper, toner and ink for the printer and copier, calculator paper, bottled water, monthly utility costs, heating and cooling costs, restocking of the first aid kits, cleaning of the FAX and copier on a monthly basis and cleaning of the inside of the trailer on a weekly basis.
- D. The Contractor shall arrange for installation of telecommunication line(s) for computer modem DSL or cable connection for internet access. The Contractor shall pay the regular monthly service charge for all line(s).
- E. At the completion of the project the Contractor shall turn over the digital camera and laptop to the Owner.

## 1.22 PROJECT SIGN

- A. Project Signs shall be as specified in Sections 00800 and/or 01620.
- B. It is the Contractor's responsibility to ensure the Project Sign meets all requirements. Contractor shall be solely responsible for the cost of the Project Sign, as well as any modifications or replacement of the sign during construction as a result of damage, vandalism, theft or a failure to meet the required signage provisions indicated.

## 1.23 TEMPORARY FENCING

A. Provide commercial grade chain link fence to prevent trespass by workmen and suppliers outside of allowable construction easements and onto private property. Temporary fencing shall also prevent the public from accessing this construction site. Locations for temporary fencing shall not trespass beyond the limits on construction easements.

- B. Provide 6 foot high fence around construction site. Equip fence with vehicular and pedestrian gates with locks.
- C. Coordinate locations for temporary fencing with Engineer.
- D. Existing fence can be used as temporary fencing to surround the construction site.

## 1.24 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.

## 1.25 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 Engineer 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 Engineer.

## 1.26 TEMPORARY SUPPORTS

A. Whenever required to complete Contractor's Work, where recommended by the manufacturer, or when required by Engineer, Contractor shall provide temporary supports for new or existing piping, equipment, fittings, connections, or appurtenant materials.

- B. Support of excavation systems are not described in this paragraph and shall be described elsewhere in the Contract Documents.
- C. Temporary supports shall be provided whenever temporary conditions of the Work are cause for forces to be applied on the new or existing piping, equipment, fittings, connections, or appurtenant materials that are beyond limits recommended by the manufacturer.
- D. It shall be the responsibility of the Contractor to determine when such conditions may exist during implementation of the Work. Contractor shall actively coordinate with the manufacturer.
- E. Temporary support systems required shall be the complete responsibility of the Contractor. All costs associated with the design, review, preparation, installation and removal of temporary systems shall be by the Contractor.
- F. Any alterations, modifications or replacement of temporary support systems shall not be cause for additional cost to the Owner.
- G. Any project conditions resulting of failure of temporary supports systems resulting in damage to new or existing piping, equipment, fittings, connections, or appurtenant materials shall be appropriately repaired or replaced at no additional cost to the Owner. This shall apply to any new or existing piping, equipment, fittings, connections, or appurtenant materials and the temporary support system itself.

# PART 2 - PRODUCTS (NOT USED)

# PART 3 - EXECUTION (NOT USED)

## END OF SECTION 01500

#### SECTION 01568

# EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS

#### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. Provide all work and take all measures to control soil erosion resulting from construction operations, prevent flow of sediment from construction site, and contain construction materials (including excavation and backfill) within protected working area as to prevent damage to any catch basin, stream or wetlands.
- B. Work and materials shall comply with the Massachusetts DEP Permit by Rule, as included in Appendix C.
- C. Wherein any conflicts arise between these Specifications and the Permits in Appendix C, Contractor shall be responsible for whichever requirement is stricter without due additional compensation.
- D. Contractor is responsible for the preparation and submittal of a Notice of Intent (NOI) for stormwater discharges associated with construction activity under a NPDES general permit.
- E. Contractor is responsible for the preparation of a Storm Water Pollution Prevention Plan (SWPPP) that shall be submitted and approved as identified herein.

#### 1.3 SUBMITTALS

- A. Contractor shall be responsible for developing and submitting for approval and obtaining all required permits, fees and documentation in accordance with EPA's NPDES program, as well as any local qualifying program. These submissions include, but are not necessarily limited to, the Notice of Intent (NOI) and associated Storm Water Pollution Prevention Plan (SWPPP).
- B. Erosion and Sedimentation Control Work Plan: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:

- 1) Work Plan describing the general approach that the Contractor will take to mitigate the impacts of erosion and sedimentation due to construction activity. Work Plan shall conform to the requirements of this section and the Permits in Appendix C and shall include the following:
  - a. Description of the materials and products planned to be used
  - b. Schedule of when materials will be set up and taken down with respect to construction activity
  - c. Submit a Plan identifying where erosion and sedimentation control devices will be employed.
- C. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1) NOI for NPDES General Construction Permit and SWPPP
  - 2) Evidence of approving authority receipt and approval of NOI and SWPPP.
  - 3) Sedimentation barriers and accessories.
  - 4) Silt sacks.
  - 5) Siltation bags.
  - 6) Sedimentation filters.

#### 1.4 QUALITY ASSURANCE

- A. Use acceptable procedures, including use of water diversion structures, diversion ditches, settling basins, and sediment traps.
- B. Operations restricted to areas of work indicated on drawings and area which must be entered for construction of temporary or permanent facilities.
- C. If construction materials are washed away during construction, remove materials from fouled areas.
- D. Stabilize diversion outlets by means acceptable to Engineer.
- E. Engineer has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct immediate permanent or temporary pollution control measures to prevent contamination of any stream or wetlands, including construction of temporary berms, dikes, dams, sediment basins, sediment traps, slope drains, and use of portable filtration system, temporary mulches, mats, or other control devices or methods as necessary to control erosion.
- F. Prior to initiating construction, Contractor to visually inspect catch basins adjacent to work areas. Any basins containing silt and debris shall be noted by the Contractor prior to construction. A written notice shall be provided to the Engineer listing location of filled basins.

#### PART 2 – PRODUCTS

#### 2.1 BALES

- A. Hay or straw or other suitable material acceptable to Engineer.
  - 1. Twine for hale bales shall be biodegradable.

#### 2.2 WOOD STAKES

A. 2-inch by 2- inch by 3-feet.

#### 2.3 SILT FENCE

- A. Provide silt fence conforming to the requirements specified in Section 02273.
  - a. Amoco 2122 as manufactured by Amoco Fabrics and Fibers Co., Atlanta, GA.
  - b. Mirafi 100X as manufactured by Mirafi, Pendergrass, GA.
  - c. Geotex 910SC as manufactured by Synthetic Industry, Chattanooga, TN.
  - d. Or acceptable equivalent product.
- B. Geotextile fabric shall conform to test requirements for minimum average roll value (weakest principle direction) for strength properties of any individual roll tested from manufacturing lot or lots of particular shipment in excess of minimum average roll value (weakest principle direction) as specified hereafter:
- C. Physical Properties of Minimum Average Roll of the woven geotextile fabric for silt fence shall be:

Property		Test Method	Units	Value	
1.	Grab Strength	D4632	lbs [N]	100[450](min.)	
2.	Permittivity	D4491	sec -1	0.10 (min.)	
3.	Apparent Opening Size	D4751	Sieve Number	20-30	
4.	Ultraviolet Stability	D4355	Percent	70 (min.)	

2.4 SILT SACK

ASTM

A. Provide woven polypropylene fabric bags to prevent sediment from entering existing catch basins. Bags shall be manufactured by ACF Environmental or equal. Polypropylene fabric shall meet or exceed the following characteristics:

<b>Property</b>	<u>Standard</u>	<u>Minimum Value</u>
Grab tensile strength	ASTM D-4632	300 lbs
Grab tensile elongation	ASTM D-4632	20%
Puncture	ASTM D-4833	120 lbs
Mullen Burst	ASTM D-3786	800 psi
Trapezoid tear	ASTM D-4533	120 lbs
UV resistance	ASTM D-4355	80%
Apparent opening size	ASTM D-4751	40 US sieve
Flow rate	ASTM D-4491	40 gpm/sf
Permittivity	ASTM D-4491	0.55 /sec

### 2.5 SEDIMENTATION FILTRATION SYSTEM

- A. Sedimentation filtration system shall be as indicated on the drawings.
- B. The filtered water shall be discharged directly to resource areas through its natural drainage courses.

#### PART 3 – EXECUTION

#### 3.1 GENERAL

- A. Do not discharge chemicals, fuels, lubricants, bitumen, raw sewage and other harmful waste into or alongside any body of water or into natural or manmade channels.
- B. Do not dispose of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in streams, wet-lands, surface waters, or natural or man-made channels leading thereto, or unspecified locations.

## 3.2 INSTALLATION – SEDIMENTATION CONTROL DEVICES

- A. Install sedimentation barriers in all locations as directed, surrounding base of all deposits of stored excavated material outside of disturbed area, and where directed by the Engineer.
- B. Install sedimentation barriers immediately after site is cleared and before excavation. Locate sedimentation barriers, surrounding stored material, approximately 6 ft. from material.

- C. Protect catch basins from sedimentation by installing silt sacks under grating casting. Silt sacks shall be provided wherever there is potential for sediment from construction activity whether called out on the Drawings or not.
- D. Do not place excavated soil material adjacent to water-course in manner that will cause it to wash away by high water or runoff.
- E. Prevent damage to vegetation by excessive watering or silt accumulation in the discharge area.
- F. Do not dump spoiled material into any streams, wetlands, surface waters, or unspecified locations.
- G. Prevent indiscriminate, arbitrary, or capricious operation of equipment in streams, wetlands or surface waters.
- H. Do not pump silt-laden water from trenches or excavations into surface waters, streams, wetlands, or natural or man-made channels leading thereto.
- I. Prevent damage to vegetation adjacent to or outside of construction area limits.
- J. Do not alter flow line of any stream unless indicated or specified.
- K. Clean and dispose of debris from sedimentation barriers on a weekly basis.
- L. Upon completion of work and upon written direction from the Engineer, remove and dispose of sedimentation barriers.
- M. Clean catch basins that have become silted-up due to construction.

## 3.3 INSTALLATION – GEOTEXTILE FABRIC

- A. Install geotextile fabric in accordance with manufacturer's printed instructions.
- B. Place geotextile fabric on the foundation subgrade prior to placing the screened gravel or crushed stone.
- C. Overlap geotextile fabric 18 inches [45 cm] minimum for unsewn lap joint. Overlap fabric 6 inches [15 cm] at seam for sewn joint.
- D. Do not permit traffic or construction equipment to travel directly on geotextile fabric.
- E. Place geotextile fabric in relatively smooth condition to prevent tearing or puncturing. Lay geotextile fabric loosely but without wrinkles or creases so

that placement of the backfill materials will not stretch or tear geotextile fabric. Leave sufficient slack in geotextile fabric around irregularities to allow for readjustments.

- F. Patch all tears in geotextile fabric by placing additional section of geotextile fabric over tear with a minimum of 3 feet [90 cm] overlay.
- G. Extend the geotextile fabric and wrap around the screened gravel or crushed stone along the perimeter of the foundation.
- H. Install silt fence in accordance with the manufacturer's printed instructions and as indicated.

# END OF SECTION 01568

#### SECTION 01600

### CONTROL OF MATERIALS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 APPROVAL OF MATERIALS

- A. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.3, below.
- B. Unless otherwise specified, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.
- C. As specified in Section 01300, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.
- D. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit additional samples or materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
- E. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against the Owner or the Engineer.

- F. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- G. The materials and equipment used on the work shall correspond to the approved samples or other data.

## 1.3 SUBMITTALS

A. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

# 1.4 BOLTS, ANCHOR BOLTS AND NUTS

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.
- B. All anchor bolts, nuts, washers, plates, and bolt sleeves shall be galvanized unless otherwise indicated or specified.
- C. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and size.
- 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. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to AN Standard B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form).
- E. 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 Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Designation A123, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.
- F. Bolts, anchor bolts, nuts, and washers specified to be stainless steel shall be Type 316 stainless steel. All anchor bolts, nuts, washers, plates and bolt sleeves to be submerged in a liquid shall also be Type 316 stainless steel.

G. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

## 1.5 CONCRETE INSERTS

A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be 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. All inserts shall be galvanized.

# 1.6 SLEEVES AND OPENINGS

- A. The Contractor shall provide all openings, channels, chases, and install anchor bolts and other items to be imbedded in concrete, as required to complete the work under this Contract, together with those required by subcontractors, and shall do all cutting and patching excepting cutting and patching of materials of a specific trade and as stated otherwise in the following paragraph.
- B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, required for the execution of their work. It shall be their responsibility before the work of the Contractor is begun to furnish him with the above items and with templates, drawings or written information covering chases, openings, etc., which they require, and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. Failing to do this, they shall be responsible for the cost of any corrective measures which may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given to him, covering details and locations of openings, he shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Engineer.
- C. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. The sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 1 in. above the finished floor surface. Threaded nipples shall not be used as sleeves.

- D. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-in. annular fin of 1/8-in. plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.
- E. All sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

## 1.7 FOUNDATIONS, INSTALLATION AND GROUTING

- A. 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.
- B. All such equipment shall be installed by skilled mechanics and in accordance with the printed instructions of the manufacturer.
- C. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 in. for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable nonshrinking grout.
- D. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.
- E. Where such procedure is impracticable, the method of placing grout shall be as permitted. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner, if necessary, given a burlap-rubbed finish, and painted with at least two coats of an acceptable paint.

## 1.8 GREASE, OIL AND FUEL

A. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, 12, 13, 14, 15 and 16 unless stated otherwise in these specifications.

## 1.9 REJECTED MATERIALS AND DEFECTIVE WORK

A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer. The Contractor shall reimburse the Owner for any expenses, losses or damages incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Engineer, occurring previous to the final payment.

### PART 2 - PRODUCTS (NOT USED)

## PAGE 3 - EXECUTION (NOT USED)

#### END OF SECTION 01600

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### SECTION 01610

### DELIVERY, STORAGE AND HANDLING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

A. This section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

#### 1.3 TRANSPORTATION AND DELIVERY

- A. Transport and handle items in accordance with manufacturer's printed 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 Engineer.
- 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, storing, 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 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. For items furnished by

others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

### 1.4 STORAGE AND PROTECTION

- A. Store and protect products in accordance with the manufacturer's printed instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer by him. Instructions shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.
- B. Store loose granular materials on solid flat surface in a well-drained area. Prevent mixing with foreign matter.
- C. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of 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 manner to reduce breakage, cracking and spalling to a minimum.
- All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere (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 Engineer. Building shall be provided with 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 insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least at 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.
  - 4. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has

DELIVERY, STORAGE AND HANDLING 01610 - 2 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

# END OF SECTION 01610

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## SECTION 01620

## IDENTIFICATION SYSTEMS (PROJECT SIGNS)

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Furnish, install, and maintain project sign.
  - 2. Furnish, install, and maintain other signs, such as job instruction and warning signs.
  - 2. Remove signs on completion of construction.

#### 1.3 SYSTEM DESCRIPTION

- A. Informational Signs:
  - 1. Painted signs with painted lettering, or standard products:
    - a. Size of signs and lettering: As required by regulatory agencies, and/or as specified herein or as appropriate to usage.
    - b. Colors: As required by regulatory agencies, otherwise uniform colors throughout Project.
    - c. Furnish, erect, and maintain job instruction signs, such as "DANGER," "KEEP OFF," "NO PARKING," etc., as may be required to conduct the Work safely. Such signs shall be neat in appearance, maintained in good condition, and promptly removed when they have served their purpose.
  - 2. Erect at appropriate location(s) to provide required information.

IDENTIFICATION SYSTEMS (PROJECT SIGNS) 01620 - 1

- B. Temporary Construction Sign for CWSRF Projects
  - 1. A project sign conforming to the requirements of the CWSRF Program is required to be provided, installed and maintained throughout the duration of the construction project. Sign requirements are provided in SECTION 00800 – SUPPLEMENTARY CONDITIONS.
  - 2. Sign shall be a minimum size of 4 ft. by 8 ft. by  $\frac{3}{4}$  inches.
  - 3. Project sign shall be displayed at a location to be determined by the Engineer. Sign shall be relocated and displayed at the direction of the Engineer.
  - 4. The sign shall include the information and color arrangement shown on the sign template in Specification Section 00800-4 (CWSRF Massachusetts DEP sign).
  - 5. Uppercase lettering shall be minimum 2.5" high by 1.5" wide. Lowercase lettering shall be minimum 2.0" high by 1.5" wide.
- C. Contractor shall apply for all required permits to allow installation of project signs.

## 1.4 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Submit illustration of Project Sign indicating dimensions, lettering, colors and other information necessary to exhibit consistency with the requirements of this specification.

## 1.5 QUALITY ASSURANCE

A. Finishes, Painting: Project sign shall resist weathering and fading for the duration of the construction period.

## 1.6 MAINTENANCE

A. Maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Wood Exterior Paint
  - 1. Tnemec Company, Inc., North Kansas, Missouri
  - 2. The Glidden Co., Cleveland, Ohio
  - 3. PPG Industries Inc., Pittsburgh, Pennsylvania
  - 4. or equal.

## 2.2 MATERIALS

- A. Project Sign Materials
  - 1. Structure and Framing: May be new or used, wood or metal, in sound condition, structurally adequate to work, and suitable for specified finish.
  - 2. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints:
    - a. Thickness: As specified on the sign template in Section 00800-4 and as required by standards to span framing members, to provide even, smooth surface without waves or buckles.
  - 3. Wrought Hardware: Galvanized.
  - 4. Alkyd Gloss Paint System:
    - a. Give priming coat (2.5 mil thick) of white lead paste-in-oil to entire woodwork of sign.
    - b. Give two (2) (1.5 mil) coats of white exterior Alkyd Gloss paint to sign including framework.
- B. Signs shall be weather resistant material.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Project Sign
  - 1. Wood surface shall be clean and dry. Paint exposed surface of supports, framing, and surface material; one coat of primer and two coats of exterior paint as indicated herein.
  - 2. Paint graphics in styles, sizes, and colors required by regulatory agency.
  - 3. Sign layout as approved by Engineer and Owner.

## 3.2 ERECTION

- A. Project Sign:
  - 1. Erect project sign at location selected by Engineer.
  - 2. Maintain in good condition until completion of project.
    - a. Remove sign, framing, supports, and foundations at completion of project.

## END OF SECTION 01620

IDENTIFICATION SYSTEMS (PROJECT SIGNS) 01620 - 4

## SECTION 01650

## FACILITY START-UP/COMMISSIONING

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. The work covered under this section of the Specifications includes providing a technical service representative from the equipment manufacturers furnished under Divisions 11, 13, and 16. The technical service representative shall oversee performance tests, acceptance tests and startup services.
- B. The Contractor shall be responsible for furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with the final testing and inspection and startup and performance testing prior to final acceptance of all mechanical and process-related equipment, including the coordination of all performance tests and the furnishing of operating instructions for all equipment.

#### 1.3 RELATED WORK

A. Additional performance testing and startup requirements are specified and included in Division 11 and 16.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Detailed test procedures shall be submitted at least fourteen (14) days prior to scheduled final inspection and testing date and the startup and performance testing date. This submittal shall include the proposed testing date for each piece of equipment, names of technical representatives who will perform equipment tests, testing record form supplied by the manufacturer to collect appropriate test data, any laboratory testing required, specific responsibilities of the Contractor and technical service representative to prepare for and execute the test, and

any electrical, chemical, water or waste disposal requirements for the test.

- 2. An inspection report prepared by each manufacturer's technical service representative summarizing the result of the final inspection and testing prior to startup shall be submitted. The reports shall include certification that the equipment is properly installed and ready for operation and results of the test and adjustments performed.
- 3. Startup and performance test reports shall be submitted within fourteen (14) days of completion of the tests. The report shall include all information indicated in the detailed test procedures and any supplemental information from laboratory analysis, specified performance compared to actual performance test results, and if performance of equipment is not acceptable, a description of the actions to be taken prior to re-testing the equipment.

# 1.5 START-UP AND OPERATING INSTRUCTIONS

- A. The Contractor shall be responsible for furnishing and installing all of the several kinds and types of equipment required in the pumping stations, and for testing each individual piece of equipment, all combinations of equipment as they may operate one in conjunction with another, and the complete system, such that each component and the total unit may operate in an acceptable fashion to the Engineer, the Owner, and to any other municipal, State or Federal authorities within whose jurisdiction the operation of the facility may be a concern.
  - 1. Equipment shall be tested for proper operation in the presence of the Engineer, and at no additional cost to the Owner.
- B. Final Testing and Inspection of Equipment
  - 1. Upon completion of installation of all permanent equipment deemed ready for operation by the equipment manufacturer, the manufacturer's technical service representative shall inspect, start-up, test and, as necessary, adjust and/or calibrate the equipment. The inspection shall consider the completeness and integrity of the installation, the alignment and clearances of the equipment parts with respect to each other, and the sufficiency of any required sealing, lubricants or packing.
  - 2. The technical service representative shall submit the results of the inspection including certification that the equipment was properly installed and is operating as specified and as installed.

- C. Start-up and Performance Testing
  - 1. Fourteen (14) days notice of scheduled start-up and performance testing dates shall be given to the Engineer for each new pumping station. The following representatives, as appropriate, shall be present simultaneously for the start-up and final performance test dates:
    - a. General Contractor
    - b. Electrical Subcontractor
    - c. Equipment Manufacturer's Technical Service Representative
    - d. Instrumentation and Control Equipment Representative
    - e. Owner and Owner's Representative
  - 2. General Requirements
    - a. If equipment is unable to operate, initial calibration and/or additional adjustments are required, or representatives are absent, the performance test shall be canceled at that time and full re-scheduling will be required. Damages shall be assessed to the Contractor for Owner's, Owner's Representative, and Manufacturer's Representative time and expenses wasted on scheduling, coordinating and attending the failed performance test.
    - b. Once the <u>complete</u> facility is fully tested, operational, calibrated and capable of performing, and approved by the Engineer, the Owner shall take occupancy of the equipment and the warranty period shall begin. It should be noted that the final performance test is meant to check complete performance of the equipment, and is not a time for contractors' or manufacturers' representatives to begin major calibrating, testing, and adjusting of their equipment to insure it works or performs as required.
    - c. All testing and related costs and fees including chemicals and deliveries shall be furnished by the Contractor and at no additional cost to the Owner.
  - 3. Startup Activities
    - a. All mechanical and electrical equipment shall be checked to verify it is properly connected. Preliminary run-ins of mechanical equipment shall be done to verify that it is

operating properly. All systems shall be cleaned of all debris and build-up.

- b. Alarm system shall be tested to show it is capable of transmitting and annunciating <u>all</u> specified alarm conditions.
- c. Instruments: Contractor shall furnish standards, calibrated meters, and necessary instruments, labor, and equipment to test installed instruments under the direction of the Engineer. Units will be tested to determine their accuracy, precision and efficiency.
- d. All safety equipment shall be installed and operating properly prior to any equipment operation or performance testing.
- e. All spare parts, tools, lubricants shall be delivered to the Owner prior to the performance test of any equipment or systems.
- 4. Performance Tests:
  - a. General: Full tests on <u>all</u> items and <u>systems</u> shall be made at the pumping stations after all equipment has been installed and a final testing and inspection and all startup activities have been satisfactorily conducted by the Contractor, and the Contractor is satisfied that the equipment is operating as specified. At no time during the startup of the facilities shall any equipment or system be operated under a more severe condition than the maximum design condition for which the equipment is rated.
  - b. Full System Test: The successful performance of all systems, equipment and components for each pumping station shall be demonstrated to the satisfaction of the Engineer by completing a full system demonstration test. The demonstration test will consist of operating the pumping stations and related equipment. Failure of equipment to operate as specified will require the test to be re-performed for the full period.
  - c. Substantial completion and facility acceptance will not be issued until the full system tests are completed successfully for all unit processes. Satisfactory performance shall be considered achieved once the facility equipment and systems, including the related electrical and instrumentation systems, have operated, and met all performance criteria, for the specified time period. All wiring connections and

instrumentation and control devices and signals shall be complete and function as a complete system.

- d. Equipment to Meet Requirements: In the event of a failure to demonstrate satisfactory facility performance on the first or any subsequent attempt, it shall be the responsibility of the Contractor to make all the necessary and required changes, replacements, and tests to make the units meet the specified operating and efficiency requirements.
- e. The Contractor shall be fully responsible for the operation and maintenance of the new equipment and systems until the performance test has been completed and substantial completion and facility acceptance has been issued.

# 1.6 GUARANTEE

- A. The Contractor shall guarantee the materials and equipment furnished and the performance thereof to be in accordance with the requirements of the Contract Documents and agrees upon written notice to make promptly and without charge, all necessary changes, corrections, and replacements (including installation of replacement parts) required to make good all defects developing in the material or equipment, under ordinary use and proper care, within a minimum period of twelve (12) months after final acceptance or substantial completion. Longer guarantee and warranty periods are required for some components of the project. See individual specification sections.
- B. The manufacturer's technical service representative shall be experienced in the installation, operation and testing of the equipment and/or system he/she shall be responsible for inspecting, starting up and testing. The manufacturer's sales representative shall not be provided as the technical service representative.

## 1.7 EQUIPMENT USAGE

A. Any partial or full usage of the proposed equipment by the Owner, and/or his employees or agents, prior to acceptance shall be the responsibility of the Contractor.

## 1.8 OPERATIONAL EXPENSES

A. The Contractor shall be responsible for the proper handling, sampling, lab testing and analysis, and disposal of all water and wastes generated from the testing and start-up of the facility.
# END OF SECTION 01650

FACILITY START-UP/ COMMISSIONING 01650 - 6 THIS PAGE INTENTIONALLY LEFT BLANK

FACILITY START-UP/ COMMISSIONING 01650 - 7

# SECTION 01700

## CONTRACT CLOSEOUT

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Closeout procedures.
  - 2. Final cleaning.
  - 3. Adjusting.

#### 1.3 RELATED WORK

A. Warranties and Bonds are included in Section 01740.

#### 1.4 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 Engineer's inspection.
- B. Provide submittals to Engineer that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payment, and sum remaining due.
- D. Submit all warranties.
- E. Submit written notice that all subcontractors and suppliers have been paid in full.
- F. Submit written notice showing the disposition of all insurance filings and claims.

CONTRACT CLOSEOUT 01700 - 1

# 1.5 FINAL CLEANING

- A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
  - 1. Remove labels that are not permanent labels.
  - 2. Clean exposed exterior and interior hard-surfaced finishes to a dustfree condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.
  - 3. Contractor shall have the installing Subcontractor shall wipe surface of non-submerged mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
  - 4. 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.

# 1.6 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 SECTION 01700

## SECTION 01710

## CLEANING UP

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. During its progress, the work and the adjacent areas affected thereby shall be 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.
- B. 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.
- C. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.
- D. The Contractor shall thoroughly clean all materials and equipment installed by him and his sub-contractors, and on completion of the work shall deliver it undamaged and in fresh and new-appearing condition. All mechanical equipment shall be left fully charged with lubricant and ready for operation.
- E. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of

operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01710

CLEANING UP 01710 - 2

## SECTION 01730

## OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

#### 1.3 RELATED WORK

- A. Section 01300: Submittals
- B. Section 01400: Quality Assurance
- C. Section 01740: Warranties and Bonds

#### 1.4 OPERATING AND MAINTENANCE INSTRUCTIONS AND PARTS LISTS

- A. Where reference is made in the Detailed Technical Specifications to operating and maintenance manuals and spare parts lists, the Contractor shall submit an electronic draft version for each piece of equipment using Submittal Exchange. Contractor shall address any Engineering comments to the draft materials and resubmit an electronic copy using Submittal Exchange until such time that the Engineer requests submittal of a hard copy version.
- B. Where reference is made in the Detail Technical Specifications to operating and maintenance manuals and spare parts lists, the Contractor shall furnish for each piece of equipment six (6) complete sets giving the information listed below.
  - 1. The manual for each piece of equipment shall be a separate document with the following specific requirements:
    - a. Contents:
      - (1) Table of contents and index
      - (2) Brief description of each system and components

- (3) Starting and stopping procedures
- (4) Special operating instructions
- (5) Routine maintenance procedures
- (6) Clean and concise manufacturer's printed operating and maintenance instructions, adjustment, lubrication and other maintenance of equipment including: parts list, illustrations, and diagrams
- (7) One copy of each wiring diagram
- (8) One copy of each approved shop drawing and each Contractor's coordination and layout drawing
- (9) List of spare parts, manufacturer's price, and recommended quantity
- (10) Name, address, and telephone numbers of local service representatives

# b. Material:

- (1) Loose leaf on 60 pound, punched paper
- (2) Holes reinforced with plastic cloth or metal
- (3) Page size, 8-1/2-in. by 11-in.
- (4) Diagrams, illustrations, and attached foldouts as required of original quality, reproduced by dry copy method
- (5) Covers: oil, moisture, and wear resistant 9 X 12 size
- c. Submittals to the Engineer:
- B. Such instructions and parts lists shall be completely and neatly annotated so that only the specific equipment and features furnished are clearly indicated. References to other sizes and types or models of similar equipment shall be deleted or neatly lined out.
- C. Such instructions and parts lists shall be delivered to the Engineer at the same time that the equipment to which they pertain is delivered to the site. Each submittal shall be accompanied by a transmittal form identifying the information included. Each submittal shall be reviewed by the Engineer for compliance with the above requirements.

# 1.5 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of Project, names, addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

- B. For Each Product or System: List names, addresses and telephone number of Subcontractors and suppliers; including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. A list of all parts for the equipment with each part identified by a functional name, the part manufacturer's name and a unique part number, (normally the part manufacturer's alpha-numeric designation). A list of parts keyed by non-unique item numbers to a sectional drawing will not be adequate to fulfill this requirement.
- E. All components of each system, e.g., pump motor, coupling, and drive, shall be combined in a single submittal with the above data provided for each component.
- F. Drawings: Supplement product data to illustrate relations of component parts, and data applicable to installation. Delete inapplicable information.
- G. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's printed instructions specified.
- H. Warranties and Bonds are as specified in Section 01740.

# 1.6 MANUAL FOR MATERIALS AND FINISHES

- A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Include manufacturer's printed recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing, applicable reference standards, chemical composition, and details of installation. Provide printed recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual product specification sections.

E. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

# 1.7 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. For each Item of Equipment and Each System provide the following:
  - 1. Description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include certified performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
  - 2. Panelboard Circuit Directories including electrical service characteristics, controls and communications, and color coded wiring diagrams as installed.
  - 3. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shut-down, and emergency instructions; and summer, winter, and any special operating instructions.
  - 4. Maintenance Requirements:
    - a. Route procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
    - b. Servicing and lubrication schedule, with list of lubricant type, frequency and method of lubrication. Any components which do not require lubrication or any expendable components which are not normally serviced shall be clearly noted as such.
    - c. Manufacturer's printed operation and maintenance instructions.
    - d. Sequence of operation by controls manufacturer.
    - e. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
    - f. Lubrication and maintenance schedules shall be similar to that specified in Section 01300.
  - 5. Control diagrams by controls manufacturer as installed.
  - 6. Contractor's coordination drawings, with color coded piping diagrams as installed.

- 7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- 8. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- 9. Test and balancing reports as specified.
- 10. Additional Requirements: As specified in individual product specification section.
- B. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

# 1.8 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in Operations and Maintenance Manual when need for such data becomes apparent during instruction.
- D. Provide a completed and filled-out Equipment Manufacturer's Certificate of Installation, Testing and Instruction form attached to the end of this section.

# 1.9 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall arrange for the services of qualified service representatives from the company that manufactured or supplied the new sewage pump station.
- B. After installation, and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include but shall not be limited to, the following points as applicable:
  - 1. Soundness (without cracked or otherwise damaged parts).
  - 2. Completeness in all details, as specified.

- 3. Correctness of setting, alignment, and relative arrangement of various parts.
- 4. Adequacy and correctness of packing, sealing, and lubricants.
- C. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.
- D. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a Certificate of Compliance stating that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void (except for the relocated variable frequency drive, for which the manufacturer's warranty has expired).
- E. After the Engineer has reviewed the reports from the manufacturers' representatives, the Contractor shall make arrangements to have the manufacturers' representatives present when the field acceptance tests are made.
- F. Refer and conform to the additional requirements specified in Section 01400.

# 1.10 NAMEPLATES

- A. With the exceptions mentioned below, each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.
- B. This requirement shall not apply to standard, manually operated hydrants or to gate, globe, check, and plug valves.

# 1.11 LUBRICANTS

- A. During testing and prior to acceptance, the Contractor shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this contract.
- 1.12 SPECIAL TOOLS

- A. For each type of equipment furnished by him, the Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.
- B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.
- C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.
- D. The Contractor shall furnish and erect one or more neat and substantial steel wall cases with flat key locks and clips or hooks to hold each tool in a convenient arrangement.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01730

# EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION, TESTING AND INSTRUCTION

Owner -
(fill in)
Project
Contract No (fill in)
EQUIPMENT SPECIFICATION SECTION NO
EQUIPMENT DESCRIPTION
I, Authorized representative of (Print Name)
(Print Manufacturer's Name)
hereby CERTIFY that
installed for the subject project (has) (have) been installed in a satisfactory manner, (has) (have) been satisfactorily tested, (is) (are) ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit(s) on
Date: Time:
CERTIFIED BY:DATE: (Signature of Manufacturer's Representative)

# OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

(I) (We) the undersigned, authorized representatives of the \_\_\_\_\_

have received classroom and hands-on instruction on the operation, lubrication, and maintenance of the subject equipment and (am) (are) prepared to assume normal operational responsibility for the equipment:

 Date:
 Date:

OPERATION AND MAINTENANCE DATA 01730 - 10 THIS PAGE INTENTIONALLY LEFT BLANK

# SECTION 01732

# SELECTIVE DEMOLITION

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Demolition and removal or salvage of selected portions of equipment or piping system as indicated on drawings.
- B. Related Sections include the following:
  - 1. Divisions 1, 2 and 11, and 16 of the Contract Specifications.

#### 1.3 **DEFINITIONS**

A. See Section 01080 – ABBREVIATIONS AND DEFINITIONS.

#### 1.4 MATERIALS OWNERSHIP

- A. Coordinate with Owner's representative, who will make final determination as to whether an item is to be salvaged or removed.
- B. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- C. In preparing bid, bidders shall consider the value of demolished materials that become Contractor's property.

#### 1.5 QUALITY ASSURANCE

A. Contractor shall exhibit experience in demolition work similar in material and extent to that indicated for this Project.

- B. Provide in accordance with Section 01400 and as specified.
- C. Demolish and remove existing construction, utilities, equipment, and appurtenances without damaging integrity of existing structures, equipment, and appurtenances that are to remain.
- D. Store equipment to be salvaged for relocation where directed by Engineer, and if necessary, protect from damage during Work.
- E. Repair or remove items that are damaged. Repair and install damaged items at no additional compensation and to condition at least equal to that which existed prior to start of Work.
- F. Exercise all precautions for fire prevention. Make acceptable fire extinguishers available at all times in areas where demolition work by burning torches is being done. Do not burn demolition debris on or near site.
- G. Protect persons and property throughout progress of Work. Proceed in such manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel.
- H. Obtain permission from Engineer before abandoning or removing any existing structures, materials, equipment and appurtenances.
- I. Make arrangements with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.
- J. Regulatory Requirements:
  - 1. Comply with governing EPA notification regulations before beginning selective demolition.
  - 2. Comply with hauling, disposal and recycling regulations of authorities having jurisdiction.
  - 3. Conform to applicable codes and requirements for demolition of structure, safety of adjacent structure, dust control, service utilities, and discovered hazards.
- K. Standards: Comply with ANSI A10.6 and NFPA 241.

# 1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

# PART 2 - PRODUCTS

## 2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

# PART 3 - EXECUTION

#### 3.1 REFERENCES

- A. Confine apparatus, storage of materials, demolition work, new construction, and operations of workmen to areas that will not interfere with continued use and operation of entire facility. Provide and maintain lights, barriers, and temporary passageways for free and safe access.
- B. Cap or plug with brick and mortar pipes and other conduits abandoned due to demolition, unless specified otherwise in the Drawings.

#### 3.2 EXAMINATION

- A. Verify that utilities have been purged, disconnected and capped.
- B. Document existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Contractor shall engage Engineer to identify those materials, equipment and appurtenance to be removed and salvaged. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

# 3.3 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Interruption to service of any utility shall be limited as stated in Section 01810.
- C. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
  - 1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.
- D. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
  - 1. Arrange to shut off indicated utilities with the Owner and/or utility companies.
  - 2. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
  - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

#### 3.4 PREPARATION

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Site Access and Temporary Controls: Conduct selective demolition and debrisremoval operations to ensure minimum interference with driveways and pedestrian pathways.
  - 1. Do not close or obstruct driveways without permission from Owner. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
  - 2. Confine apparatus, storage of materials, demolition work, new construction, and operations of workmen to areas that will not interfere with continued use and operation of entire facility. Provide and maintain lights, barriers, and temporary passageways for free and safe access.
- C. Temporary Facilities: Provide temporary protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

- 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- 3. Cover and protect furnishings and equipment that have not been removed.
- D. Provide maximum practicable protection from inclement weather for materials, equipment, and personnel located in partially dismantled structures.
- E. Provide temporary shoring or bracing for valves, piping, conduits, etc. to remain.

# 3.5 DEMOLITION REQUIREMENTS

- A. Conduct demolition so as to minimize interference with adjacent building areas.
- B. Under no circumstances shall explosives be used.
- C. Conduct operations with minimum interference to public or private accesses.
- D. Maintain protected access and egress at all times. Do not close or obstruct roadways without permits.
- E. Cease operations immediately if adjacent structure appears to be in danger. Notify Owner.

#### 3.6 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cap or plug with brick and mortar, as indicated, pipes and other conduits abandoned due to demolition.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain adequate ventilation when using cutting torches.

- 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- 7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- 8. Dispose of demolished items and materials promptly.
- 9. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition, cleaned and reinstalled in their original locations after selective demolition operations are complete.

# 3.7 SALVAGE

- A. Materials, equipment, and appurtenances designated for salvage or reinstallation shall be protected during demolition to prevent damage. Furthermore, materials, equipment and appurtenances shall be labeled, cleaned and stored in a location designated by the Owner.
- B. Equipment identified to be salvaged shall be carefully removed, protected and delivered to the Owner.
- C. The following list of equipment contains a partial list of salvage item identified by the Owner. Additional equipment and materials for salvage identified by the Owner during construction shall be removed and salvaged at no additional expense to the Owner. Contractor shall remove and salvage this equipment in accordance with these specifications.
  - None

# 3.8 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Division 1 Section "Cutting, Coring and Patching."
- C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

# 3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

## 3.10 CLEAN UP

- A. Remove demolished materials from site as work progresses.
- B. Leave areas of work in clean condition.
- C. Upon completion of demolition, the contractor is required to implement his approved sampling plan, outlined in the paint debris collection plan, on all collected paint debris.

## 3.11 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

# END OF SECTION 01732

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#### SECTION 01740

#### WARRANTIES AND BONDS

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

## 1.3 RELATED WORK

- A. Refer to General Conditions of the Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01700 Project Closeout.
- C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16.
- D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

# 1.4 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
- B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen (15) days of completion of that designated portion of the Work.

- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Engineer for approval prior to final execution.
- D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- E. At Final Completion, compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- F. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.
- H. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.
- I. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.
- J. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

# 1.5 WARRANTY REQUIREMENT

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the all related costs of removal, transportation, replacing or rebuilding defective Work, and reinstallation regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.
- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

# 1.6 DEFINITION

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

# PART 2 - PRODUCTS - (NOT USED)

# PART 3 - EXECUTION - (NOT USED)

END OF SECTION 01740

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WARRANTIES AND BONDS 01740 - 4

## SECTION 01850

## TRAFFIC MANAGEMENT

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Pedestrian and vehicular traffic and other safety control devices, requirements and management for the protection of the traveling public and working personnel during construction and related operations.
  - 2. The design, application, and installation of all devices required by this section shall conform to the requirements of the MassDOT permit and the Manual on Uniform Traffic Control Devices (MUTCD).
  - 3. Traffic management during construction and maintenance operations include installing and maintaining temporary vehicular, pedestrian and construction facilities, furnishing, installing, inspecting, resetting, and removing channelization devices necessary to maintain pedestrian and vehicular traffic during construction and fencing of excavations as required.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Traffic Management Plans: Contractor shall submit to the Engineer for approval, a traffic management plan, complete with details of the proposed methods, including materials.
  - 2. Shop Drawings
    - a. Submit complete shop drawings for the construction, and temporary pedestrian and construction facilities and sidewalks, as needed, stamped and certified by a Professional Engineer registered in the Commonwealth of Massachusetts.

- b. Show on the shop drawings all materials, including traffic control devices, signs and methods of installation.
- c. Include with the shop drawings alignment tapers, lane widths, police detail locations, temporary pavement markings, barriers and traffic control device spacing.
- 3. Safety Signing for Construction Operations. Contractor shall submit temporary traffic control plans and sign placement and size sketches showing the proposed sign setups he intends to use to provide the necessary traffic control and protection during the progress of the work, plus the sign and legend size and layout. These sketches shall be submitted to the Owner for review and approval before work begins.
- 4. The Contractor shall submit to the Owner the information required by this section a minimum of fourteen (14) working days prior to the start of construction and prior to the start of construction at any new location throughout the duration of work under this contract.
- 5. Before starting any work under this Contract, the Contractor shall prepare, and submit to the Engineer for approval, a plan that indicates the traffic routing proposed by the Contractor during the various stages and time periods of the work, and the temporary pedestrian and construction facilities, temporary barricades, signs, drums, and other traffic control devices to be employed during each stage and time period of the work, to maintain traffic and access to abutting properties. Particular care shall be taken to establish and maintain methods and procedures that will not create unnecessary or unusual hazards to public safety. Traffic control devices required only during working hour operations shall be removed at the end of each working day.

# 1.4 QUALITY ASSURANCE

A. Provide in accordance with Section 01400.

# 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 and as specified.
- B. No material shall be stored within the work area or on adjacent roadways or residential streets except which is needed to complete the work for that day.

# 1.6 TRAFFIC CONTROL REQUIREMENTS

A. The Contractor shall meet the following conditions, unless otherwise specifically approved by the Owner or Engineer:

- 1. All work shall be prosecuted with proper regard for the convenience of the public and in a manner to permit unimpeded traffic flow whenever possible. The interruption of traffic will not be permitted unless specifically allowed by the Engineer and in accordance with the requirements of the Owner and in conformance with MUTCD requirements.
- 2. The Contractor shall be responsible for coordination with the Owner's departments affected by the project.
- 3. Traffic control devices and signs shall be removed, demounted or properly covered for those periods of the day not in use.
- 4. The Owner shall be notified of any re-routing of traffic 72 hours in advance. Approval must be obtained from the Owner prior to any rerouting of traffic (except emergencies).
- 5. No operations shall be conducted, including the loading or unloading of vehicles, on or near the traveled lanes or road shoulders without first erecting warning signs and channelizing devices as directed. These precautions shall be maintained at all times while work is in progress.
- 6. Construction signs and channelizing devices shall be used to separate traffic from the work areas and for traffic control. Placement, other than as shown in the plans or the MUTCD, will require prior approval from the Owner.
- 7. Temporary signs and channelizing devices shall not be set up until there is adequate visibility or appropriate construction lighting. The Contractor shall schedule his work so that temporary signs and channelizing devices are removed and traffic is returned to its normal pattern before the end of the work period.
- 9. Work operations shall not be performed on the roadway in such a manner that traffic is obstructed or endangered simultaneously from both sides of the roadway.
- 10. The Contractor shall keep all roadway areas open to traffic as clear as possible at all times. Materials shall not be stored on any roadway area or within 10 ft. of the traveled way. Materials shall be delivered to the installation areas as they are needed to provide a continuous installation. Location of storage areas shall be subject to approval.
- 11. The Contractor shall remove all equipment and construction vehicles from the traveled way and shoulders open to traffic during non-work hours. Vehicles shall be parked no closer than 10 feet from the traveled way in pre-approved areas unless specifically permitted.

- 12. The Contractor shall provide necessary, unimpeded access for fire apparatus and other emergency vehicles through the work zones to abutting properties at all times.
- 13. Sweeping and cleaning of surfaces beyond the limits of the project required to clean up material caused by spillage or vehicular tracking during the various phases of the work shall be considered as incidental to the work being performed under the Contract and there will be no additional compensation. Sweeping and cleaning shall be done daily.

# 1.7 EXCAVATIONS

- A. The Contractor shall excavate for the amount of work to be completed and subsequently backfilled that same day. Open excavations shall not remain open through non-work hours, unless they are properly protected from a safety perspective and do not impede traffic flow. At the end of each work week, backfilled excavations shall be paved with hot mix asphalt in accordance with the Drawings and Specifications. Temporary paint pavement markings that match the existing markings disturbed by the excavation shall be applied to the new pavement.
- B. Open excavations may not be steel plated and opened to vehicular or pedestrian traffic, except where otherwise specified or unless prior approval is obtained from the Owner.

# 1.8 COORDINATION OF WORK AREAS

A. The Contractor shall be responsible for the coordination of his/her work with all utility or roadway work being performed by utility owners in relation to this project or projects adjacent to this project. The Contractor shall phase all work in a manner that will provide positive and safe through movement of traffic passing the construction site.

# 1.9 ACCESS TO PROPERTIES

- A. At least one serviceable driveway access to all residences and businesses within the project shall be maintained at all times.
- B. The Contractor shall coordinate the work with the schedules of delivery trucks to the adjacent stores and property owners so as not to impede their access.

# 1.10 HAULING

A. The Contractor is advised that all roads and bridges within or adjacent to the project shall be subject to legal loads and vehicles.

- B. The Contractor is advised that no agreements have been made by the Town of Westport with surrounding cities or towns to relieve the Contractor of liability for damage to local roads and bridges caused by the Contractor's operation. The Contractor shall contact appropriate officials of the surrounding cities or towns concerning hauling over city or town roads and bridges.
- C. The Contractor shall furnish 60" x 30" approved signs reading "CONSTRUCTION VEHICLE - DO NOT FOLLOW" to be used on trucks hauling to the project, when such signs are deemed necessary by the Engineer. The color, type of sheeting and size of lettering shall conform to that of the permanent construction signs.
- C. Each driver of any vehicle used on this contract shall be furnished written instructions concerning the manner of operation for that vehicle. Specifically, these instructions shall warn against stopping on the traveled portions of the roadway, against passing other vehicles, and against traveling in close proximity to other vehicles. A copy of these instructions shall be given to the Engineer.

# 1.11 TRAFFIC SIGNALS

- A. Traffic signals shall remain operable at all times throughout the duration of the contract unless approved otherwise by the Owner.
- B. The Contractor, at his expense, shall repair any damage to the traffic signal system resulting from the Contractor's work.

# 1.12 PEDESTRIAN TRAFFIC

- A. Sidewalks shall be maintained at all times through the construction period. Temporary sidewalks, pedestrian detours and pedestrian and construction facilities shall be constructed as needed to maintain pedestrian traffic and business access, as shown on the plans or as ordered.
- B. Pedestrian access will be provided to abutting land uses such as residences and businesses at all times, as approved by the Owner and in accordance with MUTCD and ADA requirements.
- C. Unobstructed walkways of 4 feet minimum width, unless otherwise approved by the Owner, will be provided at all times.
- D. Temporary pedestrian walkways shall be separated from roadway and constructed areas by barricades as approved by the Owner.

# 1.13 TRAFFIC CONTROL DEVICES

A. Install, inspect, remove and rest all temporary construction elements in

accordance with an approved construction staging sequence and traffic management plan.

- B. Traffic control devices shall be subject to removal, replacement, and repositioning as often as necessary, and as directed by the Owner.
- C. Materials required for the work of this Section need not be new, but must be in first-class condition and acceptable to the Owner. Any materials, that in the judgment of the Owner, are unsatisfactory in appearance or performance shall be removed and immediately replaced by acceptable units.
- D. All traffic control devices shall conform to requirements of MUTCD, and Massachusetts DOT, whichever requirement is most strict. This shall apply to all common traffic control devices whether listed below or not:
  - 1. Portable barricades
  - 2. Safety Signing for Construction Operations
  - 3. Portable Precast Concrete Barrier
  - 4. Traffic Drums
  - 5. Temporary Pavement Markings and Tape
  - 6. Variable Message Board(s) (As may be required by MassDOT)
  - 7. Special Lighting Unit (Flashing Arrow)
  - 8. Temporary Safety Fencing
  - 9. Sign Covers

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not used)

# END OF SECTION 01850
#### SECTION 02010

#### SUBSURFACE INVESTIGATION

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, presence and depth of rock, groundwater table or similar physical conditions at the site, the conformation of subsurface materials to be encountered, the character of equipment and facilities needed prior to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with all available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work.
- B. The Contractor's attention is directed to Article 4 of Section 00700 GENERAL CONDITIONS pertaining to Subsoil Investigation.

#### 1.3 SUBSURFACE DATA

A. The location and depth of subsurface investigations are shown on the Drawings and in the Specifications. Such data is offered in good faith solely for the purpose of placing the Contractor in receipt of all information available. The Contractor must interpret such data according to his own judgment and acknowledges that he is not relying upon the same as accurately describing the subsurface conditions which may be found to exist. The Contractor further acknowledges that he assumes all risk contingent upon the nature of the subsurface conditions, to be actually encountered by him in performing the work covered by the Contract, even though such actual conditions may result in the Contractor performing more or less work than he originally anticipated. PART 2 – PRODUCTS (NOT USED)

PART 3 – INSTALLATION (NOT USED)

END OF SECTION 02010

SUBSURFACE INVESTIGATION 02010 - 2

#### SECTION 02200

#### EARTHWORK

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

#### 1.2 SUMMARY

- A. This Section includes excavations of normal depth in earth for trenches and structures; backfilling such excavations to the extent required; filling; rough grading; cofferdamming; constructing embankments; miscellaneous earth excavation; dewatering; temporary excavation support; blasting; the removal, hauling and stockpiling of suitable excavated material for subsequent use in the work; all rehandling, hauling and placing of stockpiled materials for use in refilling, filling, backfilling, grading and such other operations; the removal and satisfactory disposal off the site of unsuitable material; and appurtenant work, complete, in accordance with the Drawings and Specifications, and as directed.
- B. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.3, below.

## 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

- C. Backfill Materials: If requested by the Engineer, submit a grain size analysis and curve performed in accordance with ASTM D422 for each proposed source of backfill for review by the Engineer. The grain size analysis shall indicate that the backfill material conforms to the gradation requirements specified.
- D. Excavation and Excavation Support Plan: For informational purposes only, and if requested by the Engineer, the Contractor shall submit the following prior to the start of the work, in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Submit within a minimum of four (4) weeks prior to construction:
    - a. The qualifications of the Contractor's excavation support system designer.
    - b. The qualifications of the Contractor's excavation support system installer.
    - c. Qualifications statements for (a) and (b), above, shall exhibit that each have completed at least five (5) successful excavation support projects of equal size and complexity and with equal systems within the last five (5) years.
  - 2. Submit a detailed temporary excavation support plan stamped and signed by a Registered Professional Engineer in the Commonwealth of Massachusetts. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
    - a. Excavation support system, plans, sections, details, location, layout, depths, extent of different types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.
    - b. Certificate of Design: Form in Section 01300.
    - c. Requirements of dewatering during the construction.
    - d. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.
    - e. List of equipment used for installing the excavation support systems.
  - 3. For excavation support systems left in place, submit the following asbuilt information prior to backfilling and covering the excavation support systems:
    - a. Survey locations of the temporary excavation support system, including coordinates of the ends and points of change in

direction.

- b. Type of the temporary excavation support system.
- c. Elevations of top and bottom of the excavation support systems left in place.
- 4. Submit a Construction Contingency Plan specifying the methods and procedures to maintain temporary excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.
- E. Submit a moisture-density curve indicating the maximum dry density and optimum moisture content as determined by ASTM D1557 for each proposed source of backfill for review of the Engineer.
- F. Submit a Pre-Blast Survey as described in this Section. Also, keep and submit to Engineer and at time specified by Engineer, an accurate record of each blast showing general location of blast, depth and number of drillholes, kind and quantity of explosive used, kind and number and interval of delay periods used, and other data required for a complete record.
- G. Dewatering Plan: For informational purposes only, and if requested by the Engineer, the Contractor shall submit the following prior to the start of the work, in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Submit within a minimum of four (4) weeks prior to execution of any dewatering, the Qualifications of the Contractor's Dewatering Professional. The Dewatering Professional shall have completed at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years. The submittal shall include, but not be limited to:
    - a. Qualifications of the Dewatering Professional who shall oversee the installation, operation and maintenance of the Dewatering system.
    - b. Qualifications of the Dewatering Systems Installer whose supervisor shall have a minimum of 5 years' experience in installation of well points, deep wells, recharge systems, or equal systems.
  - 2. Submit a detailed dewatering plan at least four (4) weeks prior to start of any dewatering operation. Do not submit design calculations, but submit working drawings for review by the Engineer. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means,

methods and sequencing of construction. The plan shall include the following items as a minimum:

- a. The proposed type of dewatering plan and details stamped and signed by a Professional Engineer registered in the Commonwealth of Massachusetts.
- b. Certificate of Design: Form in Section 01300.
- c. A list and description of equipment including, but not limited to, pumps, prime movers, and standby equipment, as well as the arrangement and location of system components.
- d. A description of the proposed method of dewatering; water reinfiltration; containment; treatment and discharge; and installation, maintenance, and system removal procedures.
- e. A groundwater monitoring plan shall be developed by the Professional Engineer retained by the Contractor and that designs the dewatering system. The monitoring plan shall address groundwater control within the excavations.
- f. Erosion/sedimentation control measures, and methods of disposal of pumped water.
- g. Types and sizes of sedimentation basins and filters.
- h. List of all applicable laws, regulations, rules, and codes to which dewatering design conforms.
- 3. Submit a modified dewatering plan within 24 hours, if open pumping from sumps and ditches results in boils, loss of fines or softening of the ground.
- H. Submit the qualifications of the independent geotechnical testing laboratory performing soil testing and inspection services during earthwork operations. The geotechnical testing laboratory shall demonstrate to the Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to ASTM D3740, that it has the experience and capability to conduct required field and laboratory geotechnical testing. In addition, the laboratory shall be supervised by a Registered Professional Engineer in the Commonwealth of Massachusetts. Costs for the soils laboratory services shall be paid by the contractor.

# 1.4 EXCAVATION CLASSIFICATIONS

A. Earth Excavation or "Excavation" consists of removal of materials encountered

to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.

- B. Unauthorized Excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.
  - 1. Under footings, foundations bases, concrete slabs, retaining walls or other structures, fill unauthorized excavations to the proper elevations with lean concrete. Elsewhere, backfill and compact unauthorized excavations as specified for excavations of the same class, unless otherwise directed by the Engineer.
- C. Additional Excavation:
  - 1. When excavation has reached required subgrade elevations, notify the Engineer who will review subgrade conditions.
  - 2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Engineer.
  - 3. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work or as provided for under the unit rates for this classification.
- D. Rock Excavation:
  - 1. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10 foot 0-inches in width and pits in excess of 30 feet 0-inches in either length or width are classified as open excavation.
  - 2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).
  - 3. Determination of rock excavation classification shall be made by the Engineer. Typical of materials classified as rock are boulders 1.0 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits. Intermittent drilling, blasting or

ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by Engineer. If the area to be excavated is preblasted prior to the excavation of overburden soils, the Engineer shall be notified at least two days in advance to allow observation of the preblast drilling by the Engineer in order to classify the excavation. Visual observation of the completed excavation may be made by the Engineer to modify the excavation classifications. Removal of rock excavation prior to classification by the Engineer shall be considered as earth excavation unless accepted by the Engineer in writing. Such excavation will be paid on the basis of contract unit rates for this classification.

## 1.5 EXCAVATION

- A. The Contractor shall perform all excavations of every description and of whatever substances encountered, in a manner as required to allow for placing of temporary earth support, forms, installation of pipe and other work, and to permit access to the Engineer for the purpose of observing the work. Excavations shall be to such widths as will give suitable space for the work. Bottoms of trenches and excavations shall be protected from frost and shall be firm, dry and in an acceptable condition to receive the work; work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.
- B. All excavations made in open cut shall be controlled by the conditions existing at the various locations and shall always be confined to the limits as designated by the Engineer. In no case shall earth be excavated or disturbed by machinery so near to the finished subgrade for structures and pipelines as to result in the disturbance of the earth below the subgrade. The final excavation to subgrade should be accomplished with a smooth faced bucket or by hand if directed by the Engineer.

#### 1.6 TEMPORARY EARTH SUPPORT

- A. The Contractor shall design, furnish, place and maintain such temporary excavation support systems as required to maintain lateral support, prevent loss of ground and to prevent danger to persons or damage to pavements, facilities, utilities, or structures, and to prevent injurious caving or erosion or the loss of ground, and to maintain pedestrian and vehicular traffic as directed and required.
- B. Common types of excavation support systems include, but are not limited to, singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheetpile wall, timber sheetpile wall, trench box, or combinations thereof.

- C. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, and other surcharge loads.
- D. In all sheeting, shoring and bracing operations, care shall be taken to prevent injury to persons or damage to structures, roadways, facilities, pipelines, utilities and services. Any injuries to persons shall be the responsibility of the Contractor; and any damage to the work or existing structures occurring as a result of settlement, water or earth pressure, or other causes due to inadequate bracing or other construction operations of the Contractor shall be repaired by the Contractor at no additional cost to the Owner.
- E. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance or design of the temporary excavation support systems. The Contractor shall pay for all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.
- F. Where sheeting is to be used, it shall be driven ahead of excavation operations to the extent practicable so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with selected fill, thoroughly compacted.
- G. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 5 feet [1.5 m] below the bottom of the excavation.
- H. Design temporary excavation support systems to withstand an additional 2 feet [60 cm] of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
- J. The Contractor shall leave in place all support of excavation within the zone of influence of all structures new or proposed. The zone of influence is defined as a line extending at least 1 foot beyond the outer edge of the structure foundation or pipeline spring line, then outward and downward at a slope of 1 horizontal to 1 vertical. The Contractor shall cut off the sheeting at elevations to be determined by the Engineer.
- K. The Contractor shall comply with all federal, state, and local safety regulations, and requirements.

# 1.7 DEWATERING SYSTEM

A. The Contractor shall design, furnish, install, operate, maintain and remove at his own expense, a temporary dewatering system to ensure that work is performed under dry and stable conditions, free from groundwater and/or

surface runoff. The temporary dewatering system shall be implemented so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. The Contractor shall implement erosion control measures (dewatering/siltation basin) for disposing of discharged water in order to prevent pumped drainage water from causing damage to adjacent property and in compliance with permit and other regulatory requirements.

- B. Work to be done as part of dewatering includes, but is not limited to:
  - 1. Lower the groundwater level within excavations to at least 12 inches (304.8mm) below the bottom of the excavation.
  - 2. Lower the groundwater level within entry and exit pits to at least 12 inches below the bottom of the pit excavations.
  - 3. Lower hydrostatic pressure.
  - 4. Prevent surface water from entering the excavation during construction.
  - 5. Implement erosion and sedimentation control measures for disposing of discharge water.
  - 6. Provide system to treat/settle all water removed from excavations, except water that is re-infiltrated to the ground on site in a manner that does not result in negative on- or off-site impacts.
  - 7. Provide an Environmental Site Professional/Dewatering Professional/Field Representative (hereinafter referred to as the Dewatering Professional) who will be responsible for dewatering, reinfiltration, treatment and discharge of dewatering flows as specified and in compliance with all applicable permits and regulations.
- C. Water removed from excavations shall be reinfiltrated to the ground if feasible. If reinfiltration is not feasible, treated water shall be directly or indirectly discharged to a surface water in accordance with a National Pollutant Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency (EPA). In no case shall dewatering flows be directly or indirectly released to surface waters or storm drains prior to settling and appropriate additional treatment. The Contractor is responsible for acquiring all the proper permitting required for the chosen method of discharge.
- D. Any damage resulting from the failure of the dewatering operations of the Contractor, and any damage resulting from the failure of the Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by the Contractor, at no additional expense to the Owner. The Contractor's pumping and dewatering operations shall be carried out in such a manner as to prevent damage to the Contract work and so that no loss of ground will result from these operations. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the subgrade, and modify system to perform as specified at no additional cost to the Owner. Precautions shall be taken to protect new

EARTHWORK 02200 - 9 work from flooding during storms or from other causes. Pumping shall be continuous where directed by the Engineer to protect the work and/or to maintain satisfactory progress.

- E. Notify the Engineer immediately if any settlement or movement is detected on structures. If the settlement or movement is deemed by the Engineer to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the Engineer within <u>24 hours</u>. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the Owner.
- F. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced and protected. Water from the trenches, excavations and drainage operations shall be disposed to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the Engineer.
- G. The Contractor shall control the grading in the areas surrounding all excavations so that the surface of the ground shall be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided for drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.

## 1.8 BLASTING

- A. Blasting shall be permitted as accepted by the Engineer, except as noted on the Drawings and as specified herein.
- B. All blasting operations, including transportation, handling, storage and protection of detonators and explosives shall comply with the requirements of the State Labor Department, Occupational Safety and Health Administration provisions, as well as those of State and local regulations. In the case of conflict of regulations, the most stringent regulations shall apply.
- C. Pre-Blast condition Survey: Prior to the start of blasting work, the Contractor shall engage an independent professional engineer, experienced in performing Pre-blast Surveys, to conduct a pre-blast condition survey of all existing structures and conditions on the site, adjacent to the site, or in the vicinity of the site. This survey shall extend to such structures or conditions as may be affected by the contractor's construction operations. As a minimum, condition surveys shall be performed on all structures within 300 ft. of anticipated blasting areas.

The Contractor shall also:

- 1. Coordinate activities, issue notices, obtain clearances and provide whatever photographic and secretarial assistance is necessary to accomplish the survey.
- 2. Give seven days notice in writing, to the owner of the property concerned, and tenants of the property. Advise in notice the dates on which surveys are to be made so that they may have representatives present during the examination. Provide copies of all notices to the Engineer.
- 3. The survey shall consist of a description of the interior and exterior conditions of the various structures examined. Descriptions shall locate any cracks, damage, or other defects existing and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks, damage, or other defects exist, or for defects too complicated to describe in words, photographs shall be taken and made part of the record.

The Contractor's record of the pre-blast condition survey shall consist of written documentation and photographs of the conditions identified, or a good quality videotape survey with appropriate audio description of conditions and defects. Prior to start of work, one copy of the Contractor's record of condition survey shall be submitted to the Engineer for information and retention.

The Contractor shall make an examination similar to the preconstruction survey of any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed and give notice to all interested parties so that they may be present during the final examination. Records of the final examination shall be distributed the same as the original preconstruction survey.

- D. Indemnity: Notwithstanding full compliance with these specifications, as well as the blasting plan, and successful limitation to maximum peak particle velocity and airblast overpressure noted below, the Contractor shall be solely responsible for any damage, direct or indirect, arising from blasting and shall hold the Owner and Engineer harmless from any costs of defense, arising from such damage, real or alleged. The Owner and Engineer shall be additionally-named insured on any insurance policy covering blasting carried by the Contractor, and this requirement shall also be enforced on any subcontractor.
- E. Qualifications:
  - 1. Persons responsible for blasting shall be licensed blasters in the

Commonwealth of Massachusetts and shall have had acceptable experience in similar excavations in rock and controlled blasting techniques.

2. Blast monitoring shall be conducted by an independent, qualified professional engineer or seismologist, trained in the use of a seismograph, and records shall be analyzed and results reported by persons familiar with analyzing and reporting the frequency content of a seismograph record.

- F. Codes, Permits and Regulations:
  - 1. The Contractor shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the Commonwealth of Massachusetts and the Town, governing the transportation, storage, handling and use of explosives. All labor, materials, equipment and services for the blasting operations shall comply with such requirements and shall be provided without additional cost to the Owner.
  - 2. The Contractor shall obtain and pay for all permits and licenses required to complete the work of this section, including a permit(s) to transport explosives.
  - 3. In case of conflict between regulations or between regulation and Specifications, the Contractor shall comply with the strictest applicable codes, regulations or Specifications.
- G. Safety Procedures
  - 1. Clearing the Danger Area Before Blasting: No blasting shall be permitted until the Contractor removes all personnel from the danger area to a place of safety. A loud, audible, warning system, devised and implemented by the Contractor, shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, Owner, Police Officers, and Engineer with the implemented system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared, and guards shall be stationed to prevent entry until the area has been cleared by the blaster following the blast.
  - 2. Explosives shall be stored, handled and employed in accordance with federal, state and local regulations.
  - 3. No explosives, caps, detonators or fuses shall be stored on the site during non-working hours.
  - 4. Blasting mats shall be used to cover the top and vertical face of all blasts in order to minimize the possibility of excessive throw of rock. Any damaged mats shall be replaced with mats in good condition before blasting continues.
  - 5. The Contractor shall be responsible for determining all safety requirements unique to blasting operations at these particular sites so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.
  - 6. No requirement of, or omission to require, any precautions under this

Contract shall be deemed to limit or impair any responsibility or obligations assumed by the Contractor under or in connection with this contract; and the Contractor shall at all times maintain protection to safeguard the public and all persons engaged in the work, and shall take precautions as will accomplish such end, without undue interference to the public. The Contractor shall be responsible for and pay for any damage to adjacent roadways or structures resulting from work executed under this Section.

- H. General Blasting Procedures
  - 1. The time during which explosives may be used is restricted to Monday through Thursday between the hours of 8:30 AM and 2:00 PM (prevailing time) allowing ample time for cleanup. The use of explosives is not permitted on Friday, weekends (Saturday and Sunday), holidays, on the eve of a holiday nor between the hours of 2:00 PM and 8:30 AM, unless permitted otherwise by the Owner. In order to minimize traffic disruptions, the Contractor shall schedule blasting such that any two successive blasts detonated anywhere on the project are separated by at least 2 hours.
  - 2. Immediately after blasting, the Contractor shall provide equipment to the site to clear the pavement of blastrock. The Contractor shall also use a mechanical sweeper and water spray to control dust and small stones.
  - 3. The Contractor shall advise the Owner and Engineer at least two working days in advance of the dates on which he proposes to perform blasting operations, giving the approximate hour, for the Engineer's approval. The Contractor will be responsible for obtaining the permits and police officials required to close local streets during periods of blasting. The Contractor will notify the Owner and Engineer by noon of the day prior to any day he plans not to blast where the weekly schedule shows a day of blasting. This does not include changes due to weather or unexpected equipment breakdowns.
  - 4. Blast hole diameter shall be no greater than 3 inches.
  - 5. No free flowing, pourable or pumpable explosives shall be used. All explosives shall be in cartridges or other semi-rigid container.

## PART 2 - PRODUCTS

## 2.1 DEWATERING MATERIALS

A. Provide groundwater monitoring wells in accordance with the Contractor's

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submitted dewatering plan.

- B. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system.
- C. Provide sand and gravel filter around the well screen. Wrapping geotextile fabric directly around the well screen shall not be allowed.
- D. When deep wells, well points, or vacuum well points are used, provide pumping units capable of maintaining high vacuum and handling large volumes of air and water at the same time.
- E. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.
- F. Provide dewatering equipment, including an appropriately sized settling tank, and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.
- G. Provide temporary pipes, hoses, flumes, channels, crushed stone, geotextile fabric, sedimentation barriers, or any combination of the above for the transport of discharge water over-ground to the discharge location.
- H. Provide cement grout having a water cement ratio of 1 to 1 by volume.

## 2.2 TEMPORARY EXCAVATION SUPPORT MATERIALS

- A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.
- B. Steel Sheet Piling: ASTM A328, continuous interlocking type.
- C. Timber Lagging Left in Place: Pressured treated per appropriate AWPA standards having a nominal thickness of 3 inches (76.2 mm) and a minimum allowable working stress of 1100 psi (7584.233 Kpa).
- D. Timber Sheeting Left-in-Place: Structural grade having a nominal thickness of 4 inches (101.6 mm) and a minimum allowable working stress of 1100 psi (7584.233 Kpa).
- E. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.
- F. Raker Ties: ASTM A615 Grade 60.
- G. Cement Grout Materials And Admixtures For Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.

- H. Concrete: Section 03300.
- I. Tamping tools adapted for backfilling voids after removal of the excavation support system.
- J. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

## 2.3 BACKFILL MATERIALS

A. Common Fill: Common fill shall be soil containing no stone greater than 2/3 loose lift thickness. The materials shall be free of trash, ice, snow, tree stumps, roots and other organic and deleterious materials. Common fill shall not contain more than 30 percent of weight of silt and clay. It shall have a maximum dry density of not less than 110 pounds per cubic foot and it shall be of such a nature and character that it can be compacted to the specified densities in a reasonable length of time. Topsoil, silt and clay shall not be considered common fill.

Common fill shall be used as backfill outside limits of structures and pavement structures.

B. Structural Fill: Structural fill shall consist of well graded gravel and sand consisting of hard durable particles, and free from clay, trash, ice and snow, tree stumps, roots and other organic and deleterious or organic matter. Structural fill shall be used for replacement of unsuitable materials, such as soft organic soils or existing fill, below pipe and inverts and below structures, as pavement base and for other over-excavations. Structural fill shall conform to the following gradation requirements.

Sieve Size	Percent Finer by Weight	
8-inch	100 (1)	
3-inch	70-100	
1-inch	45-90	
No. 4	20-70	
No. 10	15-60	
No. 40	10-40	
No. 200	0-10	
(1) Four-inch maximum particle size within 12 inches of slab, footing or pavement grade.		

C. Gravel: Gravel fill shall consist of hard, durable sand and gravel, and shall be free from ice and snow, roots, sod, rubbish, clay and other deleterious or organic matter. It shall conform to the following gradation requirements.

Sieve Size	Percent Finer by Weight		
(a)	100		
1/2-inch	50-85		
No. 4	40-75		
No. 10			
No. 40	10-35		
No. 100	(b)		
No. 200	0-8		
Notes:			
(a)Maximum grain size shall be four (4)-			
inches where placed as base below slab and			
pavement; elsewhere 2/3 of the loose lift			
thickness.			
(b)The amount passing the No. 100 sieve			
should be between 40 percent and 70 percent			
of the amount passing the No. 40 sieve.			

Gravel shall be used as sub-base course for pavement.

D. Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements. Crushed stone may be used underneath structures in lieu of Structural Fill.

	Percent Passing by Weight		
Sieve Size	3/4-inch Stone	1/2-inch Stone	
1-inch	100		
<sup>3</sup> / <sub>4</sub> -inch	90-100		
5/8-inch		100	
<sup>1</sup> /2-inch	10-50	85-100	
3/8-inch	0-20	15-45	
No. 4	0-5	0-15	
No. 8		0-5	

Crushed stone shall be used as the working mat below structures, as well as for pipe bedding.

E. Sand: Sand shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organic, surface coatings or other deleterious material. Sand shall conform to the following gradation:

	Percent Passing
Sieve Size	by Weight
1/2-inch	100
3/8-inch	85-100
No. 4	0-20
No. 16	0-5
No. 100	0-2

Sand shall be used around electrical and telephone conduits.

F. Filter Fabric: Filter Fabric used as a drainage medium shall consist of a nonwoven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil.

The fabric shall conform to the following recommended property tests:

			Minimum
Property	Unit	Test Method	Value
Weight	oz/sy	ASTM D-3776	4.5
Grab Strength	lbs	ASTM D-4632	120
Grab Elongation	percent	ASTM D-4632	55
Trapezoid Tear Strength	lbs	ASTM D-4533	50
Mullen Burst Strength	psi	ASTM D-3786	210
Puncture Strength	lbs	ASTM D-4833	70
Apparent Opening Size	U.S. std.	ASTM D-4751	70
(AOS)	Size Sieve		

Filter fabric shall be used as the separation layer between unsuitable native soil and the new backfill when unsuitable material is encountered.

The edges of filter fabric shall extend 1 ft up sides of trench.

G. Concrete: Concrete shall be 4-inches thick air entrained Portland cement concrete with <sup>3</sup>/<sub>4</sub>-inch aggregate 3,000 psi and wire mesh reinforced at middepth. Concrete shall be installed below existing drainage culvert when the proposed sewer crosses under the culvert as shown on the drawings.

## PART 3 - EXECUTION

# 3.1 DEWATERING

- A. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed and the geotechnical instrumentation has been installed.
- B. Furnish, install, operate, and maintain dewatering, reinfiltration, treatment and discharge systems as indicated or specified and in accordance with the dewatering plan. Where it is not feasible to discharge dewatering flows to surface waters, either directly or indirectly, without appropriate settling, at a minimum, the Contractor shall provide a sufficiently sized settling tank so that if pumping rates exceed discharge rates sufficient storage capacity is available. The Contractor is responsible to evaluate available data and determine the necessary storage capacity so as not to impede construction activities.
- C. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.
- D. Do not excavate until the dewatering system is operational.
- E. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below groundwater level have been completed such that they will not be floated or otherwise damaged by an increase in groundwater elevation.
- F. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and submit to the Engineer at no additional cost to the Owner.
- G. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials in accordance with Section 02200 at no additional cost to the Owner.
- H. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.
- I. Dewatering Discharge:
  - 1. Water to be infiltrated need not be treated. Contractor shall provide infiltration that complies with relevant local, state and federal regulations.

- 2. Transport pumped or drained water to discharge location without interference to other work, damage to pavement, other surfaces, or property.
- 3. Provide separately controllable pumping lines.
- 4. The Engineer reserves the right to sample discharge water at any time.
- 5. Immediately notify the Engineer if suspected contaminated groundwater is encountered. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.
- J. Removal:
  - 1. Do not remove dewatering system without written approval from the Engineer.
  - 2. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

## 3.2 EXCAVATION SUPPORT SYSTEM

- A. Installation of the temporary excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Install excavation support systems in accordance with the temporary excavation support plan.
- C. Do not drive sheeting within 100 feet [30 m] of concrete less than seven (7) days old.
- D. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.
- E. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.
- F. Notify utility owners if existing utilities interfere with the temporary excavation support system. Modify the existing utility with the utility owners permission or have the utility owner make the modifications at no additional cost to Owner.

- G. Support of excavation extending within the zone of influence of any structures shall be left in place unless otherwise indicated or approved in writing by the Engineer.
- H. When indicated or approved by the Engineer, remove the temporary excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with bank-run gravel, screened gravel or select borrow by tamping with tools specifically adapted for that purpose.
- I. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the work.
- J. The excavation support system left-in-place shall be cut-off a minimum of 2 feet [60 cm] below the bottom of the next higher foundation level or a minimum of 5 feet [152 cm] below finished grade.
- K. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.
- L. Submit as-built information, prior to backfilling.

# 3.3 FILLING AND BACKFILLING

- A. Subgrade Preparation: After the subgrade has been shaped to line, grade, and cross-section, it shall be thoroughly proof-compacted. This operation shall include any required reshaping and wetting to obtain proper compaction. All soft or otherwise unsuitable material (such as soft silt or clay) shall be removed to at least 24 inches below the structure and replaced with suitable material from excavation or borrow. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with accepted material and the entire subgrade shaped to line, grade and cross-section and thoroughly compacted.
- B. Backfill Material Selection: Unless otherwise specified or directed, material used for filling and backfilling shall meet the requirements specified under Materials (Part 2.3). In general, the material used for backfilling utility trench excavations, shall be material removed from the excavations provided that the reuse of these materials results in the required trench compaction and meets the requirements specified for common fill. In areas where the bottom of the excavation is in fine sand and silt, and is below the groundwater table, the first lift of backfill shall be 12-inches of crushed stone wrapped in filter fabric to provide a working mat and drainage layer.

Maintain backfill material with a uniform moisture content, with no visible wet

EARTHWORK 02200 - 21 or dry streaking, between plus 2 percent and minus 2 percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass.

Backfill which is too wet for use shall be stockpiled, allowed to dry sufficiently, and reused by the Contractor at no additional cost to the Owner.

- C. Trench Backfill:
  - 1. Backfill shall consist of the following: crushed stone wrapped in filter fabric six inches below and above the pipe; overlain by two feet of select common fill (no stones over 4 inches in diameter); overlain by common fill; overlain by gravel sub-base, or loam and seed.
  - 2. The trenches shall be backfilled as soon as practicable.
  - 3. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time; if necessary, a timber grillage or other suitable method shall be used to break the fall of material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Puddling of backfill with water will not be permitted. Backfill within areas to receive topsoil or pavement construction shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.
  - 4. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
  - 5. During filling and backfilling operations, pipelines will be checked by the Engineer to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe or any other defects they shall be remedied in a manner satisfactory to the Engineer at no additional cost to the Owner.
- D. Backfilling Against Structures:
  - 1. The Contractor shall 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 satisfactorily completed, special leakage tests of the structures shall be made by the Contractor, as required by the Engineer. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material. Structural fill material shall be used for backfilling within 2 feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.

- 2. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12-inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.
- 3. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.
- E. After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.
- F. The finished subgrade of the fills and filled excavations upon which topsoil is to be placed, or pavements are to be constructed, shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.
- G. Uniformly smooth grading of all areas to be graded, as indicated and as directed, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations, shall be accomplished. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

## 3.3 COMPACTION

A. Compaction Requirements: 95% compaction is required. Mechanical compaction shall be done in 12-inch lifts. Lifts in greater depths may be allowed if a request is submitted in writing to the Engineer or approval. The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C. The compaction requirements are as follows:

Area	ASTM Density Degree of Compaction	
Below footings	95%	
Below slabs	95%	
Pavement base course	95%	
Pavement subbase	95%	
General fill below pavement subbase	95%	
Trench backfill - below landscaped areas - below structures	90% 95%	
Other areas	90%	

#### B. Moisture Control:

- 1. Fill that is too wet for proper compaction shall be disced, harrowed, or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.
- 2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.
- C. Unfavorable Conditions:
  - 1. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.
  - 2. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.
- D. Compaction Control:
  - 1. In-place density tests shall be made by the Contractor in accordance with ASTM D1556, D2922 or D2167 as the work progresses, to determine the degree of compaction being attained by the Contractor.

Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to the Owner. In-place density tests shall be made at the Contractor's expense by the geotechnical testing laboratory.

- 2. The Engineer's duties do not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Engineer nor any observation and testing performed by him shall excuse the Contractor from defects discovered in his work at that time or subsequent to the testing.
- 3. In-place density tests shall be performed as directed by the Engineer:
- E. Compaction Methodology:
  - 1. Vibratory mechanical compaction using walk-behind plate compactors or 10,000 lb minimum vibratory roller compactors, is the preferred method for compaction. Should jetting be proposed by the Contractor, its viability to achieve the required degree of compaction shall be proven on a test section of trench, prior to allowing its use on a widespread basis. Compaction testing shall be used to determine the effectiveness of the jetting operation. Jetting shall be accomplished using a rigid pipe, long enough to reach deep into the trench. Large volumes of water under high pressure, equivalent to that available from fire hydrants, are necessary for jetting. The Contractor is made aware that municipal water will probably not be available due to limited supply, especially during the warm weather months. The Contractor shall provide water

for jetting operations at his own expense. Municipal water use, when available, shall be metered at the hydrant connection. Jetting locations shall be frequent enough to achieve required compaction. Compaction testing required if jetting is used for compaction.

2. In backfilling trenches, each layer of backfill material shall be moistened and compacted to at least degree of compaction described above and in such a manner as to permit the compaction of the filled trench or excavation with the adjoining earth to provide the required bearing value, so that paving of the excavated and disturbed areas, where required, can proceed immediately after backfilling is completed.

#### 3.4 FINE GRADING

A. Before surface or subbase is spread, the subgrade shall be shaped to a true surface conforming to the Drawings. All depressions and high spots shall be filled with suitable material or removed and such areas again compacted until

the surface is smooth and properly compacted. A tolerance of 1/2-inch above or below the finished subgrade will be allowed provided that this 1/2-inch above or below grade is not maintained for a distance longer than 50 feet and that the required crown is maintained in the subgrade. Any portion which is not accessible to a roller shall be thoroughly compacted by other mechanical methods.

#### END OF SECTION 02200

## SECTION 02444

#### CHAIN LINK FENCE

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Providing chain-link fence, gates and accessories as indicated and specified.
  - 2. Design Criteria:
    - a. Fence height shall be nominal six feet with top rail and bottom tension wire.
- B. Related sections include the following:
  - 1. Section 03346 Cast-in-Place Concrete

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 Submittal Procedures:
  - 1. Submit manufacturer's specifications, drawings, details and fence layout with appurtenances.
  - 2. Submit sample of all fencing materials. Mark or tag each sample and submit at least thirty (30) days prior to erection of fence.
  - 3. Submit certified test reports with results of tests for fence finish.
  - 4. Submit shop drawings, samples and certificates simultaneously for review.

## 1.4 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610 – Delivery, Storage and Handling. PART 2 - PRODUCTS

## 2.1 GENERAL

- A. All steel fabric, steel posts, hardware and fittings shall be galvanized. PVC privacy slats shall be provided and black in color.
- B. Steel pipe dimensions and weights: ASTM A53, Schedule 40. Dimensions specified are nominal pipe sizes.
- C. Dimensions and weight tolerances: Plus or minus five percent.
- D. Zinc Coating: Minimum 2.0 ounces per sq. ft.
- E. Provide posts with tops of same material and designed to fit securely over post and carry top rail. Carry apron around outside of post at base of top fitting.
- F. Ferrous metal fittings, posts, fence, gate framework, and accessories galvanized with heavy coating of 2.0 oz. pure zinc spelter per sq. ft., use hotdip process. Thinner zinc coatings, electro-galvanizing, zinc paint or cold galvanizing compounds shall not be used as substitute for hot-dipped galvanized finish.
- G. Fabricate and weld before hot-dip galvanizing. Weld conforming to American Welding Society standards.
- H. Hot-dip galvanized gate frame, after welding, if bolted or riveted corner fittings not used.
- I. Galvanize fittings, posts, fence and gate framework, and accessories, then epoxy phenolic primed and top coated with matching PVC, using thermal bond process.
- J. Double leaf swing gates with center bolt, center stop, and automatic backstops.

## 2.2

## 2.3 TENSION WIRE

- A. No. 6-gauge outside diameter, zinc coated coil spring steel wire.
- 2.4 TIE WIRES

- A. Tie wires, for fastening fence fabric to line posts and rails, not less than 9 gauge galvanized steel wire.
- 2.5 LINE POSTS
  - A. 2-3/8 in. outside diameter steel pipe weighing not less than 3.65 lb. per ft.
- 2.6 END, CORNER, AND PULL POSTS
  - A. 2-7/8 in. outside diameter steel pipe weighing not less than 5.79 lb. per ft.
- 2.7 GATE POSTS
  - A. 2-7/8 in. outside diameter steel pipe and gate posts, for gate leaves up to and including 6 ft. wide, weighing not less than 5.79 lb. per ft., or 2-1/2 in. square steel tube weighing not less than 5.14 lb. per ft., or 3-1/2 in. by 3-1/2 in. roll-formed, steel corner section weighing not less than 5.14 lb. per ft.

## 2.8 RAILINGS

- A. 1-5/8 in. outside diameter steel pipe with minimum weight of 2.27 lb. per ft. or 1-5/8 in. by 1-1/4 in., 14-gauge roll-form section, for top railing and railings for top middle and bottom braces between terminal posts and adjacent line posts.
- 2.9 TRUSS
  - A. 2-7/8 in. diameter steel rod diagonal truss braces between terminal and adjacent line posts and for gate framework.

## 2.10 FITTINGS

A. Heavy-duty malleable iron or pressed steel fittings of suitable size to produce strong construction.

## 2.11 STRETCHER BARS

A. Flat bars with minimum cross section dimensions of 1/4 in. by 3/4 in, full height of fabric, secured with bar bands of minimum 11-gauge sheet steel, spaced approximately 15 in. on centers and bolted with 3/8 in. diameter bolts, for attaching fabric to terminal posts.

## 2.12 GATE LEAF FRAMEWORK

- A. 1-7/8 in. outside diameter steel pipe weighing 2.72 lb. per ft, minimum.
- 2.13 GATE HINGES

A. Heavy pattern of adequate strength for gate size, with large bearing surfaces for clamping or bolting in position.

#### 2.14 PRIVACY SLATS

- A. Black HDPE slats with wings to full height of fence fabric. 1-7/16" slat width to fit in 2-in. fence fabric mesh, with UV inhibitors. Slats shall be flat, tubular with interior support legs, and shall color-match fence fabric, hardware and other fittings.
- B. Black HDPE bottom lock channel for connection to slats. Channel shall color-match fence fabric, hardware and other fittings.

## 2.15 LATCH

A. Gates with suitable latch, accessible from both sides and with provision for padlocking.

## 2.16 GATE PADLOCKS

- A. Manufacturers:
  - 1. Eaton Corp. Lock & Hardware Div., Yale Marketing Dept., Charlotte, NC;
  - 2. P&F Corbin, Div. of Emhart Corp., Berlin, CT;
  - 3. Best Universal Lock Co., Inc., Indianapolis, IN;
  - 4. Or acceptable equivalent product.
- B. Solid brass cases, hardened steel shackles, removable core cylinders, and galvanized steel chains attached to shackle by a clevis.
- C. Provide padlocks for each gate with four (4) sets of keys to Owner.

## 2.17 CONCRETE FOOTINGS

A. Class A concrete, conforming to Division 3 - Concrete.

## 2.18 GROUT

A. One part Portland cement and three parts of clean, sharp, well-graded sand with minimum water for proper workability for posts set in solid rock.

## PART 3 - EXECUTION

## 3.1 GENERAL

- A. Examine conditions under which fence and gates are to be installed. Notify Engineer, in writing, of improper conditions of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Verify measurements at site.
- D. Check location of underground work to make sure fence footings clear all utilities and structures.
- E. Do not install fence until final grading is complete and finish elevations are established.
- F. Do not drive equipment on areas to be landscaped, except as approved by Engineer. Areas not accessible from roads shall be protected with heavy wood planking. Remove barricades and protection at completion of project. Repair damaged landscape surfaces.

## 3.2 INSTALLATION

- A. Footings:
  - 1. Maintain vertical sides to minimize up-lift. Dispose of excavated material in accordance with Section 02200 Earthwork.
  - 2. Rod and compact concrete around posts. Slope top of footings above level of adjacent grade, and trowel finish.
  - 3. Size footings per detail in Drawings.
  - 4. Time of Set: 48-hrs before rails are erected or before fabric is applied or stretched.
- B. Framing:
  - 1. Install line posts not more than 10 ft. apart.
  - 2. Install pull posts not more than 600 ft. apart where a straight run of fence exceeds 600 ft. and where fence line changes direction by more than 15° but less than 30°.

- 3. Install corner posts where the fence line changes direction by more than 30°.
- 4. Set posts in concrete footings, plumb and true to line.
- 5. Brace and truss end, pull, corner, and gate posts to adjacent line posts. Provide brace to match top rail spaced midway between top rail and tension wire and extending to adjacent line posts. Provide brace to match top rail spaced midway between top rail and tension wire and extending to adjacent line post. Truss diagonally with 5/16 in. dia tension rod with turnbuckle.
- 6. Fasten top rail to end, pull, gate and corner posts. Pass top rail through fittings of line posts.
- 7. Provide expansion and contraction joints in top rail for each 100 lin ft. of fence.
- 8. Fasten bottom tension wire to end, pull, gate, corner, and line posts.
- 9. Maximum area of unbraced fence shall not exceed 1500 square feet.
- 10. Use galvanized sleeve and grout posts or install with suitable galvanized flange casings and galvanized anchor bolts as directed by Engineer.
- 11. Install gates plumb, level, and secure for full width of opening and hardware adjusted for smooth operation.
- C. Privacy Slats:
  - 1. Install privacy slats throughout by weaving through fabric. Snap or lock into horizontal bottom lock channel. Follow manufacturer instructions.
  - 2. Provide 80 linear feet of spare privacy slats material to Owner.

## 3.3 TOUCH-UP AND REPAIR WORK

A. Remove and replace fencing which is improperly located or is not true to line, grade and plumb within tolerances as indicated.

# 3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout.
# END OF SECTION 02444

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#### SECTION 02498

#### RESTORATION OF DISTURBED AREAS

#### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

A. The work covered under this Section of the Specifications includes furnishing all plant, labor, equipment, appliances and materials, and in performing all operations in connection with restoration to preconstruction conditions of all areas affected by work under this Contract, complete in accordance with the Drawings and Specifications.

#### 1.2 GENERAL

- A. Remove and reset or replace all fencing, guardrails, trees, shrubs, lawns, posts, curbing, signs, and other items which interfere with the progress of the work. Shore or guy any utility pole as required by the utility company.
- B. Contractor shall make arrangements and notify property owners for any work which will affect their properties and indicate what will be done to restore the area after construction is completed.
- C. Contractor shall notify all utility companies and local, state and federal authorities which will be affected by his work.
- D. Wherever streets, lawns, or sidewalks within or outside the contract limit lines have been excavated in fulfilling the work required under this Contract, the Contractor shall furnish and install all materials necessary to bring finished surfaces level with the existing adjacent surfaces.
- E. If, during the progress of the contract work, any water pipe, sewer, conduit, drain, or other construction is damaged as a result of operations under this Contract, the Contractor shall repair all such damage and restore work to its original condition at Contractor's sole cost.
- F. The Contractor shall restore all disturbed and damaged areas upon completion of the work in the affected area or prior to commencing work on an additional street. Failure to perform such restoration shall be cause for the Owner to engage outside work forces to do the required work and all related costs shall be deducted from payments due to the Contractor for work performed under this Contract.

RESTORATION OF DISTURBED AREAS 02498-1

#### 1.3 TRENCHES NOT IN PAVED AREAS

- A. Where the trench occurs adjacent to paved streets in shoulders, yards, sidewalks, or in cross-country areas, the Contractor shall thoroughly consolidate the backfill and shall maintain the surface as the work progresses. If settlement takes place, he shall immediately deposit additional fill to restore the level of the ground. In areas adjacent to streets which are not to be loam and seeded, the top 12-inch layer of trench backfill shall consist of compacted dense-blend gravel borrow or sand and gravel as required to match existing conditions. Trench backfill in unpaved roadways shall have the top 18-inch layer of backfill consist of compacted sand and gravel.
- B. If in the opinion of the Engineer, the top 12-inch layer is unsuitable for use as base course, he may order the Contractor to remove this layer and to provide material that meets specifications.
- C. Loam and seed or hydroseeding work shall be performed to restore grassed areas. Six inches of loam shall be placed in these areas. Seed and hydroseed mixtures shall be submitted to the Owner for approval prior to use. Contractor is responsible for watering/maintaining the new lawn until it is well established.
- D. Woodchip placement shall be carried out where directed by the Engineer. Woodchips shall be untreated and spread to a depth of 2-inches. The Contractor may utilize removed trees as material for the woodchips.
- E. Stone for driveway areas shall be suitable material and blend to match existing material. Stone shall be placed to a depth to match preconstruction conditions and compacted. Material which is removed, stockpiled and reused shall not be paid for under the applicable item in the proposal.

END OF SECTION 02498

RESTORATION OF DISTURBED AREAS 02498-2

#### SECTION 02525

#### PAVING AND SURFACING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Reference is made herein to the Commonwealth of Massachusetts Department of Transportation Standard Specifications, and all published updates, as well as the MassDOT permit contained in the appendices, hereinafter collectively referred to as the "Massachusetts DOT Standard Specifications". All references to method of measurement, basis of payment, and payment items in the standard specifications are hereby deleted. References made to particular sections or paragraphs in the standard specifications shall include all related articles mentioned therein.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Removal and replacement of existing bituminous pavement and subbase.
  - 2. Installation of temporary pavement.
  - 3. Installation of permanent trench repair, as specified.
  - 4. Milling existing pavement and installation of hot mix asphalt pavement overlay.
  - 5. Removal and resetting of granite curbing.
  - 6. Raising and adjusting castings and valves boxes.
  - 7. Removal and replacement of bituminous concrete curb.
  - 8. Installation of pavement markings.
- B. Related sections include the following:

- 1. Section 02200 Earthwork
- 2. Section 02601 Manholes
- C. Owner may elect, at no penalty, to reduce or eliminate paving quantities.

## 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES.
  - 1. Product Data: Submit complete data on materials to be used in construction, including gradation tests for granular base.
  - 2. Design Data: Submit design mix for hot mix asphalt pavement.
  - 3. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

## 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Laboratory Testing Required:
  - 1. The hot mix asphalt (HMA) mixture shall be compacted to at least 95% of the density achieved on the laboratory testing of the design mix for the project. The density of the HMA will be determined by using the following test: Nuclear Density Gauge Method ASTM D2950.
- C. Thickness: Test in-place asphalt concrete courses for compliance with requirements for thickness indicated on Drawings or specified herein. Repair or remove and replace unacceptable paving as directed by Engineer.

# 1.5 PROJECT SITE CONDITIONS\PROJECT DESCRIPTION

- A. Concrete Slab: The existing Route 6 bituminous pavement is underline by 10 foot wide 8 inch thick reinforced concrete slabs. For pipelines running longitudinally in the roadway the full 10-foot-wide concrete slab is to be removed and replaced with roadway sub base and bituminous pavement. For perpendicular pipelines that cross the roadway surface so by two minutes in concrete slab is to be saw cut prior to removal.
- B. Environmental Requirements:
  - 1. Do not place materials when underlying surface is muddy, frozen, or

has frost, snow, or water thereon.

- 2. Do not place concrete when air temperature at time of placement, or anticipated temperature for following 24 hours, is lower than 40°F or higher than 90°F.
- 3. Apply prime and tack coats when ambient temperature is above 50 deg.F (10 deg.C), and when temperature has not been below 35 deg.F (1 deg.C) for 12 hours immediately prior to application.
- 4. Base course may be placed when air temperature is above 30 deg.F (-1 deg.C) and rising.
- 5. Grade Control: Establish and maintain required lines and elevations.
- C. In general, the following pavement repairs shall be made:
  - 1. In areas where test pits or exploratory excavations occur a 2-inch temporary pavement is to be placed. When this material is disturbed during additional excavation work required for utility installation it shall be replaced.
  - 2. Temporary pavement shall be installed, as specified herein, under the direction of the Engineer.
  - 3. The paving thicknesses indicated in the Contract Documents may be increased based on permit or field requirements.

## 1.6 SEQUENCING AND SCHEDULING

- A. Frequency of trench repair paving shall be as required by the MassDOT permit.
- B. The Contractor shall provide temporary markings on the temporary pavements where existing markings are removed, at no additional cost to the Owner.
- C. Use of steel plates require the Contractor notify DOT to obtain approval prior to use. If approved, steel plates shall be recessed into the roadway and welded as required.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Bituminous Concrete: See MassDOT permit.
- B. Gravel Subbase:

- 1. Sub-grade material shall be gravel subbase as described in Section 02200.
- C. Pavement Markings:
  - 1. Pavement markings shall be replaced in-kind, after both base and final paving operations.

## PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protection:
  - 1. Existing Roadway:
    - a. Saw cut existing pavement to required width and depth to avoid damage to adjacent pavement, curbs, gutters, or other structures and as indicated on the drawings.
- B. Surface Preparation:
  - 1. Pavement Subbase:
    - a. The subbase to be placed under pavement shall be a minimum of 12-inches thick after compaction. Subbase shall be evenly spread and thoroughly compacted in accordance with Section 02200 Earthwork. Add approved suitable material to bring to required grade as necessary before placing base course.
    - b. The subbase shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content. All loose material shall be removed from the surface.
    - c. Complete subbase preparation, including dynamic compaction, for full width before placing surfacing materials.
    - d. Proof Roll the prepared subbase. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.
  - 2. Raising and Adjusting Castings:
    - a. Prior to top course paving, all existing catch basin and manhole castings and curb and valve boxes shall be raised to the proper

grade by the Contractor.

- b. Castings owned by private utilities shall be raised by the responsible utility. The Contractor shall be responsible for coordinating this work.
- c. The method of adjusting these castings shall be as follows: Cut around castings a minimum of 8 inches from casting. Excavate and if required rebuild up to 12 inches of masonry below the bottom of the casting. Backfill with suitable material and compact to bottom of casting. Place high, early strength cement or bituminous concrete collar to approximately 1½ inches below the raised casting grade.
- d. Castings which need to be raised or adjusted to complete final top course full-width paving shall be done immediately prior to paving.
- 3. Milling of Existing Asphalt Pavement:
  - a. Existing asphalt surfaces shall be milled as required by DOT.
  - b. Pavement milling shall be done in accordance with the MassDOT Standard Specifications.
- 4. Shaping and Compacting Base:
  - a. In areas of pavement replacement, the existing granular base shall be shaped in compacted to restore the pre-construction roadway grade.
  - b. Shaping and compacting shall be done in accordance with the MassDOT Standard Specifications.

# 3.2 INSTALLATION

- A. General
  - 1. Pavement thicknesses shall be as shown on the drawings or as specified herein.
  - 2. Place HMA mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225 deg.F (107 deg.C). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Protect all adjacent construction from staining with mix or damage by mechanical equipment. Clean, repair or replace any construction stained or damaged at no additional cost to the Owner.

- B. Temporary Bituminous Pavement:
  - 1. Where directed by the Engineer, the Contractor shall place temporary pavement above the trench, between the edges of the existing pavement.
  - 2. The temporary pavement shall be repaired due to damage or if settlement exceeds one inch, until replaced by permanent pavement at no additional cost.
- C. Hot Mix Asphalt:
  - 1. Repair asphalt roads, shoulders, and private driveways or streets, cut by line of trench or otherwise damaged during construction operations.
  - 2. Compact and finish pavement replacement to provide a smooth transition between new and existing surfaces.
  - 3. Where new pavement abuts existing pavement outside the limits of work, saw cut existing pavement full depth for a smooth, regular edge so that new pavement in-fill or new adjoining areas create a neat, straight seam with no feathering.
  - 4. All paving thicknesses are measured after rolling. Permanent surface courses shall be evenly spread and rolled with a power roller having a minimum weight of 5 tons.
  - 5. The base course pavement shall be repaired due to damage or if settlement exceeds one inch, as necessary to maintain the surface of the pavement until top course permanent pavement is placed, at no additional cost.
  - 6. Binder & Top Course Pavement:
    - a. Immediately prior to installing the binder course, the trimmed edges shall be made stable and unyielding, free of loose or broken pieces and all edges shall be thoroughly broomed clean. The street shall be swept with a street sweeper machine. Contact surfaces of trench sides, curbings, manholes, catch basins, or other appurtenant structures in the pavement shall be painted thoroughly with a uniform coating of bitumen just before any mixture is placed against them utilizing truck mounted spray equipment.
    - b. The binder and top course shall be regularly repaired as necessary to maintain the surface of the pavement during the warranty period.

- c. Apply tack coat at a rate of 0.10 gallons per square yard of the binder course. Apply material to penetrate and seal, but not to flood surface. Cure and dry as long as necessary to attain penetration and evaporation of volatiles.
- 7. Top Course Pavement
  - a. The top course shall be placed as shown on the drawings or as specified.
  - b. Prior to placement of the top course, the entire surface which the top course or modified top course is to be placed shall be broom cleaned and tack coated.
  - c. Prior to placing full width top course a-4 foot wide transition keyway shall be cold planed at all intersecting streets.
- 8. Pavement Placement:
  - a. Unless otherwise permitted by the Engineer for particular conditions, only machine methods of placing shall be used. Methods other than machine methods may be used, at no additional cost to the Owner. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to line, grade, width and crown. The mixtures shall be placed and compacted only at such times as to permit proper inspection and checking by the Engineer.
  - b. Place in strips not less than 10 feet wide, or to the width of the trench, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete binder course for a section before placing top course.

- c. After the paving mixtures have been properly spread, initial and intermediate compaction shall be obtained by the use of steel wheel rollers having a weight of not less than 240 pounds per inch width of tread. Begin rolling when mixture will bear roller weight without excessive displacement. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers. Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material. Follow breakdown rolling us soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- d. Final rolling of the pavement shall be performed by a steel wheel roller weighing not less than 285 pounds per inch width of tread at a mix temperature and time sufficient to allow for final smoothing of the surface and thorough compaction. Continue rolling until roller marks are eliminated and course has attained maximum density.
- e. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to match the surrounding surface density and smoothness.
- f. Immediately after placement of the new pavement, make joints between existing and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of bituminous concrete course. Clean contact surfaces and apply tack coat. All joints between the existing and new pavements shall be keyed on an angle (4' x 10') or as approved by the Owner, and shall be sealed with bitumen RS-1 and sanded.
- g. Where there is no backing for the edges of the pavement, the Contractor shall provide a gravel transition. The transition shall be installed immediately after the pavement is placed, shall be feathered and extend a minimum of 18 inches, and shall be compacted using the same equipment as for pavement compaction. Transition material to match surrounding conditions. The backing installation will be considered incidental to the pavement installation.

- h. The Contractor shall furnish and install paving to provide transition or aprons for driveways and walkways impacted by new pavement installation.
- D. Pavement Markings:
  - 1. Pavement markings shall be replaced in-kind.
  - 2. Cleaning: Sweep and clean surface to eliminate loose material and dust prior to applying markings.
  - 3. The Contractor shall lay out the locations with temporary lines or markers to ensure proper alignment of the markings. Final locations shall be subject to approval of the Owner prior to application.

- E. Curb and Gutter Replacement:
  - 1. Where required, Contractor shall remove, stack and replace curbing. Contractor shall mark all pieces removed and transport them to a stockpile site for reuse in the project. Curbing broken, chipped or otherwise damaged by the Contractor shall be replaced at no expense to the Owner.
  - 2. Prior to removing curbing, Contractor shall cut adjoining paved surfaces to minimize damage to adjacent roadways.
  - 3. Before replacing curb sections, suitable structural backfill shall be placed in the curb trench and compacted. After compaction, curbing shall be reset to pre-construction line and grade. Any settlement of curbing within one-year of completion of work shall be reset by the Contractor at not cost to the Owner.
  - 4. Replace curb and gutter with same material to pre-construction lines and curb sections.
  - 5. Removal and replacement of curbing shall be done in accordance with Commonwealth of Massachusetts specification.
  - 6. Provide expansion joints at each intersection with existing curb sections.
  - 7. Use expansion joints one inch wide.
    - a. Fill with expansion joint material and cut to shape of curb section.

# 3.3 PROTECTION

- A. Protect replacement work with barricades or other devices as approved by Engineer so that no damage occurs as a result of subsequent construction operations.
  - 1. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
  - 2. Repair damages or other irregularities to satisfaction of Engineer, at no additional cost to the Owner, before final acceptance by the Engineer.

## 3.4 GUARANTEE

A. A one-year guarantee against settlement of the trenches shall be provided by the Contractor. Settlement in excess of one (1) inch shall be considered significant, and shall be repaired. During the guarantee period, the Contractor

shall maintain the surfacing and shall promptly fill with similar material in compliance with the above specifications, any depressions and holes that may occur in the trench area so as to keep the surfacing in a safe and satisfactory condition for traffic.

## 3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

END OF SECTION 02525

## SECTION 02600

## WATER MAINS AND APPURTENANCES

## PART 1 GENERAL

## 1.1 SCOPE

- A. The Work of this section includes the furnishing of all labor, tools, equipment and materials necessary to perform all operations required for the construction of water mains including fittings, valves, hydrants, restraint systems, services and all other related items necessary to complete the Work as shown on the Drawings and as specified.
- B. All products and materials shall conform to the appropriate and latest ANSI and AWWA Standards and as otherwise specified hereinafter.
- C. All materials supplied shall be manufactured and assembled in the United States or Canada, unless otherwise approved by the Engineer.
- D. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.2, below.

## **1.2 SUBMITTALS**

- A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of Section 01300 Submittals.
- B. Submittals required under this section include, but are not limited to the following:
  - 1. Pipe and fittings.
  - 2. Hydrants.
  - 3. Valves.
  - 4. Transition couplings.
  - 5. Warning tape and tracer wire.
  - 6. All components related to services.
  - 7. Gate and service boxes.
  - 8. Restraint systems including thrust restraint glands and other miscellaneous items.

- 9. Insulation
- 10. Polyethylene encasement.
- 11. Certificate of "No Lead" for valves and service materials.
- 12. Country of manufacture and origin data for restraints, fittings, valves, hydrants, curb and valve boxes, service line components.
- C. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

# 1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All pipe when shipped shall be packed and separated by wood separators such that pipe to pipe contact is prevented during transit and/or storage.
- B. The loading, trucking, unloading, and handling of pipe and appurtenant materials shall be done by the Contractor. Care shall be taken so as not to damage the pipe, appurtenant materials or the street surface. Dropping of materials such as but not limited to pipe, special castings, valves, and hydrants, directly from the trucks upon the ground will not be permitted. Suitable effective buffers or runners shall be provided. Metal chain shall not be used for lifting materials. The Contractor shall be responsible for any damage done to the pipe or appurtenant materials until they are accepted in the completed Work.
- C. Pipes may be stored within the roadway right-of-way, outside of travelled way, at locations approved by the Engineer. All pipe shall be covered with an appropriate tarp until installation. Distribution of pipeline along the line of work, beyond materials for one day supply at any one time, will not be permitted, unless approved by the Engineer. The Contractor shall not obstruct driveways, sidewalks, or walkways nor shall pipeline materials be placed on private property.

# PART 2 MATERIALS

## 2.1 DUCTILE IRON (DI) PIPE

- A. Ductile iron pipe shall be that of a United States manufacturer who can demonstrate at least 5 years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push on joints.
- B. All ductile iron pipe shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151).

- 9. Insulation
- 10. Polyethylene encasement.
- 11. Certificate of "No Lead" for valves and service materials.
- 12. Country of manufacture and origin data for restraints, fittings, valves, hydrants, curb and valve boxes, service line components.
- C. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

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- B. All ductile iron pipe shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151).

- C. The ductile iron pipe shall be Class 350 and furnished in nominal 18 foot minimum lengths, with Push-on Joints as manufactured by U.S. Pipe, American Pipe Co., McWane Ductile, or equal with gaskets conforming to AWWA C111 ANSI A21.11 "Rubber Gasket Joints".
- D. The ductile iron pipe shall be double cement lined inside and asphalt seal coated on the outside and inside approximately 1 mil. thick. The cement lining shall conform to AWWA C104 ANSI A21.4.
- E. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

# 2.2 FITTINGS

- A. Fittings shall be manufactured in North America (United States or Canada) and shall be compact ductile iron Class 350 Mechanical Joint, conforming to AWWA C153/ANSI Specification A21.53, (2006), for pipe sizes 16-inches and smaller, unless specifically stated otherwise in the specifications or on the drawings.
- B. Fittings shall be suitable for use with restraints as specified hereinafter. Fittings shall be of the same material and have the either the same lining and coating as the pipe specified above or fusion-bonded epoxy coating.
- 3. Epoxy coating systems shall be suitable for potable water and NSF 61 certified. Coating application and materials shall comply with AWWA C116/ANSI A21.16. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends.
- 4. Caps and plugs installed in all new work as indicated on the drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
- 5. Solid sleeves shall be mechanical joints, long body ductile iron with 350 psi rating. Sleeves shall conform to ANSI/AWWA C110. They shall be suitable for use with the mechanical joint restraints specified in Paragraph 2.8.

# 2.3 JOINTS

A. Provide mechanical joint or push-on joint pipe with necessary accessories, conforming to ANSI A21.11.

- 1. Provide gasket composition suitable for exposure to liquid within pipe. For pipe in petroleum contaminated areas Nitrile gaskets shall be used.
- 2. Provide gasket composition suitable for exposure to potable water.
- B. Where necessary, provide pipe flanges and accessories conforming to ANSI A21.15.
  - 1. Provide flat faced flanges.
  - 2. Provide 1/8 in. thick, full faced gaskets suitable for exposure to liquid within pipe.
  - 3. Restrained joints shall be furnished for installation on all fittings, sleeves, couplings, hydrants, valves and pipe adjacent to these items. Refer to Paragraph 3.2D for required restrained lengths. Restraints shall be manufactured in the United States. Restraints for mechanical joints shall be Megalug Series 1100 as manufactured by EBAA Iron Co., Uni-flanged Series 1400 Mechanical Joint Restraint or equal. Restraints for push on joints shall be Series 1700 as manufactured by EBAA Iron Co., Series 1390 as manufactured by Uni-Flange or Restrained Joint Locking Gaskets, or equal.
- C. Restrained Joint Locking Gaskets shall be Field Lok 350 gaskets as manufactured by U.S. Pipe Co. or equal.

# 2.4 COUPLINGS

- A. Pressure rating at least equal to that of related pipeline with a minimum rating of 150 psi.
- B. Ductile iron couplings shall have SBR gaskets and fusion bonded epoxy coating. Couplings shall be suited for extended range of pipe materials and diameters. Couplings of similar materials shall be mechanical restrained solid sleeves. Couplings shall be manufactured by ROMAC Industries, Series 501 or equal. Couplings shall be manufactured in the United States.

# 2.5 CONNECTIONS - TAPPED

- A. Provide watertight joint with adequate strength against pullout. Use only tapered thread taps.
- B. Maximum size of taps in pipe or fittings without bosses not to exceed that listed in appropriate table of Appendix to ANSI A21.51 based on:
  - 1. 2 full threads for ductile iron.

- C. Where size of connection exceeds that given above for pipe, provide boss on pipe barrel or use tapping saddle. Make tap in flat part of intersection of run and branch of tee or cross, or connect by means of tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, as indicated or permitted.
- D. Provide tapping saddles for all service line corporation connections that are 1.5-inches or larger.

## 2.6 POLYETHYLENE PIPE ENCASEMENT

- A. Material: Virgin polyethylene conforming to ANSI/ASTM D1248.
- B. Thickness: Minimum nominal thickness of 8 mils.
- C. Material and installation methods to conform to requirements of AWWA C105.
- 2.7 INSULATION
  - A. Insulation shall be factory formed-in-place polyurethane foam insulation having nominal thickness of 2", with an in-place density of 2.5 pcf, and a "K" factor of 0.14 BTU/in./hr./deg. F/sq. ft.
  - B. Ductile Iron pipe, when located with less than 4-feet cover, shall be insulated. The insulation shall be closed cell polyurethane foam with a minimum density of 2.1 pcf, a "K" factor of 0.14 Of 0.14 Btu in/ft2 hr °F, compressive strength up to 30 lbs/in2, and a service temperature range of -20°F to 100°F. The insulation shall be 2" nominal thickness insulation, capable of being field installed, and provided with all appurtenances necessary to provide a complete insulation system as directed in manufacturer's instructions.
    - 1. Insulation kits for fittings shall consist of rigid polyurethane foam with a fully bonded polymer protective coating on all exterior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps, clips, and heat shrink sleeves or joint tape to seal between pipe and kits.
    - 2. Outer jacket on Pipe Insulation shall be high density polyethylene, UV inhibited. The jacket shall have a minimum density of 58 lbs/ft3, a thickness of 0.175-inches, service temperature of  $-30\Box F$  to  $180^{\circ}F$ , and a tensile yield strength of 3300 PSI. The sealant shall be butyl rubber.

3. Each straight joint and fitting shall be insulated with polyurethane foam and covered with HPDE jacket and fastened with <sup>3</sup>/<sub>4</sub>-inch aluminum bands and clips.

## 2.8 PIPE RESTRAINTS

- A. All pipe installed shall be restrained by means of mechanical restraint systems. Mechanical and push-on joint pipe and fittings shall be restrained in accordance with Paragraph 3.2. All restraints shall be manufactured and assembled in the United States. Restraints shall have Mega-Bond coating system to prevent corrosion.
- B. Mechanical joints shall be installed with EBAA Iron Mega-Lug Series restraints. Restraints shall be installed in full accordance with the manufacturer's instructions. All bolt heads on Mega-Lugs shall be tightened sufficiently so that they shear off to provide indication that proper tightening torque was achieved.
- C. Push-on joints adjacent to restrained mechanical joints shall be restrained with EBAA Iron Series 1700 Mega-Lug Harnesses

## 2.9 MARKER TAPE

A. Pipe marker tape shall be detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. 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 WATER PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

# 2.10 RESILIENT WEDGE SEATED GATE VALVES AND VALVE BOXES

- A. Valves shall be Resilient Seated Wedge Gate Valves as manufactured by Kennedy Valve Company or Flow Valve Company.
- B. Resilient wedge gate valves shall be iron body, resilient seated type. The valves shall be designed for minimum 200 psi working pressure and 400 psi test pressure. Valves shall have corrosion resistant fusion-bonded interior and exterior coatings.
- C. Valves are to have O-ring seals and a nonrising stem. Valves shall have a 2-inch operating nut. Valves shall open left.
- D. Resilient gate valves shall meet the most recent version of the AWWA standard specification AWWA C509. Reduced wall valves (C515) will not be accepted.

- E. Resilient wedge valves shall have mechanical joint ends suitable for use with restraints specified in Section 02615.
- F. Valves shall have a 10 mil minimum thickness factory applied epoxy coating on interior and exterior surfaces. Epoxy shall be suitable for potable water usage and NSF 61 certified.
- G. Tapping valves shall be resilient gate valves as specified above with the following exceptions. Tapping valves shall be full port opening and have flanged by mechanical joint ends.
- H. Valve boxes shall be manufactured in the United States and be cast iron, tar coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece, and a cover with two (2) lifting holes and the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The inside diameter of boxes shall be at least 5-1/4-inches and lengths shall be as necessary to suit ground elevation.
- I. Valve boxes shall be straight, plumb and centered over valve.
- J. Valves and associated couplings shall be installed using Grade 316 stainless steel nuts and bolts.

#### 2.11 HYDRANTS

A. Hydrants shall be traffic type with two sections held together with a break flange. The Owner is standardized on dry barrel hydrants of the following manufacturer, model and specifications:

Manufacturer and Model	American Darling B-62-B-5
Type of Thread	National Standard
Number of Outlets	<ul><li>2-1/2 inch hose connection (2 required)</li><li>4-1/2 inch steamer connection (1 required)</li></ul>
Diameter Valve Opening	5-1/4 inches
Diameter of Barrel	7- inches
Hub	Mechanical joint
Direction of Opening	Open Left
Depth of Bury	Five (5) feet Six (6) inches (minimum)

Equal approved models will be considered.

- B. The Owner is standardized on hydrants with 5'-6" depth of bury. However, the Contractor shall anticipate furnishing and installing hydrant extensions where specified and at other locations as may be required to field conditions. The Contractor shall field measure and determine the proper length extensions prior to ordering the hydrant extensions. Hydrant barrel extension shall be as manufactured by the hydrant manufacturer and shall include all couplings, pins, flanges, gaskets, nuts and bolts, and other accessories to provide a complete installation. Hydrants shall be manufactured and assembled in the United States.
- C. Hydrants shall be designed for 250 PSI working pressure and shall conform in every respect to the AWWA C502. All connections including couplings, valves, hydrants boots and thrust restraint glands shall be installed using Grade 316 stainless steel nuts and bolts.
- D. Hydrants shall be given two coats of quality paint after installation. The paint system for the hydrants shall be approved by the Engineer and the color system shall match the Owner's existing hydrants.
- E. Hydrants shall be manufactured within the past 12 months as determined from the date stamped on each hydrant.
- F. Each hydrant shall be furnished with a hydrant marker. The markers shall be 60 inches top flange mount with fiberglass rod, stainless steel spring and a flag. The markers shall be Product No. 404-FT as manufactured by SPK Steel Fabrication, Fitchburg, MA or approved equal models by others. The flags shall be 4" x 5" Mini Flag with two reflective bands and shall be suitable for attachment to the markers. The flags shall be Product No. 404-MNF as manufactured by SPK or approved equal.

## 2.12 PRESSURE REDUCING VALVES

- A. The pressure reducing valve installed within the vault shall be single acting type and be 3inch and 8-inch in size per Contract Drawings. The pressure reducing valve shall be hydraulic pilot controlled. The valve shall be hydraulically operated, diaphragm operated type. Valve shall be single seated, with a replaceable resilient seat that assures drop tight closure. The valve shall be provided with an adjustable, closing speed control. The valve shall be sized as shown on the plan and be globe pattern, flanged to meet ANSI Class 125 and have a maximum pressure rating of 250 psi.
- B. The pressure reducing valve shall open to reduce the service pressure provided to users. It shall be non-throttling and shall remain fully open.

The pressure reducing valve shall be furnished with a pressure control, valve position indicator and a CV flow control (closing) device. The valve control piping shall also be furnished as depicted in the Contract Drawings.

Valve and pilot materials shall be:

Valve Body	ASTM A-536 Ductile Iron
Disc Retainer & Diaphragm Washer	Cast Iron
Trim	Bronze
Disc	Buna-N Rubber
Diaphragm	Nylon reinforced Buna-N Rubber
Stem, Nut & Spring	Stainless steel
Pilot Control	ASTM B62 Bronze
Pilot Trim	Type 303 stainless steel
Rubber	Buna-N

- C. The control pilot shall be a diaphragm operated, internal valve type that alternately supplies pressure to the main valve chamber to close or exhausts pressure from the main valve chamber to open. The control pilot shall have an external sensing line that senses tank level. Pilot shall have an adjustment range of [5-40] feet. The sensing line piping shall be complete with a bleed and drain system to simulate a lowering reservoir head. The pressure reducing valve shall be a Flowmater Model C101, or equal.
- D. Pressure reducing valves shall meet the table criteria below:

Size	Minimum Flow (gpd)	Maximum Flow (gpd)
3-inch	11	340
8-inch	80	2,400

## PART 3 EXECUTION

## 3.1 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joining ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5 feet, and with even support for the pipe barrel.
- C. Only nylon-protected slings shall be used for handling the pipe. No hooks or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.
- E. If during the handling of the pipe, the interior coating is disturbed or chipped, the pipe shall not be allowed for use.

## 3.2 ALIGNMENT AND PLACEMENT OF PIPE

- A. Jointing of ductile iron pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8-inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
- B. Installation and jointing of push-on ductile iron pipe shall be in accordance with AWWA C600 Sections 9b and 9c, latest revision, as applicable.
- C. Mechanical joints shall be installed with Mega-Lug style restraints. Restraints shall be installed in full accordance with the manufacturer's instructions. All bolt heads on wedge action style retainer glands shall be tightened sufficiently so that they shear off to provide indication that proper tightening torque was achieved.
- D. Pipe, fittings, and valves shall be restrained for the minimum lengths listed on the following table:

MINIMUM RESTRAINED LENGTHS		
FITTING	RESTRAINT LENGTH	
6" – 45° Bend	8-feet in each Direction	
6" - 90° Bend	18-feet in each Direction	
6" – 22-1/2° Bend	4-feet in each Direction	
6" – 11-1/4° Bend	2-feet in each Direction	
6" Vertical Offset		
Upper 45° Bend	13-feet in each Direction	
Lower 45° Bend	7-feet in each Direction	
Upper 22.5° Bend	7-feet in each direction	
Lower 22.5° Bend	4-feet in each direction	
Upper 11.25° Bend	4-feet in each direction	
Lower 11.25° Bend	2-feet in each direction	
8" – 45° Bend	10-feet in each Direction	
8" - 90° Bend	23-feet in each Direction	
8" – 22-1/2° Bend	5-feet in each Direction	
8"-11-1/4° Bend	3-feet in each Direction	
8" Vertical Offset		
Upper 45° Bend	17-feet in each Direction	
Lower 45° Bend	9-feet in each Direction	
Upper 22.5° Bend	9-feet in each direction	
Lower 22.5° Bend	5-feet in each direction	
Upper 11.25° Bend	5-feet in each direction	

Lower 11.25° Bend	3-feet in each direction
12" – 45° Bend	14-feet in each Direction
12" - 90° Bend	33-feet in each Direction
$12'' - 22 - 1/2^{\circ}$ Bend	7-feet in each Direction
12" – 11-1/4° Bend	4-feet in each Direction
12" Vertical Offset	
Upper 45° Bend	24-feet in each Direction
Lower 45° Bend	13-feet in each Direction
Upper 22.5° Bend	12-feet in each direction
Lower 22.5° Bend	6-feet in each direction
Upper 11.25° Bend	6-feet in each direction
Lower 11.25° Bend	6-feet in each direction
12" x 12" x 8" Tee	17-feet in Branch
12" x 12" x 6" Tee	1-feet in Branch
8" x 8"x 8" Tee	25-feet in Branch
8" x 8" x 6" Tee	11-feet in Branch
12" Valve or Dead-end	58-feet in each Direction
8" Valve or Dead-end	41-feet in each Direction
6" Valve or Dead end	31-feet in each Direction

Lengths shown are based on 150 psi test pressure, 4-1/2-foot bury, soil type GP, trench Type 3, and 2:1 safety factor. A low side depth of bury of 5 feet was used for vertical bends. Restrained lengths in branch for tee fittings is assuming a minimum attached length of pipe of 5 feet in each direction. Changes in conditions will require revision in lengths.

- A. Restrained push on joints shall be installed with specified joint restraints. Restraints shall be installed in full accordance with the manufacturer's instructions.
- B. Ductile iron pipe installed near catholically protected gas lines or within areas subject to corrosive soils or waters shall be fully encased with polyethylene material.
- C. Insulated pipe with jacket shall be 2" rigid preformed insulation with 2" rigid insulation wrap around bell collars is to be installed as detailed where shown on the drawings and on any pipe having less than 4-foot cover.
- D. Mechanical joint solid sleeves shall be used to join plain ends on ductile iron pipe. Mechanical joints shall be installed with Mega-Lug restraints, as specified hereinbefore.
- E. Install "Buried Pipe" identification tape in all pipe trenches as specified in Section 01063.

## 3.3 INSTALLATION

- A. Piping Support:
  - 1. Furnish and install supports to hold piping at lines and grades indicated or specified.

- 2. Support pipe and appurtenances connected to equipment to prevent any strain imposed on equipment.
- B. Pipe and Fittings:
  - 1. Remove and replace defective pieces.
  - 2. Clear of all debris and dirt before installing and keep clean until accepted.
  - 3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
  - 4. Provide firm bearing along entire length of buried pipelines.
  - 4. Pipe for fittings shall be round as indicated or marked from the manufacturer.
- C. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.
- D. Appurtenances: Set valves, fittings and appurtenances as indicated.
- E. All Water shutdowns and times are subject to approval by the Owner and the Engineer.
- F. Water shutdowns for any part of the public water system shall be approved by the Owner and in general shall be between the hours of 9:00 AM and 4:00 PM.
- G. Notifications to residents for water shutdowns shall be coordinated with the Owner's requirements.
- H. The vertical clear distance between water mains and sewers or drains will be no less than 18-inches, unless otherwise approved by the Engineer, or specifically indicated on the drawings. In locations where water mains shall pass over or under existing sewers or drains, the Contractor shall plan the laying of the mains such that the joints of a section of water main at least 18-feet long are equally distant from the sewer or drain. Contractor shall also be required to encase any water crossing in concrete a minimum of 5 feet each side of the waterline and 6" around the main. The water main shall also be wrapped in 40-mil plastic prior to encasement.

## 3.4 JOINTS AND COUPLINGS

- A. Push-on Joints:
  - 1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.

- 2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.
- 3. Where required, install restraint and secure push-on joint restraint in accordance with manufacturer's instructions.
- B. Mechanical Joints:
  - 1. Wire brush surfaces in contact with gasket and clean gasket.
  - 2. Lubricate gasket, bell, and spigot with soapy water.
  - 3. Slip restraining gland and gasket over spigot and insert spigot into bell until seated.
  - 4. Seat gasket and press gland firmly against gasket.
  - 5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.
- C. Mechanical Joint Solid Sleeve:
  - 1. Clean pipe ends for distance of 8 in.
  - 2. Use soapy water as gasket lubricant.
  - 3. Slip restrained joint follower and gasket over each pipe to a distance of 8-in. from end and place middle ring on pipe end until centered over joint.
  - 4. Insert other pipe end into middle ring and bring to proper position in relation to pipe laid.
  - 5. Press gaskets and followers into middle ring flares.
  - 6. After bolts inserted and nuts made finger tight, tighten diametrically opposite nuts by use of torque wrench of size and torque specified. Tighten bolt heads until top of bolt shears off.

## 3.5 HYDRANT BRANCHES

- A. Furnish and install hydrants on hydrant branches where shown the Contract Drawings or as approved by the Engineer.
- B. Each hydrant branch shall consist of a valve anchoring tee with 6-inch branch, 6-inch gate valve (mechanical joint), a 6-inch pipe nipple of the required length and thrust restraint glands provided on the joints of all valves, fittings and hydrants. The base of all hydrants, valve anchoring tees and hydrant valves shall be set on concrete pads.
- C. Hydrant barrel extensions shall be furnished and installed where necessary to provide a hydrant elevation acceptable to the Engineer.
- D. Construct hydrant drainage wells of one-half (1/2) cubic yard capacity of crushed stone placed in the excavated area below and around the hydrant bottom. Furnish and place filter fabric over the stone to minimize migration of fines into the stone.
- E. Hydrants shall be given two (2) coats of quality paint after installation.

## 3.6 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Bury marker tape with the printed side up at a depth of 18-inches below the top surface of earth or the top surface of the subgrade under pavements.

## 3.7 TESTING

- A. Clean of all dirt, dust, oil, grease and other foreign material, before conducting pressure and leakage tests.
- B. Pressure and Leakage Tests. Refer to Section 02704 for requirements.

## 3.8 DISINFECTING AND FLUSHING

- A. Disinfect potable water lines using procedures and materials conforming to AWWA C651.
- B. Refer to Section 02675 for additional requirements.

## 3.9 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

# END OF SECTION 02600

#### SECTION 02601

#### SEWER MANHOLES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with constructing all sewer manholes.
  - 2. Base: Precast concrete. Tops accurately shaped by ring forms to suit riser sections.
  - 3. Walls (Risers and Cones): Precast Concrete
  - 4. Top of Cone: Brickwork or reinforced concrete grading rings for adjusting frame to match finished surface not to exceed dimension indicated on Contract Drawings.
  - 5. Inverts: Form invert channels of brickwork. Conform accurately to adjoining pipes size. Curve side inverts and lay out main inverts (where direction changes) in smooth curves of longest possible radius tangent to adjoining pipelines centerline.
  - 6. Frames and Covers: Cast-iron, as indicated or specified.
  - 7. Watertight Frames and Covers: Provide were indicated on the Contract Drawings and as specified.
- B. Related sections includes the following:
  - 1. Section 02200 Earthwork
  - 2. Section 02525 Paving and Surfacing

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Submit manufacturer's specifications and product data including drawings showing dimensions, reinforcing and materials for all items furnished under this section.
  - 2. Submit manufacturer's written instruction for installing resilient connector.

## 1.4 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Manholes: Manholes shall conform in shape, size, dimensions, materials, and other respects to the details indicated on the Drawings, as herein specified. All manholes shall have concrete bases. Concrete bases shall be precast unless otherwise specified. Invert channels shall be formed of brick and mortar upon the base. Manhole walls shall be precast concrete sections. The dome of the manholes shall be a precast concrete section. The top 6-inches of the dome, not to exceed 10-inches, shall be built of brick and mortar, or plastic riser rings, to permit adjustment of the frame to meet the street surface or finished grade.
- B. Inverts: Channels shall be at least the same depth as the pipe diameter and the shelf shall have a non-skid surface. The bells shall either accept the "boot" connector or a properly sized rubber ring to seal the pipe to manhole connection in accordance with ASTM C 923 and ASTM C 1244. All bell angles shall be fabricated within three degrees of the design shown on the plans.
- C. Portland Cement: ASTM C150, Type II
- D. Hydrated Lime: ASTM C207, Type S
- E. Sand: Fine Aggregate for mortar, but passes No. 8 Sieve.

- F. Brick: The brick shall be sound, hard, and uniformly burned brick regular and uniform in shape and size of compact texture. Brick shall comply with the ASTM Standard Specification for "Sewer Brick (made from clay or shale)", Designation C32, for Grade SA, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight. Rejected brick shall be immediately removed from the work area and substituted with brick satisfactory to the Engineer.
- G. Bituminous Dampproofing Material:
  - 1. No. 46-449 Heavy Duty Black made by Tnemec Company, Inc., North Kansas City, MO.
  - 2. No. 35-J-10 Hi-Build Bituminous Coating made by Valspar Corporation, Short Hills, NJ.
  - 3. Bitumastic Super Service Black made by Kop-Coat Company, Inc., Pittsburgh, PA.
  - 4. Or acceptable equivalent product.
- H. Plastic Coated Steel Steps. Minimum dimensions: Step width 14 inches, distance from manhole wall 5 inches after installation. Equal to: PS2-PF-SL Manhole Steps made by M.A. Industries, Inc., Peachtree City, GA.
  - 1. Manhole steps for precast reinforced concrete barrel sections shall be 3/8-inch grade 60 steel reinforcing rod encapsulated with molded copolymer polypropylene or approved equal. The embedded portion of the steps shall be insulated from the concrete by the manhole manufacturer to prevent deterioration of the metal by interaction with the concrete.
  - 2. The copolymer polypropylene conforming to ASTM D4101-82 PP200B33454 with a minimum carbon black content of 1/2% by weight or other demonstrated equivalent sunlight protection system.
- I. Steps capable of resisting following loads without loosening or damaging:
  - 1. Minimum horizontal pull out load 1,600 pounds (800 pounds per leg).
  - 2. Minimum vertical load 800 pounds.

## 2.2 PRECAST CONCRETE BASES

- A. The precast bases shall be supported on a compacted level foundation of crushed stone at least 12-inches thick.
- B. The precast bases shall be manufactured to contain wall openings of the minimum size, to receive the ends of the pipes and such openings shall be

accurately set to conform with line and grade of the sewer. Subsequent cutting or tampering in the field, for the purpose of creating new openings or altering existing openings, will not be permitted. Connection of sewer pipe to manholes shall be made using the mechanical connections.

C. Precast bases shall be at least 5-inches thick for 4-foot diameter manholes and 8-inches thick for 5-foot diameter manhole. Pre-cast walls shall be 6-inches thick.

## 2.3 PRECAST CONCRETE SECTIONS

- A. ASTM C478 and following modifications:
  - 1. Wall thickness: as indicated.
  - 2. Cement: ASTM C150, Type II, otherwise as directed by Engineer.
  - 3. Joints between sections: Butyl rubber-based sealants.
  - 4. Cure by subjecting to saturated steam at temperature between 100 and 130 degrees F. for 12 hours or more.
  - 5. Cast or drill only two lift holes in each section.
  - 6. Clearly mark date of manufacture and name or trademark of manufacturer on insides of walls on all sections.
  - 7. Accept on basis of material tests and product inspection.
- B. Cones and Conical Transitions similar in design and construction to riser sections. Use flat slab tops only where indicated.
- C. Cast and build into bases during manufacture:
  - 1. Resilient connectors for pipe connections
  - 2. Holes for future pipe connections
- D. Set steps accurately as indicated.

## 2.4 FRAMES AND COVERS

A. The Contractor shall furnish manhole frames and covers conforming to the details shown on the Drawings, or as specified in this Section, unless specifically called out on the Contract Drawings to use an alternate type of manhole frame and cover.

- B. Frames and covers shall be Cast Iron minimum Class 25 conforming to ASTM A48, and as follows:
  - 1. Castings to be free from scale, lumps, blisters and sandholes.
  - 2. Frames and covers shall be of cast iron with diamond cover surface design. Machine contact surfaces to prevent rocking.
  - 3. Thoroughly clean and hammer inspect.
  - 4. Covers for all sewer structures shall have the word "SEWER" cast upon them.
  - 5. Frames shall have a 24-inch diameter free and clear opening, unless otherwise indicated.
  - 6. Include frame and cover model numbers. Frames and covers shall be:
    - a. Model No. LB268-1, LeBaron Foundry, Inc., Brockton, MA.
    - b. Model No. R-1720, Neenah Foundry Co., Albany, NY.
    - c. Model No. 1104, Campbell Foundry Co., North Haven, CT.
    - d. Or approved equal.
  - 7. Capable of withstanding AASHTO H-20 loading unless otherwise indicated or specified.

# 2.5 WATERTIGHT FRAMES AND COVERS

- A. Contractor shall furnish watertight manhole frames and covers where indicated on the Contract Drawings. Watertight frame and covers shall be constructed of elastomeric risers and frames and cast iron covers as specified in this Section.
- B. Materials
  - 1. Properties of the Elastomer: component parts shall be molded and cured in such a manner than any cross section will be dense, homogenous, and free of porosity, blisters, pitting, and other imperfections.
  - 2. Component parts shall be fabricated from a high-grade rubber compound. The basic polymer shall be natural rubber, synthetic rubber, or a blend of both acceptable to the owner. There shall be no reclaimed material incorporated in the finished product.
  - 3. The manhole cover shall be manufactured to ASTM A48 class 35B grey iron requirements and shall have a tensile strength of 35,000 LBFS per sq. in.

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- C. Design
  - The chimney riser, frame, and cover system shall consist of interlocking composite rings, a composite rubber frame as described in Paragraph 2.5B above, and a cast iron manhole cover.
  - 2. Each component part of the system shall have, as part of its construction, the ability to limit lateral movement after installation. The lateral movement shall be limited by the integration of an interlocking of the frame and adjustment risers, as well as between the adjustment risers on their opposing surfaces by a matching rib and groove system. The interlocking rib and groove system shall also be self-sealing, providing a barrier and limiting the inflow of subsurface water and backfill fine material into the manhole through the chimney area.
  - 3. The chimney riser, frame, and cover system shall have a AASHTO H-25/HS-25 Load Rating, testing conducted in accordance with the AASHTO M306 (Standard Specification for Drainage, Sewer, Utility and Related Castings) requirement of 50,000 LB proof load concentrated on a 9-inch by 9-inch area.
  - 4. The chimney riser, frame, and cover system shall be corrosion resistant.
  - 5. The chimney riser, frame, and cover system shall be watertight, serving to prevent inflow and infiltration through and around the cover, through the chimney, and through any joints between system components or to the existing structure.
  - 6. Cover shall be a bolted locking cover.
- D. Manufacturers
  - 1. Frames and covers shall be the Lifespan System as manufactured by Hamilton Kent of Winchester, TN, or approved equal.

# 2.6 JOINTS

- A. Ends of each length of manhole riser sections and the bottom end of manhole tops, of the cone type, shall be provided with tongue-and-groove ends of concrete formed on machined rings to insure accurate joint surfaces. The joints shall be the type using a butyl-rubber polymer gasket for sealing the joints. All joints shall be provided so as to be watertight under all conditions of service. The ends of risers and cones to be jointed using petroleum resistant joints which shall be designed to enclose the gasket on four surfaces when the joint is in its final position.
- B. Gaskets: Gaskets for sealing joints shall be of petroleum resistant materials of a special composition having a texture to assure a watertight and permanent

seal. The joint sealing gasket shall be of a composition and texture which shall be resistant to sewage, industrial wastes, petroleum products (oil, gasoline, etc) and groundwater, and which will endure permanently under the conditions likely to be imposed by this use. A 6-inch sample of gasket shall be submitted to the Engineer for review.

- C. Between precast sections: Butyl rubber-based sealants per Type B, AASHTO M198, but no bitumen content.
- D. Resilient connectors for pipes to precast sections: ASTM C923, and to manufacturer's standards. Do not use connectors using castings and bolts with non-resilient bearing.
- E. Rubber ring waterstops for use in pipe-to-manhole joints: Rings of resilient material that will fit snugly over pipes, held firmly against pipe surface by means of a mechanical take-up device which when tightened will compress resilient material or by a stretch fit. Waterstop designed and installed so that leakage between pipe and manhole is minimized.
  - 1. Materials and manufacture of waterstops: ASTM C923.
- F. Non-shrink mortar for pipe connections to existing manholes:
  - 1. Masterflow 713 Grout made by Master Builders, Cleveland, OH.
  - 2. Five Star Grout made by U.S. Grout Corp., Old Greenwich, CT.
  - 3. Upcon made by Upco Co., Cleveland, OH.
  - 4. Or acceptable equivalent product.

# 2.5 MIXES

- A. Concrete: Cast-in-place, Class A, Section 03300.
- B. Mortar:
  - 1. For Brickwork: The mortar shall be composed of type II Portland cement and sand in the proportions of 1:2. Sand shall comply with the "Standard Specifications" for "Fine Aggregate", for concrete masonry. No mortar cement or lime shall be used.
  - 2. For Plugging lift holes: Mix portland cement and sand in proportion by volume of 1: 1-1/2, with sufficient water.

# PART 3 - EXECUTION

## 3.1 SETTING PRECAST SECTIONS

- A. Manhole risers and tops shall be installed using approved butyl-rubber polymer type gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations, and as approved. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to insure watertight joints. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of pipes to manholes shall be by means of a flexible manhole sleeve cast into the manhole wall. Sleeves shall be resistant to sewage, industrial wastes, petroleum products, and groundwater. The serrated flange is cast into the manhole base and/or wall to form a tight waterstop. The pipe is secured in the sleeve using a stainless steel strap, clamp, draw bolt and nut.
- B. Care shall be taken to assure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so that the manhole steps shall be in alignment.
- C. All holes in sections used for handling shall be thoroughly plugged with non-shrink grout. Hammer mortar into hole until dense and excess of paste appears, then smooth flush with adjoining surface.

# 3.2 LAYING BRICKWORK AND GRADING RINGS

- A. Only clean bricks shall be used in brickwork for manholes. Moisten bricks, before laying. The brick 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. Moistening grading rings NOT PERMITTED.
- B. Lay bricks in full bed and joint of mortar without subsequent grouting, flushing or filling; bond thoroughly.

#### 3.3 PLASTERING AND CURING BRICK MASONRY

- A. Plaster outside faces with mortar for brick: 1/4 in. to 3/8 in. thick.
- B. Moisten brick masonry before application of mortar.
- C. Spread and trowel plaster carefully.
- D. Check after hardening by tapping for bond and soundness.

- E. Remove and replace unbonded and unsound plaster.
- F. Protect from too rapid drying by moist burlap or as approved.
- G. Protect from weather and frost.

# 3.4 JOINTING AND CONNECTIONS

- A. Use joints between precast sections, and between pipes and precast sections conforming to related standards and manufacturer's instruction.
- B. Hold rubber ring water stops for pipe-to-manhole firmly against pipe surface by mechanical take-up device to compress resilient material when tightened. Install to minimize leakage.
- C. Apply non-shrink mortar according to manufacturer's instruction.
- D. Close openings for future connection with brick masonry bulkhead.

# 3.5 COATING

A. Apply two heavy coats of bituminous waterproofing material to exterior surfaces, by brush or spray according to manufacturer's instructions.

# 3.6 SETTING FRAMES AND COVERS – STANDARD MANHOLE FRAME AND COVER SYSTEM

- A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings. Frames shall be set concentric with the top of the manhole and in a full bed of mortar so that the space between the top of the brick and mortar 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 concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 4-inches above the flange.
- B. Manhole covers shall be left in place in the frame on completion of other work at the manholes.
- 3.7 SETTING FRAMES AND COVERS WATERTIGHT MANHOLE FRAME AND COVER SYSTEM
  - A. Chimneys, frames and covers shall be installed in accordance with the manufacturer's instructions.
  - B. The contractor shall prepare the top surface of the precast concrete structure prior to the installation of the frame and cover. The contractor shall ensure the concrete structure is in good order; otherwise the contractor shall

reconstruct the precast concrete structure. The contractor shall wire brush those surfaces in order to remove scale or loose impediments before installation.

- C. An accurate measurement of the distance between the precast concrete structure and the surface grade should be taken. A pre-installation of the frame, cover, and chimney component parts should be done to ensure the system is measured to within 0.25" below surface grade.
- D. A continuous bead of construction grade flexible butyl resin sealant shall be placed on the concrete surface prior to the setting of the chimney to facilitate a complete seal between the bottom component of the system and the precast concrete surface. The sealing bead shall be not less than 7/16 of an inch in diameter.
- E. The chimney risers will be placed, with the groove up, and stacked in combination to meet the final grade. The frame should then be placed on top. A cast iron or equivalent locking cover, which has been approved to work with the chimney riser and frame system, shall then be placed in the frame and the bolts tightened to ensure the lugs fully engage the 3 locking cavities in the rubber frame.
- F. The area surrounding the structure, including the riser shall be filled and compacted with specified backfill material up to the base of the frame.
- G. Once any paving or concrete work has been completed, the cover shall be removed and any loose debris or extraneous material shall be removed, leaving a clean surface on all contact points.
- H. A continuous bead of butyl sealant shall be placed into each of riser grooves prior to the installation of the next riser onto the stack or frame if it is the top Riser on the stack.

# 3.8 STUBS IN MANHOLES

A. Stubs placed as specified and indicated on the Drawings shall be a minimum of 3 feet long or the length identified on the Drawings. The stubs, regardless of size, shall be identical to the adjacent sewer pipe, sealed with a watertight cap. Stubs shall be set accurately to the required line and elevation and be placed in the manhole as indicated on the Drawings. Pipe materials shall correspond to the Specifications for the adjacent installed sewer pipe.

# 3.9 INSTALLING STEPS

A. Embed or attach steps in wall during or after casting.

- 1. Embedded Steps: Use cleaning agents to remove dirt, oil, and grease. Rinse, dry and coat with heavy-bodied bituminous material, parts to be embedded. Dry and secure in forms for embedment during casting.
- 2. Attached Steps: Drive into plastic inserts. Embed inserts during casting or drive inserts into holes formed during casting.
- 3. Embed plastic coated steel steps during casting or attach after casting: Drive into holes formed during casting, or into embedded plastic inserts.

# 3.10 TESTING

- A. Leakage tests shall be made and observed by the Engineer and a representative of the Contractor on each manhole. The test shall be an exfiltration test made as described below.
- B. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking grout. The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged.
- C. The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily watertight. If the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone. After two hours, the manhole shall again be refilled to the top of cone. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period and there shall be no visible leakage. If the manhole fails this requirement, the manhole will be deemed to have failed the test. It shall then be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct and replace it. The manhole shall then be retested and, if satisfactory, all interior joints and those exterior joints within 6 feet of the surface shall be filled and pointed.

D. The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at his own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to insure that the water table is below the bottom of the manhole throughout the test.

- E. If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole, such a test can be used to evaluate the watertightness of the manhole. However, if the Engineer is not satisfied, the Contractor shall lower the water table and carry out the test as described herein above.
- F. Leakage tests for four (4) foot and five (5) foot diameter manholes may be made using vacuum testing equipment. This type of test may be used only immediately after assembly of the manhole and only prior to backfilling. The manhole to pipe connection should only be a flexible connector. All lift holes shall be plugged with a non-shrinking mortar. For this test, each four or five foot diameter manhole shall be tested under 10-inch of Hg vacuum. The test shall pass if the vacuum remains at 10-inch Hg or drops no lower than 9-inch Hg after 60 seconds for manholes 0 to 10 feet deep, 75 seconds for manholes 10 to 15 feet deep or 90 seconds for manholes 15 to 25 feet deep.

# 3.11 CLEANING

A. All excess material including dirt, loose concrete, bricks, grit, stones and any other material, shall be removed from all manholes prior to final review by the Engineer.

# 3.12 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

# END OF SECTION 02601

## SECTION 02609

## **REINFORCED-CONCRETE DRAIN PIPE**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Providing and testing reinforced concrete pipe as indicated and specified.
- B. Related sections include the following:
  - 1. Section 02200 Earthwork
  - 2. Section 02601 Manholes
  - 3. Section 03300 Cast-in-Place Concrete

## 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Shop drawings showing pipe dimensions, reinforcement, joint and other details for each type and class pipe.
  - 2. If less than 100 units of given size and class, submit three certified copies of pipe tests on identical pipe units made by same manufacturer within past year.
  - 3. If more than 100 units of given size and class, submit:
    - a. Reinforcing steel mill or sample test reports for each shipment of steel.
    - b. Cement mill test reports for each shipment of cement.

- c. Aggregate test reports before manufacturer of pipe and monthly thereafter during production.
- d. Records of average daily temperature and number of days pipe units cured, when average daily temperature below 60 deg. F.
- e. Concrete cylinder compression test results within three days after test.
- f. Absorption test results.
- g. Pipe load-bearing test results.

# 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B Provide pipe made by manufacturer of established good reputation in the industry and manufactured in a plant adapted to meet the design requirements of the pipe.
- C. Accept on basis of tests of materials, absorption tests, plant load-bearing tests, pressure tests, and inspection of completed product.
- D. Testing Agencies:
  - 1. Engage an acceptable independent testing laboratory to perform or witness tests, other than mill tests on reinforcing steel and cement, and certify the results.
- E. Allow Owner to engage independent testing laboratory at Owner's expense to perform additional inspection or tests of any or all pipe units at manufacturer's plant or elsewhere. Accept such additional inspections or tests as test results of record.
- F. Conduct all tests in accordance with applicable ASTM Specifications.
  - 1. Materials:
    - a. Reinforcing Steel: Mill test reports or reports on samples taken from each shipment to pipe manufacturer.
    - b. Cement: Mill test reports for each shipment to pipe manufacturer. Cement for this project kept segregated from other cement.

- c. Aggregates: Tests to demonstrate compliance with specified requirements. Initial tests prior to commencement of pipe manufacturer and additional tests at least monthly during production of pipe.
- 2. Concrete: Compression tests on standard cylinders for first pipe unit, then for every 100 cu. yd. of concrete used in pipe fabrication, or for each additional 200 units of pipe, whichever is lesser amount of concrete. Make 4 cylinders for each test and break them at 7, 14 and 28 days. Set aside one cylinder in case of unsatisfactory break.
- 3. Conduct pipe tests on units selected at random by Engineer.
  - a. Absorption: Before load test, take 3 cores from each unit. Test by boiling. Average absorption: Maximum 8 percent of dry weight, no single test more than 9 percent.
  - b. Load-Bearing: Before delivery, conduct one test or one pipe unit of each size and class, and one additional test for each 200 units of each size and class, after taking cores for absorption test. Carry test to specified load to produce 0.01in. crack; if no crack produced, pipe may be used. Plug cored holes with mortar as specified for repairs.
  - c. Pressure: Before delivery, test six units of each size and class. Join units in normal manner using joint to be furnished and bulkhead end units independently. Average internal hydrostatic pressure of 10 psi for 10 minutes minimum without visible leakage from joints or barrels. Perform test in presence of Engineer.
- G. Inspection by Engineer:
  - 1. At place of manufacture.
  - 2. At site of work after delivery.
  - 3. Reject pipe at any time if it fails to meet specified requirements, even if sample pipe accepted at plant.
  - 4. Immediately remove rejected pipe from site.

# 1.5 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

## PART 2 - PRODUCTS

# 2.1 PIPE FABRICATION

- A. Interior: Smooth; no projections, indentations, offsets or irregularities.
- B. Classes: As indicated.
- C. Conform to ASTM C76, modified as follows:
  - 1. Provide with proper concrete ends true to size; form on machined rings to ensure accurate joint.
  - 2. Use Type II cement, no admixtures unless permitted by Engineer.
  - 3. Cement content in concrete: At least 564 lbs. per cu. yd.
  - 4. Aggregates: Fine and Coarse Aggregate per Section 03300.
  - 5. Reinforcement: Section 03200. Longitudinal reinforcement continuous. Minimum cover 3/4 in. Elliptical reinforcement not allowed.
  - 6. Minimum laying length: 8-ft. except where otherwise indicated or permitted.
  - 7. Curing: Saturated steam at temperature between 100 and 130 deg. F. for minimum 12 hours.
  - 8. Shipping: Aged at least 450 day-degrees including steam curing period before shipping. Day-degrees defined as total number of days times the average daily air temperature at pipe surface. (Example: Five days at daily average temperature of 60 deg. F. equals 300 day-degrees.)
  - 9. No lift holes.
  - 10. Repairs:
    - a. Mortar: Minimum compressive strength 4,000 psi at 7 days, and 5,000 psi at 28 days, when tested in 3-in by 6-in. cylinders stored in standard manner.
    - b. Only those allowed by ASTM C76.
  - 11. Mark permanently on inside and outside of pipe:

- a. Date of manufacture
- b. Class
- c. Size
- d. Consecutive number
- e. Manufacturer's trade mark

# 2.2 FITTINGS AND SPECIALS

- A. Reinforcement: As required for class of pipe to be used.
- B. Details: As indicated and conforming to approved shop drawings.
- C. Pipebells for chimneys or building connections:
  - 1. Formed or built into pipe unit at plant.
  - 2. Vitrified-clay bells with premolded gaskets: ASTM C700, extra strength, and ASTM C425.

# 2.3 JOINTS

- A. Rubber Gasket Type: Gaskets in compression permitting longitudinal and angular movement.
- B. Pipe 36 in. or less in diameter: O-ring: ASTM C361 and as specified.
- C. Pipe larger than 36 in. in diameter: O-ring or ribbed-gasket: ASTM C443 and as specified.
- D. Design:
  - 1. No visible leakage, when tested under average internal hydrostatic pressure of 10 psi.
  - 2. Diameter of joint surfaces compressing the gasket: Not off more than 1/16 in. from true diameter, or as permitted by above ASTM Standard, whichever is less.
- E. Composition and Texture of Gaskets:
  - 1. Resistant to common ingredients of sewage, industrial wastes, and groundwater. Permanent under anticipated service conditions.

2. Fabricated by manufacturer regularly making rubber gaskets for pipe.

# PART 3 - EXECUTION

- 3.1 HANDLING
  - A. Handle into position in acceptable manner.
  - B. Furnish suitable devices for support when lifted.

# 3.2 INSTALLATION

- A. Inspect before installation. Remove and replace defective units. Clear of debris and dirt.
- B. Bedding:
  - 1. Support on compacted screened gravel or crushed stone per Section 022010, or as indicated. Do not permanently support on saddles, blocking, or stones.
  - 2. Provide bell holes for imparting bearing pressure to pipe barrel.
- C. Alignment:
  - 1. Install to line and grade indicated.
  - 2. Maintain close joints with next adjoining unit. Match inverts. Do not drive down to grade by striking.
- D. Jointing:
  - 1. Clean and lubricate bell or groove before jointing per manufacturer's recommendation. Push into place. Force pipe units together by proper devices leaving minimum open recess inside and outside and achieving tightly sealed joints. Avoid force that could wedge apart or split bell or groove ends. Do not pull or cramp joints, except where permitted by Engineer.
  - 2. Inspect proper position of joint gasket with feeler gage furnished by Contractor.
  - 3. Remove and replace unfittable pipe units with suitable units and new gaskets.
  - 4. Install gaskets and assemble joints in accordance with recommendations of manufacturers of joint material and pipe, subject

to acceptance by Engineer. Provide watertight pipeline with flexible joints.

- E. Backfill:
  - 1. Compact gravel between pipe and sides of trenches to hold pipe in correct alignment. Fill bell holes with screened gravel and compact as indicated.
  - 2. Prevent floatation in trench.
- F. Cleaning:
  - 1. Use watertight plugs in open ends of pipe and branches when installation not in progress.
  - 2. Do not use pipeline as conductor for trench drainage.
  - 3. Prevent earth, water, and other material from entering pipeline.
  - 4. Clean pipeline and manholes upon completion. Prevent soil, water, and debris from entering existing sewers.

# 3.3 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

# END OF SECTION 02609

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#### SECTION 02612

#### VALVES AND APPURTENANCES

#### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Provide valves, gates, and miscellaneous piping appurtenances as indicated and specified.
  - 1. Sizes and capacities as indicated or specified.
- B. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.3, below.
- C. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Section 02200 EARTHWORK

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 Submittal Procedures:
  - 1. Submit manufacturer's specifications, catalog data, descriptive matter, illustrations, certified shop drawings, wiring, diagrams, etc.
  - 2. Operating and maintenance instructions and parts lists.
  - 3. Submit certified copy of test results, for each plug valve, hydrostatically tested in both directions at factory, for review.
- B. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel

(AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

## 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Suitable-type enclosures for specified atmospheres.
- C. Shop Painting:
  - 1. Shop coats compatible with and made by same manufacturer as field applied coats. All coating surface preparation and coating use, mixing, application, and curing in accordance with current printed instructions of coating manufacturer and as specified.

#### 1.5 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

## PART 2 – PRODUCTS

#### 2.1 NON-LUBRICATED ECCENTRIC PLUG VALVES

- A. Manufacturers: DeZurik, Inc., Sartell, MN; M&H Valve Co., Anniston, AL; Keystone Drum-Owen Valve Co., Lehigh Valley, PA; or acceptable equivalent product.
- B. Non-lubricated, eccentric type with resilient seats.
- C. Bodies of cast iron, ASTM A126 Class B with bolted bonnets. Suitable for 175 psi working pressure for valves 12-in. and smaller. Suitable for 150 psi working pressure for valves 14-inch to 36-inch.
- D. Port areas of valves 20-in. and smaller not less than 80 percent of pipe area.
- E. Valve seats of Neoprene or Buna-N synthetic rubber. Seat material shall coat the plug or shall be held by a stainless steel seat ring and shall be held attached to the valve with self-locking stainless steel screws.
- F. Provide valves with coated plugs with mating seats of 90 percent, minimum, pure nickel welded into the body of valves 3-in. and larger.
- G. Provide valves with seats clamped to valve with mating seat of 90 percent, minimum, pure nickel welded to the valve, or coat the valve body with thermally bonded nylon and coat the valve plug and bonnet with thermally bonded epoxy.
- H. Upper and lower plug journal bearings either thermally bonded epoxy coatings, or removable, permanently lubricated stainless steel bushings for valves 20-in. and smaller;

VALVES AND APPURTENANCES 02612 - 2

- I. Stem seals of either adjustable multiple V-packing or multiple point contact rubber rings. Stem seals replaceable without valve disassembly.
- J. Restrained mechanical joint ends for buried valves.
- K. Buried or submerged plug valves
  - 1. Provide gear operator with operating nut and valve box. Gear operator to be totally enclosed with gasketed stainless steel covers with stainless steel fasteners for access to valve packing.
  - 2. Valve operator shall be suitable for buried service. Operator shall produce required operating torque to seat, unseat or hold the vane steady in any intermediate position. Operator shall produce required operating torque with a maximum input of 150 ft-lbs on the wrench nut. All actuator components between input and stops shall withstand without damage an input torque of 300 ft-lbs minimum. It must be fully gasketed and grease packed and designed to withstand submersion in water to 10 pounds per square inch. Valves shall have 2-inch standard AWWA operating nuts. All valves shall open left.
  - 3. Provide gate boxes and steel extension stems or universal-joint operating rods with 2-in. square operating nuts at upper end with coupling connected to valve stem to bring the operating nut to within 2 feet of ground surface.

#### 2.2 VALVE BOXES

- A. Manufacturers: Clow Corporation, Chicago, IL; Mueller Co., Decatur, IL; or acceptable equivalent product.
- B. Materials:
  - 1. Valve boxes adjustable, telescoping, heavy-pattern type of cast iron. Designed and constructed to prevent direct transmission of traffic loads to pipe or valve. Adjustable through at least 6 in. vertically without reduction of lap between sections to less than 4 in. Inside diameter at least 4-1/2 in. Lengths as necessary for depths of valves or stops with which boxes are used. Top of cover flush with top of box rim. Cast arrow and word OPEN to indicate direction of turning to open valve in top of valve covers. Covers shall have the words "SEWER" cast into them.
  - 2. Curb boxes for curb stops, cast iron extension type, Buffalo pattern base, diameter to suit curb stop size; flush cover marked VALVE.

#### 2.3 T-HANDLE OPERATING WRENCHES

A. Furnished by gate or valve manufacturer.

- B. T-handle operating wrenches provided in lengths necessary to permit operation of all valves by operators of average height working in normal positions.
- C. Provide three suitable levers or wrenches for each size of buried valve operator nut. Wrenches or levers of suitable size and sufficient length for easy operation of valves at rated working pressure.

## 2.4 SHOP PAINTING

- A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces (except stainless steel), high solids epoxy with the following characteristics:
  - 1. Solids by Volume: Minimum 69% (percent +/-2)
  - 2. Type: Polyamidoamine, self-priming.
  - 3. Dry Film Thickness: 6-8 mils per coat.
  - 4. Number of Coats required: Two.
  - 5. V.O.C. Requirement: 2.79 max.
  - 6. Color: Provide as specified for piping system of same service or as selected by the Engineer.
- B. Surface preparation, mixing and application and safety requirements shall be in accordance with the paint manufacturer's printed instructions.
- C. Ferrous surfaces obviously not to be painted shall be given a shop applied coat of grease or ruse resistant coating.
- D. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment is accepted.

#### 2.5 AIR RELEASE VALVES

- A. Manufacturers: DeZURIK APCO Model ASU or pre-approved equal.
- B. Design:
  - 1. Combination Air Valves shall be single body design and shall provide both Air Release and Air/Vacuum valve functions.
  - 2. General:
    - a. Design Maximum Working Pressure: 150 psi (1030 kPa) for ASU-SCAV body style, sizes 1-6" (25-150mm) and 300 psi (2070 kPa) for ASU-CAV body style, sizes 1-4" (25-100mm).
    - b. Maximum Fluid Temperature: 180 deg F (82.2 deg C)
    - c. Air release shall be accomplished by dual-range venting design to provide varied and predictable air flow over a wide range of conditions. Air release shall have a 5/16" self-adjusting orifice.

VALVES AND APPURTENANCES 02612 - 4 The fractional air release orifice must be capable of releasing 140 scfm of air at 150 psi differential pressure.

- d. Valves shall close tightly at any pressure as low as 2 psi without leaking or spilling. The Air/Vacuum inlet and outlet areas shall meet the flow area requirements set forth in AWWA C512. In any case, the smallest crosssectional area must define the size of the valve.
- e. Valve shall have an upper body compression chamber to limit fluid level and solids interference. It shall also have a funnel shaped lower body to reduce solids buildup and allow for selfcleaning and maximum outflow.
- f. A hydraulics-based float design shall be used to reduce the ballistic effect and instability of high-speed fluid flow. Float shall be oversized so Combination Air Valves will work in fluids containing fats, oils or greases (FOG) with specific gravity as low as 0.7.
- g. The guided float shaft shall provide smooth Air Release and Air/Vacuum operation that will not foul and reduce performance on dirty service applications. To avoid loss of performance, the Air Release and Air/Vacuum seating action shall be direct driven by the shaft-mounted float. No linkages shall be used.
- h. Flow deflector/splash reduction ring shall be used to restrict solids entry and minimize flow effect and splash that can cause float instability.
- A 90-degree threaded side outlet shall be included with the valve with an extension pipe having a drip line beyond the valve body (1-4"). 1-4" valves shall be capable of converting to optional vertical threaded outlet or mushroom cap without removing the valve from service and valve disassembly.
- j. When using the standard side outlet (1-4") or mushroom cap outlet (6"), the overall valve height and weight shall not exceed:

	Threaded Inlet		Flanged Inlet	
Size	Height	Weight	Height	Weight
1", 2"	22"	43lb.	24"	50lb.
3", 4"	25"	52 lb.	27"	71 lb.
6"	-	-	27"	95 lb.

- C. Materials:
  - 1. Body: 316 Stainless Steel.
  - 2. Float: 316 Stainless Steel.
  - 3. Float Shaft: 316 Stainless Steel (1-4") or 17-4PH stainless steel (6").
  - 4. Piston stem and seat shall be 17-4 PH stainless steel.
  - 5. Elastomer seals shall be Acrylonitrile-butadiene (NBR).
  - 6. Piston stem guide bushings shall be Acetal Polyoxymethylene (POM).
  - 7. All metal internal and external bolting and other hardware including pins, set screws, studs, bolts, nuts, and washers: Stainless Steel.
  - 8. End connections: shall be NPT or ASME 125/150 flanged. Valves shall have two lifting lugs for ease of valve installation.

- D. Specifications for optional accessories:
  - 1. BFK = Backflush Kit for ASU Valves; Includes Two Brass Back Flush Shut Off Valves, 316 Stainless Steel Piping, and 5 Feet of Hose with Galvanized Steel Quick Disconnect couplings.
  - 2. DAT = Double Acting Throttling Device (1-4"). Double-Acting Throttling Device should be used to regulate and restrict air venting.
    - a. This device will establish a pressure loading on the rising column of fluid to eliminate damaging shock to the pump, controls and check valve on pump start.
    - b. On pump stop, the Double-Acting Throttling Device shall automatically open allowing full line unrestricted air re-entry to prevent vacuum from forming in the suction column.
    - c. Materials of construction shall be certified conforming to following ASTM specifications:
      - 1. Housing: Iron (with Fusion Bonded Epoxy on Exterior)
      - 2. Adjusting screw: Stainless Steel
      - 3. Spring: Stainless Steel
      - 4. Plug: PTFE
  - 3. MRC = Mushroom Cap 304 Stainless Steel (1-4") (Standard on 6" Valve Size)
  - 4. VTO = Vertical Outlet (1-4"). Vertical Outlet: Type 303 Stainless Steel
- E. Testing:
  - 1. Each Valve shall be shop tested in conformance with AWWA C512.
  - 2. Certified test reports shall be available upon request

# PART 3 – EXECUTION

#### 3.1 GENERAL

- A. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.
- B. Clean all debris, dirt, gravel, etc, from inside of piping before placing valves in place.
- C. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair, valves and other equipment which do not operate easily or are otherwise defective.
- D. Set plumb and support valves adequately in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in control piping for easy access.
- E. Provide valves with extension stems where required for convenience of operation. Provide extension stems for valves installed underground and elsewhere so that operating wrench does not exceed 6 ft. in length.

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## 3.2 PLUG VALVES

A. Install valves in horizontal sewage piping with shaft horizontal such that in open position, plug located in upper part of valve body. Valves oriented so that in closed position, plug is at downstream end of valve.

# 3.3 BURIED VALVES

A. Buried valves and boxes shall be set with the operating stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve.

# 3.4 VALVE BOXES

- A. Provide valve box for each buried stop and valve.
- B. Valve boxes shall be installed vertically, centered over the operating nut, and the elevation of the top shall be adjusted to conform with the finished surface of roadway or other surface at the completion of the contract. Boxes shall be adequately supported during backfilling to maintain vertical alignment.
- C. Set box so top is flush with finished surface and so box does not bear on valve, stop, or pipe.

## 3.5 TOUCH-UP FIELD PAINTING

A. After installation and approved testing by the Engineer, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop paint coating.

## 3.6 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

# END OF SECTION 02612

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## SECTION 02615

## DUCTILE IRON SEWER PIPE AND FITTINGS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.3, below.
- B. This section includes the following:
  - 1. Furnishing and installing ductile-iron pipe and fittings, as indicated and specified.
- C. Joints:
  - 1. For joints in buried exterior pipelines, provide push-on joint.
  - 2. All fittings and valves shall be mechanical joint.
- D. Related sections includes the following:
  - 1. Section 01063 MISCELLANEOUS REQUIREMENTS
  - 2. Section 02200 EARTHWORK
  - 3. Section 02612 VALVES AND APPURTENANCES

## 1.3 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTAL PROCEDURES:

# DUCTILE-IRON PIPE AND FITTINGS 02615 - 1

- 1. Submit shop drawings or descriptive literature, or both, showing dimensions, joint and other details for each type and class of pipe, fitting and restraint system to be furnished for the project. All materials furnished under the Contract shall be manufactured only in accordance with the Specifications. Submittals shall include material information, dimensions, pipe class information, weights, coating and lining system data.
- 2. For North American pipe and fittings, submit manufacturer's literature stating that the ductile iron pipe and fittings have been manufactured and tested in accordance with AWWA/ANSI specifications.
- 3. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

# 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Owner reserves right to inspect and test by independent service at manufacturer's plant or elsewhere at his own expense.

# 1.5 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

# PART 2 - PRODUCTS

- 2.1 PIPE
  - A. Ductile Iron:
    - 1. Ductile iron pipe shall be that of a United States manufacturer who can demonstrate at least 5 years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push-on joints.
    - 2. All ductile iron pipe shall conform to ANSI A21.50 (1976) (AWWA C150) and ANSI A21.51 (AWWA C151).

- 3. The ductile iron pipe shall be Pressure Class 350. All pipe shall be furnished in nominal 18-foot minimum lengths, with Push-on Joints as manufactured by U.S. Pipe and Foundry Company, Griffin Pipe Co., Clow Corporation, or equal with gaskets conforming to AWWA C111 ANSI A21.11 "Rubber Gasket Joints".
- 4. The ductile iron pipe shall be cement lined and then asphalt seal coated on the outside and inside approximately 1 mil. thick. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

# 2.2 FITTINGS

A. Fittings shall be manufactured in the United States and shall be compact ductile iron Class 350 Mechanical Joint, conforming to ANSI Specification A21.53 (AWWA C153), latest edition, for pipe sizes 16-inches and smaller, and Class 350 standard Mechanical Joint fittings conforming to AWWA C110/ANSI A21.10, latest edition except as specified, for pipe sizes 16 through 24-inches, unless specifically stated otherwise in the specifications or on the drawings. Fittings shall be suitable for use with restraints as specified hereinafter. Fittings shall be bituminous coated on the exterior and cement lined on the interior. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends.

# 2.3 JOINTS

- A. Provide mechanical joint or push-on joint pipe with necessary accessories, conforming to ANSI A21.11.
  - 1. Provide gasket composition suitable for exposure to liquid within pipe.
  - 2. Provide gasket composition suitable for exposure to potable water.
- B. Provide pipe flanges and accessories conforming to ANSI A21.15.
  - 1. Provide flat faced flanges.
  - 2. Provide 1/8 in. thick, full faced gaskets suitable for exposure to liquid within pipe.

# 2.4 RESTRAINED JOINTS

# DUCTILE-IRON PIPE AND FITTINGS 02615 - 3

- A. Restrained joints shall be furnished for installation on all fittings, sleeves, and valves. Refer to Paragraph 3.2D for restrained lengths. All restraints shall be manufactured and assembled in the United States. Restraints shall have Mega-Bond coating system to prevent corrosion, or equal. Restraints for mechanical joints shall be Megalug Series 1100 as manufactured by Ebaa Iron Co., MJ Field Lok Gasket as manufactured by U.S. Pipe, Series 1400 Mechanical Joint Restraint as manufactured by Uni-Flange or equal. Restraints for push-on joints shall be Series 1700 as manufactured by Ebaa Iron Co., or Series 1390 as manufactured by Uni-Flange and use stainless steel hardware.
- B. Restraint systems for push-on pipe utilizing steel-wedge gaskets having a pressure rating of 350 psi will be acceptable.
- C. Restraints for couplings shall be Series 3800 Mega-Coupling as manufactured by EBAA Iron Co., or Series 1100 CH Split Megalug Coupling Harness as manufactured by EBAA Iron Co. or equal.

# 2.5 COUPLINGS

- A. Couplings shall be manufactured in accordance with AWWA C219 and as specified hereinafter. Pressure rating at least equal to that of related pipeline with a minimum rating of 150 psi.
- B. Ductile iron coupling with SBR gaskets and fusion bonded epoxy coating. Coupling shall be suited for extended range of pipe materials and diameters. Coupling shall be XR501 as manufactured by Romac Industries or equal by Dresser or Rockwell. Couplings shall be manufactured in the United States.

#### 2.6 CONNECTIONS - TAPPED

- A. Provide watertight joint with adequate strength against pullout. Use only tapered thread taps.
- B. Maximum size of taps in pipe or fittings without bosses not to exceed that listed in appropriate table of Appendix to ANSI A21.51 based on:
  - 1. 2 full threads for ductile iron.
- C. Where size of connection exceeds that given above for pipe, provide boss on pipe barrel or use tapping saddle. Make tap in flat part of intersection of run and branch of tee or cross, or connect by means of tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, as indicated or permitted.

#### 2.7 STANDARD LINING AND COATING

- A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to AWWA C104.
- B. Outside of pipe and fittings shall have a factory applied asphaltic coating per AWWA/ANSI C151/A21.51.

# PART 3 - EXECUTION

## 3.1 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5 feet, and with even support for the pipe barrel.
- C. Only nylon-protected slings shall be used for handling the pipe. No hooks or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

# 3.2 ALIGNMENT AND PLACEMENT OF PIPE

- A. Jointing of ductile iron pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8-inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
- B. Installation and jointing of push-on ductile iron pipe shall be in accordance with AWWA C600 Sections 9b and 9c, latest revision, as applicable.
- C. Mechanical joints shall be installed with Mega-Lug, MJ Field Lok Gasket, or Uni-Flange restraints. Restraints shall be installed in full accordance with the manufacturer's instructions. All bolt heads on Mega-Lugs or Uni-Flanges shall be tightened sufficiently so that they shear off to provide indication that proper tightening torque was achieved.

# 3.3 INSTALLATION

# A. Piping Support:

- 1. Furnish and install supports to hold piping at lines and grades indicated or specified.
- 2. Support pipe and appurtenances connected to equipment to prevent any strain imposed on equipment.
- B. Pipe and Fittings:
  - 1. Remove and replace defective pieces.
  - 2. Clear of all debris and dirt before installing and keep clean until accepted.
  - 3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
  - 4. Provide firm bearing along entire length of buried pipelines.
- C. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.
- D. Appurtenances: Set valves, fittings and appurtenances as indicated.

# 3.4 JOINTS AND COUPLINGS

- A. Push-on Joints:
  - 1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
  - 2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.
  - 3. Where required, install restraint and secure push-on joint restraint in accordance with manufacturer's instructions.

- B. Mechanical Joints:
  - 1. Wire brush surfaces in contact with gasket and clean gasket.
  - 2. Lubricate gasket, bell, and spigot with soapy water.
  - 3. Slip gland and gasket over spigot and insert spigot into bell until seated.
  - 4. Seat gasket and press gland firmly against gasket.
  - 5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.
- C. Sleeve-Type Coupling:
  - 1. Clean pipe ends for distance of 8 in.
  - 2. Use soapy water as gasket lubricant.
  - 3. Slip follower and gasket over each pipe to a distance of 6 in. from end and place middle ring on pipe end until centered over joint.
  - 4. Insert other pipe end into middle ring and bring to proper position in relation to pipe laid.
  - 5. Press gaskets and followers into middle ring flares.
- D. After bolts inserted and nuts made fingertight, tighten diametrically opposite nuts by use of torque wrench.

# 3.5 TESTING

- A. Pressure and leakage tests will be made by the Contractor to determine that the force main is structurally sound and free of excess leakage. Pipeline shall be subject to a hydrostatic test equal to 100 psi. All equipment, materials and labor for testing shall be furnished by the Contractor.
- B. Once the pipeline section has been filled at normal pressure and all entrapped air removed from the line, the Contractor shall raise the pressure by a special pressure pump taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipeline. This pressure shall be checked for leaks by the Engineer. Measured rate of water leakage shall not exceed the allowable leakage specified herein.
- C. Allowable Leakage:

- 1. Pump the main to specified test pressure. When pressure is reached, stop pump. If pressure drops 5 psi or more, start pump and measure the quantity of water required to maintain the specified pressure. Repeat this process as required.
- 2. Ensure that pipe reach does not exceed the allowable leakage rate or exceeds the allowable hydrostatic variation specified in Paragraph 3.3B.
- 3. Calculate allowable leakage with following formula:

 $\begin{array}{l} Q = 0.0075 \text{ DLN where} \\ Q = allowable leakage in gallons per hour \\ D = nominal diameter of pipe in inches \\ L = length of section tested in thousand feet \qquad N = square root of avg. \\ test pressure in psi (N=10 for 100 psi test pressure) \end{array}$ 

- 4. Calculate allowable leakage separately for each diameter and add resulting allowable leakage rates to obtain total allowable leakage for entire reach.
- 5. Measure and record volume of water pumped into main to maintain test pressure. If actual volume exceeds the allowable, contractor shall stop test and initiate corrective measures.
- D. Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair excess at his expense. Pipe shall be accepted only when leakage does not exceed above standard. Acceptance does not absolve the Contractor from his responsibility if leaks develop later within the specified period of warranty.
- E. Contractor shall prepare a written report of the test procedures utilized, names of test personnel and equipment used in the tests, test results and calculations. Two copies of the report shall be submitted to the Engineer upon completion of the testing work.

# 3.6 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – CONTRACT CLOSEOUT.

# END OF SECTION 02615

# DUCTILE-IRON PIPE AND FITTINGS 02615 - 8

## SECTION 02621

## SEWER SERVICES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 SUMMARY

A. The work covered under this Section of the Specifications includes furnishing of all plant, labor, equipment, appliances, and materials, and performing all operations in connection with the furnishing, installing and testing of pipe, pipe fittings and chimneys, jointing materials, and accessories of various materials, sizes, classes, joints, and types and appurtenant work, complete in place.

## 1.3 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01300 SUBMITTAL PROCEDURES.
- 1.4 QUALITY ASSURANCE
  - A. Provide in accordance with Section 01400.

#### PART 2 - PRODUCTS

- 2.1 MATERIALS
  - A. Service connections shall be 6-inch diameter polyvinyl chloride pipe (unless otherwise indicated) and specification for materials and air testing shall apply. All connections into sewers shall be by wyes and couplings manufactured for use with that type of pipe. Service connections will generally terminate at the property line unless otherwise determined by the Engineer, with well-blocked air-tight plugs for air testing. After a section of new sewer main has been pressure tested and flushed, the Contractor shall survey the location of the end of the stub and the elevation to the top of the stub at its end. The end cap shall be marked and left in place. Service connections made using saddles and tapping shall be allowed only when authorized by the Engineer.

#### 2.2 SERVICE LOCATION MARKER

A. Contractor shall provide permanent metal service connection markers at the end of every sewer service. Marker shall be placed directly above the capped end of sewer service pipe and extend to within six inches of finished grade. Marker material shall be metal for locating with a metal detector. Marker shall

have sufficient mass for easy detection.

# 2.3 CHIMNEYS

- A. Provide chimney connection between building service and mainline sewer when mainline sewer invert is greater than 12 feet deep.
- B. Installation of chimneys when the mainline invert is less than 12-feet deep will not be allowed without the prior review by the Engineer.
- C. Chimneys shall be constructed as shown on the details and include a ductile iron or PVC main sewer sanitary wye and bend.
- D. Where chimney live loads are significant, as determined by the Engineer, the chimneys shall be encased in concrete and slab protected.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Pipe shall be laid accurately on line, with a uniform grade of 1/4-inch per foot (2 percent slope).
- B. Service Connections shall be installed as shown on the Details. Contractor shall provide all couplings and adaptors as required to make connections.

# END OF SECTION 02621

# SECTION 02622

# POLYVINYL CHLORIDE GRAVITY PIPE

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Providing and testing of pipe, pipe fittings and specials, jointing materials, and accessories, of various sizes, classes, joints and types, and appurtenant work, at the locations and to the lines and grades as indicated and/or as directed, complete in place, in accordance with the drawings and specifications.
  - 2. The pipe specified under this section shall include all gravity flow sanitary sewers.
- B. Related sections include the following:
  - 1. Section 02200 Earthwork
  - 2. Section 02601 Sewer Manholes

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Submit shop drawings or descriptive literature, or both, showing pipe dimensions, joints, joint gaskets, and other details for each size of pipe to be furnished for the project. All pipe furnished shall be manufactured only in accordance with the specifications and the drawings.

#### 1.4 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 and as specified.

# 1.5 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

## PART 2 - PRODUCTS

## 2.1 PIPE FITTINGS AND SPECIALS

- A. The polyvinyl chloride pipe and fittings, including those required for stubs, shall conform to ASTM Standard Specifications for Type PSM PVC Sewer Pipe and Fittings, Designation ASTM D3034, latest revision, for sizes 4"-15" and ASTM F679, latest revision, for sizes 18"-27". The pipe shall have a maximum pipe diameter to wall thickness ratio (SDR) of 35. The pipe shall be tested by the flat plate deflection method at a minimum of 45 psi at 5 percent deflection in accordance with ASTM D 2412. Standard laying lengths shall be either 13 feet or 20 feet.
- B. Specials, if required, shall conform to the Specifications for straight pipe insofar as applicable and to the details indicated on the Drawings or bound into the back of the Specifications.
- C. Insulation shall be manufactured by Thermal Pipe Systems, Braintree, Massachusetts, Atlas Insulation, Ayer, Massachusetts or Insulated Piping Systems Inc., Canton, Massachusetts, or other approved manufacturer. Insulation shall be factory foamed-in-place polyurethane foam insulation having nominal thickness of 3", with an in-place density of 2.5 pcf, and a "K" factor of 0.14 BTU/in./hr./°F/sq. ft. Straight joints between insulated pipe lengths, and the end sections of non-insulated pipe, shall be sealed with heat shrinkable wrap-around polyethylene as supplied by manufacturer and installed in field by contractor. Insulation jacket shall be PVC.

#### 2.2 JOINTS

A. Joints for the polyvinyl chloride pipe shall be push-on bell and spigot joints using elastomeric ring gaskets. The gaskets shall be securely fixed into place in the bells so that they cannot be dislodged during joint assembly. The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, as well as petroleum products (oil, gasoline, etc.) and groundwater, and which will endure permanently under the conditions of the proposed use. The joints shall conform to ASTM Standard Specifications for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals, Designation D3212.

#### 2.3 INSPECTION, TESTS AND ACCEPTANCE

A. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the above-mentioned ASTM
Specifications. In addition, the pipe shall be subject to thorough inspection and tests, the right being reserved for the Engineer to apply such tests as he deems necessary.

- B. All tests shall be made in accordance with the methods prescribed by the above mentioned ASTM Specifications, and the acceptance or rejection shall be based on the test results.
- C. The Contractor shall furnish all labor to assist the Engineer in inspecting the pipe. Pipe will be inspected upon delivery, and such as does not conform to the requirements of this contract shall be rejected and shall immediately be removed from the project site by the Contractor.

## 2.4 PREFABRICATED CUTOFF WALLS

A. Prefabricated cutoff walls, or trench dams, shall be constructed of Acryonitrile Butadiene Styrene (ABS), and shall have elastomeric PVC couplings to form a watertight seal around the outside of the pipe. Installed dams shall form an impenetrable barrier in the pipe envelope to the flow of water. Trench dams shall be Ripley's Dam as sold by Everett J. Prescott, Inc., McRip Manufacturing, or equal.

## PART 3 - EXECUTION

## 3.1 HANDLING PIPE

- A. Handle and store pipe in accordance with the manufacturer's recommendations and as stated herein.
- B. All pipe shall be stored at the site until installation in a manner which will keep the pipe at ambient outdoor temperatures. Temporary shading shall be provided as required to meet this requirement. Simply covering the pipe which allows temperature build-up when exposed to direct sunlight will not be permitted.
- C. Care shall be taken to avoid damaging the pipe and fittings.

## 3.2 INSTALLATION

- A. Each pipe unit shall be inspected before being installed. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement for straightness, it shall be rejected and removed from the site. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit at the Contractor's expense.
- B. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Crushed stone and shall be as specified in 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. Special care

shall be taken to hold the trench width at the crown of the pipe to the maximum width indicated in the Trench Detail on the Contract Drawings.

- D. All pipe and fittings shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the completed work.
- E. Pipe and fittings shall be installed to the lines and grades indicated on the Drawings. Care shall be taken to ensure true alignments and gradients.
- F. Before any joint is made, the previously installed unit shall be checked to assure that a close joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven 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 units together so that they will fit with minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends.
- H. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.
- 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 at no additional cost to the Owner.
- J. Details of gasket installation and joint assembly shall follow the directions of the manufacturers of the joint materials and of the pipe, all subject to review by the Engineer. The resulting joints shall be watertight and flexible.
- K. All premolded gasket joint polyvinyl chloride pipe of a particular manufacturer may be rejected if there are more than five unsatisfactory joint assembly operations or "bell breaks" in 100 consecutive joints, even though the pipe and joint conform to the appropriate ASTM Specifications as hereinbefore specified. If the pipe is unsatisfactory, as determined above, the Contractor shall, if required, remove all pipe of that manufacturer of the same shipment from the work and shall furnish pipe from another manufacturer which will conform to all of the requirements of these specifications. The cost of replacing the rejected pipe shall be paid by the Contractor and not the Owner.
- L. Open ends of pipe and branches shall be closed with polyvinyl chloride stoppers secured in place in an acceptable manner.
- M. After each pipe has been properly bedded, enough bedding material 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 bedding material and compacted, and then bedding material shall be

placed and compacted to complete the pipe bedding.

- N. The Contractor shall take all precautions to prevent flotation of the pipe in the trench.
- O. At all times pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs, or by other acceptable means.
- P. If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe.
- Q. Pipelines shall not be used as conductors for trench drainage during construction.

## 3.3 ALLOWABLE PIPE DEFLECTION

- A. Pipe provided under this Specification shall be so installed as to not exceed a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
- B. Upon completion of a section of pipe, including placement and compaction of backfill, the Contractor shall measure the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer, and be reviewed by the Engineer. The section of pipe must be placed and backfilled for a minimum of 90 days before the deflection can be measured.
- C. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem without additional compensation.

## 3.4 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 the pipeline and manholes being careful to prevent soil, water and debris from entering any existing pipe.

## 3.5 TESTING OF PIPE

A. The following schedule of pipe testing shall be completed, as indicated in the schedule:

Test Type	Frequency of Test	Specification
Deflection	Perform on sections of pipe that have	Paragraphs
Test	been installed and backfilled for a	3.3B & C

	minimum of 90 days.	
Air Pressure	Each manhole-to-manhole pipe segment	Paragraph 3.5 B
Test	installed and backfilled	

- B. Air Pressure Test
  - 1. After completing installation and backfill of pipe, the Contractor shall, at his expense, conduct a line acceptance test using low pressure air.
  - 2. Equipment used shall meet the following minimum requirements.
  - 3. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
  - 4. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
  - 5. All air used shall pass through a single control panel.
  - 6. Three individual hoses shall be used for the following connections.
    - a. From control panel to pneumatic plugs for inflation.
    - b. From control panel to sealed line for introducing the low pressure air.
    - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
  - 7. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to the manufacturer's recommended inflation pressure. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
  - 8. After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.
  - 9. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be

disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) is not less than the time shown for the given diameter in the following table.

Pipe Diameter	Time
Inches	Minutes
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

10. In areas where groundwater is known to exist, the Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10-inches long, through the manhole wall adjacent to one of the sewer lines entering the manhole. This shall be done at the time the line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same). In no case shall the starting pressure exceed 9.0 psig.

### 3.6 TEST FAILURE

A. If the section of pipe fails to pass the leakage and pressure test, the Contractor shall locate, uncover and repair or replace the defective pipe fitting or joint and retest all at his own expense. Pipe will be considered passing only when the

leakage does not exceed the above standard. Passing the test does not absolve the Contractor from his responsibility if leaks develop later within the period of warranty.

# 3.7 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

END OF SECTION 02622

#### SECTION 02623

## POLYVINYL CHLORIDE PRESSURE PIPE

### PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Providing and testing of 4-inch and 12-inch diameter SDR 21 Polyvinyl Chloride (PVC) pressure pipe, pipe fittings, mechanical restraints and specials, jointing material and accessories of various sizes, classes, joints and types, appurtenant work, and spare parts at the locations and to the lines and grades as indicated and/or as directed, complete in place in accordance with the drawings and specifications.
- B. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.3, below.
- C. Related sections include the following:
  - 1. Section 02200 Earthwork
  - 2. Section 02601 Sewer Manholes

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 Submittal Procedures:
  - 1. Submit shop drawing or descriptive literature, or both, showing pipe dimensions, joint material and dimensions, standards compliance and

other details for each type and class of pipe to be furnished for the project. All pipe furnished shall be manufactured only in accordance with the specifications and the drawings.

- 2. Submit shop drawings or descriptive literature, or both, of specials and spare parts to be furnished for the project. All materials furnished shall be manufactured in accordance with the specifications and the drawings.
- 3. Submit shop drawings or descriptive literature for all fittings, fitting adapters, gasket materials and restraint systems to be furnished for the project. All fittings and restraints shall be manufactured in accordance with the specifications and drawings.
- 4. Submit data on joint lubricants.
- 5. Submit pressure test description. Include proposed equipment to be utilized in the testing and experience of personnel who will conduct the testing. Upon completion of the testing, two copies of a written report of the tests and the results obtained shall be submitted to the Engineer.
- B. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

## 1.4 QUALITY ASSURANCE

A. Provide in accordance with Section 1400 and as specified.

## 1.5 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

#### PART 2 – PRODUCTS

#### 2.1 PVC FORCE MAIN

- A. The force main shall be SDR21 unplasticized polyvinyl chloride (PVC) pipe pressure rated 200 pounds per square inch (psi) with a long term 2.5 safety factor and having integral thickened wall bells and spigot joints. All PVC force main pipe shall meet steel pipe sizing (IPD) equivalent outside diameters in accordance with ASTM D2241.
- B. Each PVC pipe segment shall be marked with permanent ink the following: nominal pipe size, pressure rating, material, class, and manufacturer. The

pipe shall be furnished in standard 20 ft lengths. Sewer force main pipe shall be green in color and have words "Forced Sewer" or similar labeled on each pipe length. PVC force main pipe shall be as manufactured by JM Eagle or equal.

- C. The pipe shall meet the requirements of ASTM D 2241 "Standard Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series)." All pipe shall be made from PVC resin that meets or exceeds cell class 12454 as defined in ASTM D 1784.
- D. The pipe shall be suitable for sewer pressure pipe applications and have factory installed elastomeric gaskets which meet the requirements of ASTM F 477. The gaskets shall provide a tight seal that protects the line from shock and vibration, and compensates for expansion and contraction of pipe lengths.
- E. Elastomeric gaskets for PVC pipe and fittings shall meet the requirements of ASTM D3139, capable of withstanding a pH of 9.5, and shall be petroleum resistant. The elastomeric gasket shall provide a tight seal that protects the line from shock and vibration, and compensates for expansion and contraction of pipe lengths. The elastomeric gasket shall not support the growth of bacteria.
- F. A sustained hydrostatic pressure test shall be conducted on at least one pipe length per 300 lengths produced. The test shall be conducted in accordance with ASTM D2241 and continue for at least 1,000 hours. The pipe shall not balloon, burst or weep as defined in ASTM D1598 when tested at a sustained pressure of 420 psi applied for 1,000 hours as specified in ASTM D2241.
- G. The bell sections shall be at least a strong and hydrostatically acceptable as the pipe barrels and meet or exceed the requirements of Hydrostatic Test ASTM D 2241. The joints shall meet or exceed the requirements of ASTM D 3139 for joint tightness.
- H. Randomly selected samples shall be quick burst tested in accordance with ASTM D1599. The pipe shall withstand without failure a pressure of 630 psi applied in 60 to 70 seconds at 73°F.
- I. Drop Impact Test: The pipe shall withstand, without failure, using Tup B and Flat Plate Holder B, at 73F, an impact test of 160 ft/lbs per ASTM D2444.
- J. The inside surface of each length of pipe shall be free from nicks, scratches and other surface defects and blemishes. The pipe shall be homogeneous throughout free of any bubbles, voids or inclusions.
- K. Lubricant used for joint assembly shall be non-toxic, shall be suitable for sewer force main applications and shall have no deteriorating effect on gasket material

## 2.3 FITTINGS AND RESTRAINTS

- A. Fittings for PVC force main shall be Class 350 Ductile Iron manufactured in the United States in accordance with ANSI/AWWA C153/A21.53. Fittings shall be rated for 350 psi pressure. Fittings shall be provided with epoxy coating system per ANSI/AWWA C116/A21.16. The protective fusion-bonded epoxy coatings shall be utilized on all interior and exterior surfaces. Coatings shall be a minimum thickness of 4 mils in the joint area and 6-8 mils on the body castings.
- B. Nuts and bolts for mechanical joints shall be Corten or high strength steel per ANSI/AWWA C111/A21.11.
- C. Gaskets shall be elastomeric gaskets as specified for PVC pipe. Fittings shall be equipped with transition gaskets to allow for installation with IPS pipe specified in Paragraph 2.1.
- D. SDR 21 PVC push-on joints within 40-feet of the HDPE-to-main transition point shall be restrained with Series 6500 Bell Restraint Harnesses as manufactured by EBAA Iron. Restraints for ASTM D2241 pipe bells shall consist of restraints manufactured of ductile iron conforming to ASTM A536. Split-serrated rings shall be utilized behind the pipe bell. A split serrated ring shall grip the pipe and sufficient number of bolts shall be used to connect the bell ring to the gripping ring. The restraints shall be coated using MegaBond system utilizing a 2-coat thermoset heat cured epoxy protection system.
- E. PVC push-on joints shall be restrained within distances of fittings as specified in Section 3.2. Restraints shall be ductile iron retainers equal to Series 6500 as manufactured by EBAA Iron or equal. Retainers shall contain sufficient number of tie-bolts to restrain a minimum test pressure of 150 psi. Restraints shall be manufactured in the United States.
- F. Mechanical joint fittings shall be restrained with ductile iron components equal to Series 2000PV as manufactured by EBAA Iron or equal. The MJ restraints shall be suitable for use with IPS PVC pipe as specified in Paragraph 2.1.
- G. Restraints shall have an identification number consisting of the year, day, plant and shift cast into each gland body.
- H. The restraint devices shall be coated with a corrosion resistant material bonded to the restraint, wedge assemblies and related parts and be suitable for underground service. The coating shall be "MEGABOND" as manufactured by EBAA, Iron, Inc. or approved equal.

## 2.4 INSULATION (if needed)

- A. Insulation shall be manufactured by Thermal Pipe Systems, Braintree, Massachusetts, Atlas Insulation, Ayer, Massachusetts or Insulated Piping Systems Inc., Canton, Massachusetts, or other approved manufacturer. Insulation shall be factory foamed-in-place polyurethane foam insulation having nominal thickness of 2", with an in-place density of 2.5 pcf, and a "K" factor of 0.14 BTU/in./hr./°F/sq.ft. Straight joints between insulated pipe lengths, and the end sections of non-insulated pipe, shall be sealed with heat shrinkable wrap-around polyethylene as supplied by manufacturer and installed in field by contractor. Insulation jacket shall be 20-gauge corrugated aluminum preformed to be fastened with stainless steel screws and bands. Jacket shall have one layer of one mil. polyethylene film with a protective coat of 40-lb. virgin kraft paper to act as a moisture and galvanic corrosion barrier.
- B. Insulation shall be provided for force main installed with less than 5 feet of cover, or where indicated on the Drawings.

## PART 3 – EXECUTION

### 3.1 PIPE HANDLING

- A. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.
- B. Pipe stored on site shall be protected from direct sunlight and suitably ventilated.

## 3.2 ALIGNMENT AND PLACEMENT OF PIPE

- A. Stakeout of sewer work and setting of line and grade is the responsibility of the Contractor.
- B. Except where specifically identified on the Contract Drawings, the force main shall be installed on a continuous slope so that no "high points" exist which may result in entrapment of gases and so that no "low points" exist which may induce settlement of solids. Strict conformance to this requirement is expected and will be closely monitored by the Engineer.
- C. Jointing of PVC pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to insure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

- D. Mechanical joint restraints to be installed on IPS pipe shall have the spacers removed and screws replaced per the restraint manufacturer's instructions.
- E. All pipe joints shall be restrained within the minimum distances from fittings and valves per the recommendations of the manufacturer. The Table presented below provides a representative sampling of minimum distances based on the assumptions identified:

NOMINAL	FITTING	<b>RESTRAINT LENGTH FROM</b>
<u>SIZE</u>		FITTING OR VALVE
	Horizontal Bend	
	11-1/4° Bend	1-feet in each Direction
	22-1/2° Bend	2-feet in each Direction
	45° Bend	4-feet in each Direction
	90° Bends	10-feet in each Direction
	Vertical Offset	
4"	Upper 11-1/4° Bend	2-feet in each Direction
	Lower 11-1/4° Bend	1-foot in each Direction
	Upper 22-1/2° Bend	5-feet in each Direction
	Lower 22-1/2° Bend	2-feet in each Direction
	Upper 45° Bend	9-feet in each Direction
	Lower 45° Bend	3-feet in each Direction
	Horizontal Bend	
	11-1/4° Bend	3-feet in each Direction
	22-1/2° Bend	5-feet in each Direction
	45° Bend	9-feet in each Direction
	90° Bends	21-feet in each Direction
12"	Vertical Offset	
	Upper 11-1/4° Bend	5-feet in each Direction
	Lower 11-1/4° Bend	2-feet in each Direction
	Upper 22-1/2° Bend	10-feet in each Direction
	Lower 22-1/2° Bend	3-feet in each Direction
	Upper 45° Bend	19-feet in each Direction
	Lower 45° Bend	6-feet in each Direction
n/a	16"x16"x10" Tee	14-feet along the 10" Branch

- 1. Lengths shown are based on 100 psi test pressure, 5-foot bury, soil type GP, trench Type 3, and 2:1 safety factor. Changes in conditions will require revision in lengths.
- F. During backfilling operations, a brightly colored polyethylene tape manufactured specifically for warning and identification of buried utility lines shall be buried 2 feet below the ground surface along the entire length of the force main from the pumping station to the point of discharge. Tape shall be provided in rolls, 6-inches minimum width, color coded for intended service with warning and identification imprinted in bold black letters continuously and

repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED SEWAGE FORCE MAIN BELOW" or similar wording. Code and letter coloring shall be permanent, unaffected by moisture and other substances contained the trench backfill material.

#### 3.3 TESTING OF THE PVC FORCE MAIN

- A. Pressure and leakage tests will be made by the Contractor to determine that the PVC force main is structurally sound and free of excess leakage. Pipeline shall be subject to a hydrostatic test equal to 1.5 times the operating pressure. All equipment, materials and labor for testing shall be furnished by the Contractor.
- B. Once the pipeline section has been filled at normal pressure and all entrapped air removed from the line, the Contractor shall raise the pressure by a special pressure pump taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipeline. This pressure shall be checked for leaks by the Engineer. Measured rate of water leakage shall not exceed the allowable leakage specified herein.
- C. Allowable Leakage:
  - 1. Pump the main to specified test pressure. When pressure is reached, stop pump. If pressure drops 5 psi or more, start pump and measure the quantity of water required to maintain the specified pressure. Repeat this process as required.
  - 2. Ensure that pipe reach does not exceed the allowable leakage rate or exceeds the allowable hydrostatic variation specified in Paragraph 3.3B.
  - 3. Calculate allowable leakage with following formula:
    - Q = 0.0075 DLN where
    - Q = allowable leakage in gallons per hour
    - D = nominal diameter of pipe in inches

L = length of section tested in thousand feet N = square root of avg. test pressure in psi (N=10 for 100 psi test pressure)

- 4. Calculate allowable leakage separately for each diameter and add resulting allowable leakage rates to obtain total allowable leakage for entire reach.
- 5. Measure and record volume of water pumped into main to maintain test pressure. If actual volume exceeds the allowable, contractor shall stop test and initiate corrective measures.
- D. Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair same at his expense. Pipe shall be accepted only when leakage does not exceed above standard. Acceptance does not absolve the

Contractor from his responsibility if leaks develop later within the specified period of warranty.

E. Contractor shall prepare a written report of the test procedures utilized, names of test personnel and equipment used in the tests, test results and calculations. Two copies of the report shall be submitted to the Engineer upon completion of the testing work.

## 3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

END OF SECTION 02623

### SECTION 02647

### CONNECTING TO EXISTING WATER MAINS

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Connecting to existing mains.
- B. Related sections include the following:
  - 1. Section 02200 Earthwork
  - 2. Section 02600 Water Main and Appurtenances

### 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES.
  - 1. Submit shop drawings and manufacturer literature for sleeves, valves, couplings and piping to be used in connecting to existing mains.

#### PART 2 - PRODUCTS

#### 2.1 COUPLINGS - SLEEVES

A. Couplings and sleeves shall be as specified in Section 02600.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Verification of Conditions: The Contractor shall verify field conditions by test pits or other methods prior to construction.

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## 3.2 INSTALLATION

- A. The Contractor shall make all connections to the existing mains as indicated in the Contract Documents.
- B. The Contractor shall develop a program for the construction and putting into service of the new work subject to the approval of the Engineer. All work involving cutting into and connecting to the existing water mains shall be planned so as to interfere with operation of the existing facilities for the shortest possible time.
- C. The Contractor shall have all preparatory work done prior to making the connection and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation.
- D. The Contractor shall have no claim for additional compensation, by reason of delay or inconvenience, for adapting his operations to the requirements of the Owner.
- E. Under no circumstances shall any customer be without water for a period of more than 4 hours without prior written approval of the Owner
- F. The Owner does not guarantee a tight shut-off for existing local community water valves. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any damages be claimed because of water leaking through closed valves after dewatering is completed. It shall be the responsibility of the Contractor to provide the means to dewater the excavation if required when making connections.
- G. The Contractor shall be responsible for the following restrictions on shutdown of water mains:
  - 1. Valves to be operated only by the Water Department personnel.
  - 2. 24 hour advance notice for shutdown requests shall be given to the Water Department's Representative and Superintendent.

## 3.3 APPLICATION:

- A. Cut-ins:
  - 1. Cut-ins to existing mains shall be performed after approved disinfection and pressure test results have been obtained for the new mains.

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- 2. Cut-ins shall be accomplished with fittings or, if possible, pipe deflection.
- 3. Attachment to existing mains shall be accomplished with restrained mechanical joints, long body solid sleeve.

## 3.4 CLEANING

A. Contractor shall clean the existing main with wire brush and wash the pipe surface and the tapping sleeve and valve interior with 5% hypochlorite (bleach) solution.

## 3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

## END OF SECTION 02647

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#### SECTION 02675

### DISINFECTION OF WATER MAINS

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Disinfection of pipelines.
- B. Related sections include the following:
  - 1. Section 02615 Ductile Iron Pipe and Fittings.
  - 2. Section 02704 Pipeline Pressure and Leakage Testing.

#### 1.3 SYSTEM DESCRIPTION

- A. Disinfect all water main and appurtenances installed under this contract. Disinfection shall occur after successful pressure and leakage testing as specified in Section 02704 has been conducted.
- B. The location of main line and appurtenances are shown on the Drawings.
- C. Pipeline disinfection shall be performed in conjunction with the related work items of dewatering, testing, and discharge of chlorinated water, prior to placing newly installed water main in service. The Contractor's responsibility shall include, but not be limited to the following:
  - 1. Provision of the chlorine product for disinfection at the rate and dose specified shall be in accordance with AWWA standards.
  - 2. Provision of pipeline taps for dosing and testing of chlorinated water, as necessary.
  - 3. Furnishing, installation and removal of bulkheads required for testing.
  - 4. Labor and equipment necessary to dispense the dose chlorine at points and rates as directed by the Engineer.

- 5. Labor and equipment to operate newly installed mainline valves, air release valves, and blowoff valves as necessary and directed by the Engineer.
- 6. Labor and equipment to dechlorinate the treated water prior to discharge.
- D. The Contractor shall be responsible for disinfecting and putting into service new water mains which shall become the property of the Owner.
- E. Contractor shall be responsible for coordinating all activities with the Owner.

## 1.4 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTALS:
  - 1. One week prior to initiating disinfection work, the Contractor shall submit to the Engineer a written workplan describing fully his proposed work. The workplan shall include, but not be limited to, the following:
    - a. List of main segments by valve or station locations.
    - b. Description of the pipe diameter and lengths to be tested.
    - c. Full description of method to be used (slug or continuous feed) in disinfecting the mains.
    - d. Chlorine agent to be utilized.
    - e. Chlorine material safety data sheets.
    - f. Chlorine batching calculations to show required level of chlorine being added to the mains.
    - g. Flushing methods listing pipe diameter, length, flushing time calculations and location of flushing outlets.
    - h. Methods of measuring chlorine solution being added to the pipe and after it has been added.
    - i. Sample collection techniques.
    - j. Names of personnel who will be conducting the disinfecting and sampling.
    - k. Name of laboratory proposed to perform the tests.
    - 1. Dechlorination methods, including dechlorination agent and locations.
    - m. Backflow preventor data (model, size).
  - 2. Engineer shall review the Contractor's workplan. Workplan shall be revised and resubmitted as required by the Engineer.
  - 3. No disinfection work shall commence until Engineer approves the workplan.

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### 1.5 QUALITY ASSURANCE

A. Provide in accordance with Section 01400.

### 1.6 PROJECT/SITE CONDITIONS

- A. Contractor shall utilize water from the active water mains to perform disinfection work as specified.
- B. All water shall be discharged in accordance with local, state and federal regulations.

## 1.7 SEQUENCING AND SCHEDULING

- A. Coordinate operation of existing valves, timing and duration of shut-down of existing mains, and disinfecting, and re-energizing of the water main with the Engineer and where applicable with the Owner including notification of the following prior to the stated work:
  - 1. Valve Operations: Notify Engineer one (1) working day prior to stated work.
  - 2. Disinfecting: Notify Engineer three (3) working days prior to stated work.
  - 3. Notification shall include location of work, length and diameter of the pipe to be disinfected and other pertinent information.
  - 4. Contractor shall allow at least 24 hours for City approval to activate water mains after passing disinfection testing results are submitted.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Calcium hypochlorite shall conform to AWWA B300.
  - 1. Granules with 70 percent available chlorine.
- B. Liquid sodium hypochlorite shall conform to AWWA B300.
- C. Backflow preventer devices (reduced pressure devices), model to be State approved.

- D. Line purge dechlorinator with dechlorination tablets or other method acceptable to the Engineer. Dechlorinator shall have 2-1/2 inch NPT coupling and capacity flow rates of up to 1,600 GPM. Dechlorination tablets shall be ascorbic acid, sodium sulfite or sodium thiosulfate, capable of dechlorinating the flushed water. Dechlorinator shall be H<sub>2</sub>O Neutralizer as manufactured by Measurement Technologies, Inc., Redmond, WA (860-651-3368), Model LPD-250 as manufactured by Pollard Water, New Hyde Park, NY.
- E. Chlorine residual analyzer.

## PART 3 - EXECUTION

- 3.1 PREPARATION
  - A. General:
    - 1. Perform disinfection in accordance with AWWA C651.
    - 2. The Engineer will review disinfection procedure, designate dosage and will perform necessary water quality tests to verify that disinfection has been accomplished according to public health standards.
  - B. Flushing:
    - 1. If water of sufficient quantity and pressure is available, flushing as specified here and after should be performed:

Prior to chlorination, mains shall be properly flushed by the Contractor. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5 feet per second (approximately 900 GPM in a 12-inch main, 400 GPM in an 8-inch main, 220 GPM in a 6-inch main, and 30 GPM in a 2-inch main). Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1000-foot of main at the above flow rates).

- C. Discharge:
  - 1. Following disinfection, water with concentrations of chlorine shall be dechlorinated and discharged to the atmosphere.
    - a. The Contractor shall notify the Engineer and Owner of the specific location where chlorinated water will be discharged

at least three (3) days in advance of proposed discharge.

2. Water with high concentrations of chlorine (residual greater than 2 mg/l) shall be dechlorinated to a level of 2 PPM or less prior to its discharge. Dechlorination shall be conducted by use of a line purge dechlorinator or other method acceptable to the Engineer. Dechlorination shall be in accordance with the manufacturer's instructions and AWWA C651, Section 4.5.

## 3.2 INSTALLATION

- A. Calcium Hypochlorite:
  - 1. Use only as a solution.
  - 2. Pump into pipe with a suitable chemical feed pump.

### 3.3 APPLICATION

- A. Special Techniques:
  - 1. Disinfect pipes by the continuous feed.
    - a. Continuous feed method:
      - Operate all appurtenances to ensure that all hydrants, gate valves, and sample taps have been disinfected. Manipulate valves to prevent super chlorinated water from entering existing distribution system.
      - The City will operate all valves in the system. Contractor shall coordinate with Owner a minimum of 48 hours in advance to arrange for City personnel to operate valves.
      - 3) Perform pressure and leakage testing in accordance with specification 02704.
      - 4) Feed chlorine into pipe so water entering contains 25 mg/l of available chlorine.
      - 5) Apply chlorine continuously until entire pipe is filled with chlorine solution. All chlorination ports must be open before system gates are operated to ensure oneway flow.
      - 6) Retain treated water in pipe for at least 24 hours.
      - 7) Ensure that chlorine residual at end of test is at least

10 mg/l.

- 8) Coordinate a third-party testing agency to collect bacteriological samples after 24-hour hold period. Coordinate with a third-party testing agency to collect the second bacteriological sample after 48-hour hold period.
- 9) Provide all laboratory and pressure test results, and chain of custody documentation to Owner and Engineer under a submittal cover when results are available. Any failed test results must also be provided for review when available. Contractor shall not activate mains until final approval is received from the City of Somerville. Allow for 24 hours for City approval.
- 10) All corporations used for disinfection purposes shall be closed and plugged after disinfection is complete. All tubing shall be removed.
- 11) Activate water main
- 2. Ensure that appurtenances are fully disinfected.

## 3.4 FIELD QUALITY CONTROL

- A. Tests:
  - 1. Measure chlorine levels with meters or color-wheel. Paper pool strips are not acceptable methods for determining chlorine levels.
  - 2. Bacteriological test samples shall be collected by the Contractor after the chlorine solution has been flushed out of the pipe.
  - 3. Disinfection shall be repeated, as necessary, to produce satisfactory bacteriological samples.
  - 4. Twenty-four (24) hours after the main has been fully dechlorinated and flushed, bacteriological samples shall be taken. Water samples shall be taken from corporation stops along the length of the water main as designated by the Engineer. Samples shall be collected every 1,200 ft of new or rehabilitated water main, plus one set from each end of the line and at least one from each branch greater than one pipe length, each in duplicate, in sterile bottles and furnished to the Engineer or Owner for delivery to a State approved laboratory for analyses. Duplicate samples shall be collected a minimum of 15 minutes after

the original while the sampling taps are left running. The Contractor shall be responsible for all necessary work including delivery of samples to a certified laboratory and shall include the cost for sampling and analysis in his bid price.

- 5. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the Owner's system. The failure of any sample to pass the laboratory tests shall require the Contractor to re-flush and rechlorinate the mains and resample and test the water until acceptable results are obtained, all at no additional cost to the Owner.
- B. Activation:
  - 1. Upon receipt of satisfactory bacteria sample test results and successful pressure tests, Contractor shall notify Engineer. Copies of all test reports shall be given to the Engineer and Owner. Contractor shall not activate main until authorization from the owner is received.
  - 2. Contractor shall note that work under this Contract shall not be considered completed until satisfactory installation and testing of the water mains have been completed.
  - 3. All corporations installed for disinfection purposes shall be closed and plugged. All tubing shall be removed.

## 3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01701.

END OF SECTION 02675

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#### SECTION 02704

### WATER PIPELINE PRESSURE AND LEAKAGE TESTING

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Perform field hydrostatic pressure and leakage testing of pipes.
- B. Related section includes the following:
  - 1. Section 02600 Water Mains and Appurtenances

#### 1.3 DEFINITIONS

A. Make up water - Make up water is defined as total amount of water introduced into pipe during make up water test to maintain test pressure.

#### 1.4 SYSTEM DESCRIPTION

A. Pipe installed under Section 02600 shall be tested in accordance with the requirements of this section.

#### 1.5 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES:
  - 1. Testing schedule and test procedure.
    - a. Indicate proposed time and sequence of testing on schedule.
    - b. Indicated test procedure requirements as follows:
      - (1) Limits of each pipe tested.

- (2) Position of all valves during testing.
- (3) Location of temporary caps and plugs.
- (4) Other applicable procedures.
- (5) Equipment to be utilized.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Complete pressure and leakage testing of pipes prior to final cleaning and disinfection; Engineer shall be present during all testing.
  - 1. Coordinate with Owner and notify Engineer of time and place of testing at least 3 days prior to commencement of work.

#### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT

- A. Provide test equipment as follows:
  - 1. Piping connections between pipe tested and water source.
  - 2. Equipment, materials, and facilities required to perform specified tests including but not limited to the following:
    - a. Pumping equipment
    - b. Calibrated barrel
    - c. Pressure gauges
  - 3. Sectionalizing devices required including but not limited to the following:
    - a. Flanges
    - b. Valves
    - d. Bracing
    - e. Blocking

## PART 3 - EXECUTION

## 3.1 PREPARATION

A. Provide blocks, anchors, and supports for pipe before test pressure is applied.

## 3.2 INSTALLATION

- A. Water:
  - 1. Schedule filling of line through Owner and Engineer at least three (3) days in advance of testing.
  - 2. Do not allow water to enter other parts of the pipeline, not subject to testing, unless approved by the Engineer.
  - 3. Dispose of test water in a manner approved by the Engineer.
- B. Venting:
  - 1. Ensure that air release valves, hydrants, etc. and other venting devices are properly installed and placed in open position when filling pipe with water.
  - 2. Hydrants shall be utilized to allow air to escape.
  - 3. Do not close hand-operated vent valves until water flows in an uninterrupted stream from each valve.

## 3.3 APPLICATION

- A. Pressure Testing:
  - 1. All pipe and appurtenances installed shall be hydrostatically tested in accordance with ANSI/AWWA C600, latest version unless stated otherwise herein.
    - a. Test pressure, expressed in terms of feet of water, applied at any point in the pipe equals arithmetic difference between specified test pressure plane (gauge) elevation and elevation of horizontal center line of pipe at selected location.
    - b. Multiply value by 0.433 to obtain pounds per square inch.
    - c. Ensure pressure gauges are accurately calibrated.

- d. Do not attempt pressure testing until all air has been vented from the mains.
- 2. All new water mains which shall become the property of the Owner shall be pressure tested at 200 psi for a continuous period of two hours.
- B. Leakage/Make Up Water Testing:
  - 1. Conduct leakage testing in with the course of conducting pressure tests.
  - 2. Ensure that joints in piping are watertight and free from visible leaks during leakage test.
  - 3. Test Pressure make up water:
    - a. Maintain specified pressure for pressure testing of reach during leakage test.
    - b. Maintain hydrostatic pressure within plus or minus 5 percent during entire time of makeup water measurements.
  - 4. Make up Water Measurement:
    - a. Do not attempt measurement of make up water until trapped air has been vented and constant test pressure has been established.
    - b. Measure make up water by means of an approved calibrated barrel installed in the pressure piping on discharge of the pump.
      - (1) Ensure that barrel is accurately calibrated.
  - 5. Allowable Leakage:
    - a. Ensure that pipe reach does not exceed the allowable make up water rate.
    - b. Calculate allowable leakage with following formula:

Q = 0.0075 DLN where

- Q = allowable make up water in gallons per hour
- D = nominal diameter of pipe in inches

L = length of section tested in thousand feet (1000-foot maximum; 1,000 feet = value of 1 in formula)) N = square root of avg test pressure in psi (12.25 for 150 psi)

c. Calculate allowable make up water separately for each diameter and add resulting allowable leakage rates to obtain total allowable leakage for entire reach.

## 3.4 FIELD QUALITY CONTROL

- A. Inspection:
  - 1. Locate defective joints and pipe materials during pressure testing.
  - 2. Locate and repair leaking joints and other defective items of work to reduce pipe leakage to an amount acceptable to Engineer, or where applicable, the Owner's requirements.

## 3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

## END OF SECTION 02704

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#### SECTION 02761

#### BYPASS FLOW HANDLING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Bypass flow handling will be required for connection of the new force main from the 35 State Road pump station to the existing force main in Route 6.
- B. The existing White's Pump Station pumps at a rate of approximately 250 gpm. The White's Pump Station currently receives wastewater flow from White's of Westport (66 State Road), Hampton Inn Fall River/Westport (53 Old Bedford Road), TownePlace Suites by Marriott Westport (41 Old Bedford) and businesses at 35 State Road. The White's Pump Station pumps a maximum of approximately 44,000 GPD.
- C. This Section includes the following:
  - 1. Furnishing all plant, labor, equipment and materials, as well as performing all operations associated with handling bypass flows from the existing system around the work indicated on the Drawings in accordance with these Specifications.
  - 2. Maintaining flow from main pipelines without interruption of service and maintaining flow in lateral connections with minimal interruption of service.
  - 3. Performing the work in a sequence that is the least disruptive to vehicular and pedestrian traffic and in a manner that shall protect the public from damage to persons and property.
- D. Contractor shall design the bypass flow handling system.

#### 1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300– SUBMITTALS PROCEDURES.
  - 1. Shop drawings and/or manufacturer's descriptive literature indicating materials, equipment and methods to complete bypass flow handling operations.

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- 2. Work plan including the following items:
  - a. Location, configuration and routing of bypass flow handling pipes.
  - b. Staging area(s) for pumps and other equipment.
  - c. Upstream flow collection location and/or bulkheads.
  - d. Downstream discharge location.
  - e. Method of protecting structures that accept discharge flows.
  - f. Locations of individual bypass flow handling systems.
  - g. Sample notification of property owner service shutdown.
  - h. Traffic management plan.
  - i. Roadway, railroad, and/or cross-country crossing details including hose ramps or trench details.
  - j. Noise pollution abatement plan.
- 3. List of 24-hour emergency telephone numbers at which the Contractor may be reached.
- B. Contractor shall submit a Certificate of Design (refer to SECTION 01300 SUBMITTAL PROCEDURES) for the bypass flow handling system and shall be responsible for the design of the following system components:
  - 1. Pumps.
  - 2. Generators and power sources.
  - 3. Suction and discharge piping.
  - 4. Temporary pipe supports and anchoring.
  - 5. Pipe plugging and bulkheads.
  - 6. Noise control equipment.
  - 7. Calculation of average and maximum daily flows.
  - 8. Calculations of static lift, friction losses, flow velocity and flow rate.
  - 9. Systems testing and start-up.
  - 10. Maintenance of system for off-construction hours.
  - 11. Contingency plan and equipment for system failures.
- C. Contractor shall submit complete documentation of qualifications as specified herein.

#### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. The Contractor designing and installing the bypass flow handling system shall have completed at least five (5) projects of similar size and complexity as this project in the United States within the past three (3) years. Contractor may employ the services of a subcontractor that specializes in this work to fulfill this requirement.

C. Rejection of any subcontractor and/or manufacturer by the Engineer due to insufficient qualifications shall not be grounds for modifications to the Contract Documents such as change in scope, time of completion or contract amount.

### 1.5 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610.

#### PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. The bypass flow handling equipment shall be of sufficient size and material to convey existing flows from one access structure to at least the next access structure immediately downstream of the work without overflow, spillage or discharge to the surrounding environment.
- B. Contractor shall be fully equipped to operate and respond to any repair or replacement of the system (24 hours per day and 7 days per week) while the bypass flow handling system is in use.
- C. Contractor shall incorporate noise reduction equipment to minimize impact on the surrounding environment. Such measures shall include insulated enclosures, hospital grade silencers or mufflers, equipment modifications and/or special equipment to limit noise to eighty (80) dBA at seven (7) feet or sixty (60) dBA at the nearest residence or business.

## PART 3 – EXECUTION

#### 3.1 PREPARATIONS

- A. Contractor shall perform all work in accordance with municipal, state and federal requirements.
- B. Contractor shall obtain relevant permits required to perform work prior to the commencement of construction at no additional cost to the Owner.
- C. Prior to the commencement of construction, Contractor shall perform all possible preparatory work. The Contractor shall, at all times, conduct operations to interfere as little as possible with existing flows.
- D. Contractor shall verify flow conditions in the existing system prior to the commencement of construction. The Contractor shall have no claim for additional compensation by reason of delay or inconvenience in adapting its operations to the need for maintaining existing flows.
- E. Twice, prior to start-up of bypass flow handling system, Contractor shall notify, in writing, each property owner whose service shall be temporarily shut down within

BYPASS FLOW HANDLING 02761-3 seven (7) days prior to the shut down and twenty-four (24) hours prior to the shut down. Contractor shall prepare notifications in accordance with Owner's requirements.

### 3.2 GENERAL

- A. Contractor shall design the layout and routing of the bypass flow handling system to minimize disturbance to public and private land and to maintain access for pedestrians and traffic.
- B. The Contractor shall maintain traffic throughout the duration of bypass flow handling in accordance with the requirements of the "Manual on Uniform Traffic Control Devices", latest edition.
- C. If excavation is required across roadways, all work shall be performed in accordance with municipal and/or state requirements.
- D. Contractor shall furnish, install, maintain and operate all temporary facilities such as dams, pumping equipment, conduits and all other labor and equipment necessary to intercept the flow before it reaches points where it would interfere with the work.
- E. Contractor may utilize pipelines in an existing parallel system as an alternative to installing a full bypass flow handling system pending approval by the Engineer and the Owner. Contractor shall submit a Certificate of Design prior to utilizing the parallel system and shall restore the parallel system to pre-construction conditions upon completion of construction.
- F. Contractor shall design, furnish and install individual bypass flow handling systems for flowing lateral connections or high occupancy buildings.
- G. Upon completion of construction, the Contractor shall remove plugging and/or bulkheads in a manner that permits the existing flows to slowly return to preconstruction conditions and prevent surcharging, flooding or causing any other disturbances downstream.

#### 3.3 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

## END OF SECTION 02761

### SECTION 03300

### CAST-IN-PLACE CONCRETE

### PART 1 – GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes. Manhole base slabs, pipe and utility encasements, thrust blocks and wherever cast-in-place concrete is indicated.
- B. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.3, below.

## 1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 Submittal Procedures:
  - 1. Product Data: For each type of manufactured material and product indicated.
  - 2. Design Mixes: For each concrete mix.
  - 3. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement.
  - 4. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

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- a. Cementitious materials and aggregates.
- b. Form materials and form-release agents.
- c. Steel reinforcement and reinforcement accessories.
- d. Admixtures.
- e. Curing materials.
- f. Ready-mix concrete producer.
- g. Repair materials.
- h. All Waterstops
- i. Adhesives
- j. Non-shrink Grout
- B. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

### 1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Ready Mix Producer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Testing Agency Qualifications: Contractor shall employ a testing agency, acceptable to the Engineer and qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
  - 1. ACI 301, "Specification for Structural Concrete."
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 350, "Code requirements for Environmental Engineering Concrete Structures."

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### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01610 and as specified.
- B. Deliver, store, and handle steel reinforcement to prevent bending and damage.

### PART 2 – PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiberreinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

#### 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

### 2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

## 2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded.
- C. Water: Potable and complying with ASTM C 94.

## 2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

## 2.6 WATERSTOPS

- A. Hydrophilic Waterstops:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Greenstreak.
    - b. Meadows: W. R. Meadows, Inc.
    - c. Adeka
- B. Flexible PVC Waterstops:
  - 1. Embed in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
  - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Greenstreak.
- b. Meadows: W. R. Meadows, Inc.
- c. Vinylex Corporation.

### 2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. This product shall not be used as a substitutiom for curing compounds.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film.
- D. Water: Potable

### 2.8 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
  - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
  - 2. Fly ash shall not be used.
- B. Concrete mixes shall be designed for the classes indicated below and in accordance with the requirements indicated.

Design Mix Schedule					
Class	Specified Compressive Strength (psi)	Minimum Cement Content (lb/cy)	*Maximum Water/ Cementitious Ratio	% Air Entrainment	
А	4,000	565	0.50	5.5+/-1	
В	3,000	N/A	0.50	5.5+/-1	
С	2,000	N/A	0.76	N/A	

\* Total water in mix at time of mixing, including free water in aggregates.

1. Mix Classifications: The design mix classes indicated above shall be used as indicated on the Drawings and as follows:

Class A: Use in all areas, unless lower strength is indicated.

Class B: Wherever specifically indicated.

Class C – Wherever low strength concrete fill is indicated.

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- C. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement of 1" to 4".
- D. Admixtures: Subject to Engineer's approval, use admixtures according to manufacturer's written instructions.

# 2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

# 2.10 PIPE PENETRATION SEALING MATERIALS

- A. Mechanical seals shall be modular, adjustable, bolted, mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. Seals shall be rated by the manufacturer for 40 feet of head or 20 psig. Seal back side of all modular seal assemblies with backing rod and caulk.
- B. Caulking for PVC pipe shall be in accordance with pipe manufacturer's printed instructions. Sealant shall be a two part foamed silicone elastomer as manufactured by Dow Corning Co., product No. 3-6548 silicone R.T.V.; 3M brand fire barrier products caulk C.P. 25 and 3M brand putty 303; or Flame-Safe fire stop systems Fig. No. FS-500 by Thomas & Betts Corporation. Packing shall be a fire retardant pliable material, Fig. 310 by Sealtite Co., White Oakum W.S.-600 by American Manufacturing Co., or acceptable equivalent product. Sealant bead configuration, depth and width shall be in accordance with manufacturer's recommendations.
- C. Bonding compound shall be Sikadur Hi-Mod epoxy by Sika Corporation, equal by Euclid Chemical Corporation, Master Builders Company, or an acceptable equivalent product.

# 2.11 GROUT

A. Nonmetallic, nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time. Minimum compressive strength shall be 5,000 psi in 28 days.

## PART 3 – EXECUTION

# 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads. Tolerance limits shall be per ACI 117 and surface irregularities per ACI 347R.
- B. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
- C. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- D. Retighten forms and bracing before placing concrete, to prevent mortar leaks and maintain proper alignment.
- E. Coat contact surfaces of forms with form-release agent.

# 3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

## 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 72 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Clean and repair surfaces of forms to be reused in the Work.
- C. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
  - 1. At least 70 percent of 28-day design compressive strength.
  - 2. Determine compressive strength of in-place concrete by testing representative field cured test specimens according to ACI 301.
  - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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### 3.4 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

## 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain required concrete cover. Do not tack weld crossing reinforcing bars, unless indicated on the Drawings.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging and lap edges and ends of adjoining sheets at least one mesh spacing.
- 3.6 JOINTS
  - A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
  - B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
    - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
    - 2. Form using bulkhead forms with keys, unless otherwise indicated. Leave-in-Place bulkhead forms are prohibited.

#### 3.7 WATERSTOPS

- A. Do not begin installation until substrates have been properly prepared.
- B. Concrete surfaces must be clean and free of laitance, oil, dirt, paint or other foreign material.
- C. Concrete surfaces to receive waterstop material must be clean and free of contaminates or debris. Remove oils, curing agents, or sealers from the surfaces to be treated.

- D. Structural defects such as loose rock pockets and honeycombing should be routed out to sound concrete and repaired with crystalline waterstop grout per manufacturer's installation instructions.
- E. Follow manufacturer's recommended procedures for mixing, application and installation and curing of waterproofing products.

# 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved in writing by Engineer.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers to avoid could joints.
  - 1. Limit drop height of concrete off of chute to 60-inches (1500mm).
  - 2. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
- E. Cold-Weather Placement: Comply with ACI 306.1.
- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R.

## 3.9 FINISHING FORMED SURFACES

A. The finish of formed surfaces shall proceed concurrently with, or immediately after the repair of surface defects. The selection of finishes shall be as indicated in the table below.

<b>Concrete Finishes (Formed Surfaces)Location</b>	Finish	
Concrete surfaces not exposed to view	Rough-Formed Finish	
Concrete surfaces exposed to view.	Smooth-Formed Finish	

- B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched.
- C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of

seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

# 3.10 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water
    - b. Continuous water-fog spray
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.

## 3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas. Submit proposed methods of repair to Engineer for review and approval. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

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#### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall employ qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete, plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
  - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - 6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
  - 7. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days, two at 28 days, and one at 56 days.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

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- E. Test results shall be reported in writing via FAX or email to Engineer, Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day, 28-day and 56-day tests.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete, at no additional cost to the Owner, when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer. Petrographical analysis to determine water/cement ratio cement content, hydrated cement content, etc. shall be performed by the testing and inspection agency as directed by the Engineer when test results indicate requirements have not been met.

## 3.13 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700.

# END OF SECTION 03300

# SECTION 03410

## PRECAST STRUCTURAL CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Precast structural concrete required for the vaults as depicted on Contract Drawings.
  - 2. Frames and Covers: Cast-iron, as indicated or specified.
  - 3. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.4, below.
- B. Related Requirements:
  - 1. Section 02200 Earthwork.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.
- C. Shop Drawings:
  - 1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
  - 2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.

- 3. Indicate type, size, and length of welded connections by AWS standard symbols.
- 4. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
- 5. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.
- 6. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
- 7. Indicate relationship of precast structural concrete units to adjacent materials.
- 8. Indicate estimated camber for precast floor slabs with concrete toppings.
- 9. Indicate shim sizes and grouting sequence.
- 10. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and testing agency.
- B. Material Certificates: For the following:
  - 1. Cementitious materials.
  - 2. Reinforcing materials and prestressing tendons.
  - 3. Admixtures.
  - 4. Bearing pads.
  - 5. Insulation.
  - 6. Structural-steel shapes and hollow structural sections.
- C. Material Test Reports: For aggregates, by a qualified testing agency.
- D. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
  - 1. Designated as a PCI-certified plant as follows:
    - a. Group C, Category C1 Precast Concrete Products (no prestressed reinforcement) Category C2 Prestressed Hollowcore and Repetitively Produced Products Category C3 Prestressed Straight Strand Structural Members Category C4 Prestressed Deflected Strand Structural Members.
- B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Structural Systems.
- C. Installer Qualifications: An experienced precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project installed by erector in Structural Systems and who can produce an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual Standards and Guidelines for the Erection of Precast Concrete Products."
- D. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- E. Quality-Control Standard: For manufacturing procedures, testing requirements, and qualitycontrol recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
  - 2. AWS D1.4/D1.4M, "Structural Welding Code Reinforcing Steel."

#### 1.6 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

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- 1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
- 2. Place adequate dunnage of even thickness between each unit.
- 3. Place stored units so identification marks are clearly visible, and units can be inspected.
- C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- D. Lift and support units only at designated points indicated on Shop Drawings.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
  - 1. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318 (ACI 318M).
    - a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of minus 18 to plus 120 deg F (minus 10 to plus 67 deg C)
  - 2. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.
  - 3. Vehicular Impact Loads: Design spandrel beams acting as vehicular barriers for passenger cars to resist a single 6000-lbf (26.7-kN) load applied horizontally in any direction to the spandrel beam, with anchorages or attachments capable of transferring this load to the structure. Design spandrel beams assuming the load to act at a height of 18 or 27 inches (457 or 686 mm) above the floor or ramp surface, whichever is more severe, on an area not to exceed 1 sq. ft. (0.0929 sq. m).

## 2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
  - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

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# 2.3 REINFORCING MATERIALS.

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

## 2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type III, gray, unless otherwise indicated.
- B. Supplementary Cementitious Materials:
  - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
  - 2. Silica Fume: ASTM C1240, with optional chemical and physical requirement.
  - 3. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C33/C33M. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
  - 1. Submit test results of aggregate including petrographic report
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- E. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
  - 1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
  - 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
  - 7. Plasticizing Admixture: ASTM C1017/C1017M, Type I.
  - 8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
  - 9. Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.
- G. Bituminous Dampproofing Material
  - 1. No. 46-449 Heavy Duty Black made by Tnemec Company, Inc., North Kansas City, MO.
  - 2. No. 35-J-10 Hi-Build Bituminous Coating made by Valspar Corporation, Short Hills, NJ.

- 3. Bitumastic Super Service Black made by Kop-Coat Company, Inc., Pittsburgh, PA.
- 4. Or acceptable equivalent product.

# 2.5 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
  - 1. Use fly ash, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 75 percent.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C1218/C1218M.
- D. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
  - 2. Maximum Water-Cementitious Materials Ratio: 0.40.
- E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

## 2.6 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

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- B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
  - 1. Edge and Corner Treatment: Uniformly chamfered.

## 2.7 FABRICATION

- A. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- B. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- C. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
  - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
  - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
  - 3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
  - 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- D. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- E. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- G. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
  - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed

Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

- H. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
- I. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- K. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

## 2.8 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

# 2.9 COMMERCIAL FINISHES

A. Commercial Grade: Remove fins and protrusions larger than 1/8 inch (3 mm) and fill holes larger than 1/2 inch (13 mm). Rub or grind ragged edges. Faces must have true, welldefined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch (5 mm).

## 2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
  - 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C1610/C1610M, ASTM C1611/C1611M, ASTM C1621/C1621M, and ASTM C1712/C1712M.
  - 1. Test and inspect self-consolidating concrete according to PCI TR-6.

## PRECAST STRUCTURAL CONCRETE 03410 - 8

- C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.
- D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M.
  - 1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
  - 2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
  - 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
  - 4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:
    - a. Project identification name and number.
    - b. Date when tests were performed.
    - c. Name of precast concrete fabricator.
    - d. Name of concrete testing agency.
    - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

#### 2.11 FRAMES AND COVERS

- A. The Contractor shall furnish manhole frames and covers conforming to the details shown on the Drawings, or as specified in this Section, unless specifically called out on the Contract Drawings to use an alternate type of manhole frame and cover.
- B. Frames and covers shall be Cast Iron minimum Class 25 conforming to ASTM A48, and as follows:

- 1. Castings to be free from scale, lumps, blisters and sandholes.
- 2. Frames and covers shall be of cast iron with diamond cover surface design. Machine contact surfaces to prevent rocking.
- 3. Thoroughly clean and hammer inspect.
- 4. Covers for all sewer structures shall have the word "SEWER" cast upon them.
- 5. Frames shall have a 24-inch diameter free and clear opening, unless otherwise indicated.
- 6. Include frame and cover model numbers. Frames and covers shall be:
  - a. Model No. LB268-1, LeBaron Foundry, Inc., Brockton, MA.
  - b. Model No. R-1720, Neenah Foundry Co., Albany, NY.
  - c. Model No. 1104, Campbell Foundry Co., North Haven, CT.
  - d. Or approved equal.
- 7. Capable of withstanding AASHTO H-20 loading unless otherwise indicated or specified.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

## 3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
  - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.

- 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
- 3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
- 4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
  - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Field cutting of precast units is not permitted without approval of Architect.
- E. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
  - 1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
  - 2. Fill joints completely without seepage to other surfaces.
  - 3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
  - 4. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
  - 5. Keep grouted joints damp for not less than 24 hours after initial set.

## 3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

## 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Erection of precast structural concrete members.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.
- G. Prepare test and inspection reports.

## 3.5 REPAIRS

- A. Repair precast structural concrete units if permitted by Architect.
  - 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

## 3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
  - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
  - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

## END OF SECTION 03410

### SECTION 11100

### ELECTROMAGNETIC FLOW METER

### PART 1 – GENERAL

#### 1.1 SCOPE

A. This section describes the requirements for an electromagnetic flow meter and microprocessor-based signal converter. Under this item, the contractor shall furnish and install the magneter equipment and accessories as indicated on the plans and as herein specified.

#### 1.2 SUBMITTALS

- A. The following information shall be included in the submittal for this section:
  - 1. Data sheets and catalog literature for the magmeter and the microprocessor-based signal converter.
  - 2. Connection diagrams for equipment wiring.
  - 3. List of spare parts and optional equipment.

#### PART 2 – PRODUCTS

#### 2.1 ELECTROMAGNETIC FLOWMETER (MAGMETER)

- A. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter, type MAG 5000.
- B. Sensor:
  - 1. Operating principle: Utilizing Faraday's Law of Electromagnetic Induction, the flow of liquid through the sensor induces an electrical voltage that is proportional to the velocity of the flow.
  - 2. Construction:
    - a. The sensor flow tube shall be 304 stainless steel surrounded by two coils. Liner material shall be EPDM or NBR rubber.
      Measurement and grounding electrodes shall be Hastelloy C. Connecting flanges shall be carbon steel.
    - b. Installation: Meter shall be verified according to MI-001 for 0 diameter inlet and 0 diameter outlet installation.

- c. Operating Temp: -20 to  $+160^{\circ}$  F.
- d. Size: 1" to 88" diameter (see instrument schedule).
- e. Submergence: The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes.
- f. Signal converter: Type MAG 5000.
- g. Enclosure: NEMA 4X enclosure.
- h. Display: Background illumination with alphanumeric 3-line, 20character display to indicate flow rate, totalized values, settings, and faults.
- i. Power supply: 115/230 VAC or 11-24VDC.
- j. Operating temperature: -5 to +120 degrees F.
- k. Outputs: 0-20 mA or 4-20 mA into 800 ohms max. One relay rated at 42 VAC/2 A, 24 DC/1 A. Digital (frequency or pulse) for external display of flow rate or totalizer.
- l. Communications: HART.
- m. Sensor and signal converter performance:
  - 1) Flow Range: 1.5 fps to 33 fps for accuracies stated below.
  - 2) Accuracy: 0.4% of actual flow. Meter shall be verified according to MI-001 for 0 diameter inlet and 0 diameter outlet installation with accuracy of 1% of actual flow or better
- p. Separation: Maximum distance of 900 feet between signal converter and sensor without the use of any additional equipment.
- q. Bi-directional flow capabilities shall be standard
- r. Totalizer: Two eight-digit counters for forward, net, or reverse flow
- s. The electromagnetic flow meter shall be a Siemens Model MAG 5100 W flow sensor with a Siemens Model MAG 5000 signal converter, or equal. Insertion type flow meters will not be accepted.

- C. Spare Parts
  - 1. Spare parts for the equipment shall include the following, unless otherwise noted:
  - 2. One set of manufacturers recommended spare parts.
  - 3. Extra operation manuals as required.

## 2.2 OPERATOR FUNCTIONS

- A. Calibration
  - Each flow sensor shall be wet calibrated and all of the calibration information and factory settings matching the sensor shall be stored in an integrally mounted SENSORPROM® memory unit. The SENSORPROM® shall store sensor calibration data and signal converter settings for the lifetime of the product. At initial commissioning, the flowmeter commences measurement without any initial programming. Any customer specified settings are downloaded to the SENSORPROM®. Should the signal converter need to be replaced, the new signal converter will upload all previous settings and resume measurement without any need for reprogramming or rewiring.
  - 2. A certificate of calibration shall accompany each flow sensor.
- B. Signal Converter Function Details
  - 1. The following functions shall be provided:
    - a. All programming shall be accomplished through an integral keypad and all programming shall be protected by a user-defined password.
    - b. The signal converter shall be integrally mounted or remotely mounted using a remote-mount kit provided by the manufacturer.
    - c. The signal converter shall provide a 0/4-20 mA DC signal proportional to flow rate into 800 ohms max. Output selectable as unidirectional or bi-directional.
    - d. The relay shall be programmable as error indicator, limit alarm or pulsed output.
    - e. The signal converter system shall be equipped with an error and status log with 4 groups of information.
      - Information without a functional error involved.
      - Warnings which may cause malfunction in the application

- Permanent errors, which may cause malfunction in the application.
- Fatal error, which is essential for the operation of the flowmeter.
- f. A system error shall be indicated by a flashing icon on the display or activation of the relay when set as an error alarm.
- d. The first nine standing errors shall be stored in the error pending log. A corrected error is removed from the error pending log. A status log shall be provided to store the last 9 error messages received for 180 days regardless of correction.

### 2.3 **REVERIFICATION**

- A. External Verification
  - 1. Verification using a stand-alone Siemens SITRANS Verificator to measure a number of selected parameters in the flow sensor and signal converter, which affects the integrity of the flow measurement, shall be available through a factory verification service.
- B. Parameters
  - 1. Verification of the Flowmeter shall consist of the following test routines:
  - 2. Insulation test of the entire flowmeter system and cables.
  - 3. Test of sensor magnetic properties.
  - 4. Signal converter gain, linearity, and zero point tests.
  - 5. Digital output test.
  - 6. Analog output test.
- C. Certificate
  - 1. A certificate of verification shall be issued if the flowmeter passes all of the tests within 2% of the original factory test parameters.
- D. Internal Verification
  - 1. Verification using Siemens PDM software v9.2 or higher utilizing HART communication protocol to measure a number of selected parameters in the flow sensor and signal converter, which affects the integrity of the flow measurement, shall be available.

- E. Certificate
  - 1. A certificate of verification shall be issued if the flowmeter passes all of the tests within the original factory test parameters.

### PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Follow manufacturer's recommendation for the minimum upstream and downstream installation requirements for the flow sensor.
- B. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures as per the manufacturers' recommendations.

### 3.2 MANUFACTURER'S OR SYSTEM INTEGRATOR'S FIELD SERVICES

- A. Installation Include 1/4 day for each flow meters (2 separate trips) for a manufacturer authorized service representative to verify proper mounting of the equipment, including mounting technique, mounting surface, and functional location.
- B. Final Acceptance Include 1/2 day for each flow meters (1 trip) for a manufacturer authorized service representative to test equipment to demonstrate that the transmitter and transducer has been properly installed, properly calibrated, and is functioning as specified.
- C. Training Provide two 1/4 days of instruction (separate days) to be conducted at the project site with a manufacturer's representative. Notify the Engineer and Owner in writing a minimum of two weeks in advance. Training shall include calibration, troubleshooting, and maintenance.

### 3.3 CERTIFICATION OF TESTING

- A. Unless waived in writing by the Engineer, all tests shall be made in the presence of a duly authorized representative of the Owner. When the presence of such representative is so waived, certified results of the tests made and the results thereof shall be furnished by the Contractor.
- B. All tests shall be performed in the presence of the Owner. Written notice of all tests shall be given the Owner at least two weeks in advance.
- C. Final Acceptance Manufacturer's representative shall be at the project site as specified above to verify that the equipment meets the specification requirements per this section.

## 3.3 MANUFACTURER'S ASSISTANCE

### A. Warranty

- 1. The manufacturer of the electromagnetic flow meter shall guarantee for 18 months of operation that the equipment shall be free from defects in design, workmanship, or materials from the date of acceptance. See Section 01740 for additional requirements.
- 2. In the event a component fails to perform as specified, or is proven defective in service during the guarantee period, the manufacturer shall promptly repair or replace the defective part at no cost to the owner.

## END OF SECTION 11100
# SECTION 11306

# PREFABRICATED PUMP STATIONS

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including The Agreement and Division 1 Specification sections, apply to work of this section.
- B. The following sections also contain additional requirements that relate to this section:
  - 1. Division 1 General Requirements
  - 2. Division 2 Site Construction
  - 3. Division 3 Concrete
  - 4. Division 16 Electrical Work
- C. This project is being funded (in part or entirely) by the Clean Water State Revolving Fund (CWSRF) program, and therefore, has statutory requirements commonly known as "American Iron and Steel," or AIS. All iron and steel equipment and materials on this project may be subject to these requirements. Contractor and manufacturer shall be aware of the AIS requirements and shall submit evidence of compliance with these requirements, as stated in Section 1.5, below.

### 1.2 REFERENCES

- A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.
  - 1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)
    - a. ANSI B16.1 Cast iron pipe flanges and flanged fittings.
    - b. ANSI C104/A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
    - c. ANSI C110 Ductile-Iron and Gray-Iron Fittings
    - d. ANSI/AWWA C115/A21.51Cast/ductile iron pipe with threaded flanges.

- e. ANSI 253.1 Safety Color Code for Marking Physical Hazards.
- f. ANSI B40.1 Gages, Pressure and Vacuum.
- g. AWWA C508 Single Swing Check Valves.
- 2. American Society for Testing and Materials (ASTM)
  - a. ASTM A48 Gray Iron Castings.
  - b. ASTM A126 Valves, Flanges, and Pipe Fittings.
  - c. ASTM A185 Welded Steel Wire Fabric for Concrete Reinforcement
  - d. ASTM A307 Carbon Steel Bolts and Studs.
  - e. ASTM A36 Structural Steel.
  - f. ASTM A615 Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
  - g. ASTM C150 Portland Cement
  - h. ASTM C33 Concrete Aggregates
  - i. ASTM D429 Test Methods for Rubber Property Adhesion to Rigid Substrates
- 3. Institute of Electrical and Electronics Engineers (IEEE)
  - a. ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.
  - b. ANSI/IEEE Std 112 Test Procedure for Polyphase Induction
  - c. IEEE Std 242 Protection of Industrial and Control Power Systems.
- 4. National Fire Protection Association / National Electrical Manufacturers Assoc. (NEMA)
  - a. NFPA 70 National Electrical Code.b. NEMA Std MG1 Motors and Generators.
- 5. Miscellaneous References
  - a. Ten-State Standards Recommended Standards for Sewage Works.
  - b. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
  - c. NMTBA and JIC Std National Machine Tool Builders Association and Joint Industrial Council Standards
  - d. ISO 9001 International Organization for Standardization.
  - e. ISO 14001 International Organization for Standardization.
  - f. AASTHTO M-198 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

## 1.3 PROCUREMENT

- A. All prefabricated pump stations shall be provided by Smith & Loveless Inc. of Lenexa, Kansas, USA. No other pump manufacturers will be considered or allowed.
  - 1. Refer to the attachment at the end of this specification for the quotes from Smith & Loveless Inc. for the pump station, including testing and appurtenances.
  - Contractor shall obtain and provide copies of the actual invoices from Smith & Loveless to the Owner. Should the Contractor negotiate or otherwise acquire a reduction in the pricing identified, fifty percent (50%) of the differential will be refunded to the Owner.
- B. Pump station alarm(s) shall be transmitted via cellular radio telemetry using a Mission Communications RTU Model MyDro 150 or equal The MyDro 150 shall have an onboard interactive display and enhanced electronics. Each remote terminal unit (RTU) shall include all necessary hardware for a complete installation including a cellular radio, enclosure, backup battery, transformer, and an antenna with a cable and mounting hardware.
- C. Work under this section includes design, fabricate, install, adjust and test a factory-built, pre-assembled, pre-wired and pre-tested sewage lift station. Station shall be complete with all equipment specified herein; factory assembled in a steel enclosure.
- D. An automatic pumping station shall include all needed equipment, factory installed in a rectangular, dual compartment welded steel chamber consisting of a separate entrance to the wet well and an equipment chamber. The equipment chamber shall have two (2) separate fiberglass covers.
- E. The principal items of equipment shall include two vertical, close coupled, motor driven, vacuum primed, non-clog pumps; valves; internal piping; central three-phase power and control panel with circuit breakers, motor circuit protectors, motor starters, automatic digital pumping level controls, color touch screen HMI and auxiliaries; submersible level transducer; 24V control power transformer; lighting; sump pump; ventilating blower; priming pumps with pump prime detection system and appurtenances; and all internal wiring. The pumping station shall include, , vacuum pump exhaust and an air exhaust stack, dehumidifier, ventilation blower, ladder with safety extension, storage shelves, a complete array of control options including relays and programmable logic.
- F. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 PRODUCTS of this section.
- G. Station shall include all materials and equipment necessary for continued, uninterrupted operation.

- H. Station shall include the ability to be isolated and bypassed from outside the pump station, as shown on the Drawings.
- I. Station shall transmit alarm condition(s) via cellular radio system.
- J. The pumping station shall be assembled, tested and certified at the factory by the manufacturer then disassembled for shipment and delivered to the site.
- K. The pumping station manufacturer shall provide factory trained, qualified personnel to reassemble the pumping station in the field, if necessary.
- L. Manufacturer shall perform in-field station testing, start-up and training for permanent operators and staff.
- M. Manufacturer shall furnish all recommended spare parts, Operation and Maintenance Manuals for all supplied equipment, and all project testing documentation in comprehensive package to the owner if available.

## 1.4 DESIGN CRITERIA

- A. Pump must be designed to handle raw, unscreened, domestic sanitary sewage. The Pump Station located at 35 State Road and 287-291 State Road are in the Base Bid, the Pump Station located at 833 State Road is in Bid Alternate A, and the Pump Station located at 1115 State Road is in Bid Alternate B.
- B. The Prefabricated Pump Stations shall be designed to meet the following criteria.

Prefabricated Pump Station Design Criteria		
Parameter	Value	
<b>Operating Condition</b>	At Start-Up	
Pump Station Location	35 State Road	
Application	Raw Unscreened Domestic Sewage	
Pump Quantity	2	
Preferred Pump Station Manufacturer	Smith & Loveless	
Pump Station Model	R <sup>2</sup> WWMPS	
Pump Model	4B2X*1	
Suction Connection Size (inches)	6	
Discharge Connection Size (inches)	6	
Static Reprime Lift (ft)	13.44	
Pump capacity (gpm)	265	
TDH (feet)	84	
Pump Speed (rpm)	1760	
Brake Horsepower	10.8	
Pump Impeller Diameter (inches)	9-3/4	
Speed Control	None (Constant Speed)	
Primary Level System	Pressure Transducer	
Backup Level System	Floats	

Prefabricated Pump Station Design Criteria	
Parameter Value	
<b>Operating Condition</b>	At Start-Up
Motor Horsepower	15
Motor Voltage	230 volts / 3 phase
Available Power	3 phase

Prefabricated Pump Station Design Criteria		
Parameter	Value	
Operating Condition	At Start-Up	
Pump Station Location	287-291 State Road	
Application	Raw Unscreened Domestic Sewage	
Pump Quantity	2	
Preferred Pump Station Manufacturer	Smith & Loveless	
Pump Station Model	R <sup>2</sup> WWMPS	
Pump Model	4B3X	
Suction Connection Size (inches)	4	
Discharge Connection Size (inches)	4	
Static Reprime Lift (ft)	7	
Pump capacity (gpm)	125	
TDH (feet)	44	
Pump Speed (rpm)	1170	
Brake Horsepower	5.9	
Pump Impeller Diameter (inches)	7 - 1/2	
Speed Control	None (Constant Speed)	
Primary Level System	Pressure Transducer	
Backup Level System	Floats	
Motor Horsepower	5	
Motor Voltage	230 volts / 3 phase	
Available Power	3 phase	

Prefabricated Pump Station Design Criteria		
Parameter	Value	
<b>Operating Condition</b>	At Start-Up	
Pump Station Location	833 State Road	
Application	Raw Unscreened Domestic Sewage	
Pump Quantity	2	
Preferred Pump Station Manufacturer	Smith & Loveless	
Pump Station Model	R <sup>2</sup> WWMPS	
Pump Model	6D3B*1	
Suction Connection Size (inches)	12	
Discharge Connection Size (inches)	8	
Static Reprime Lift (ft)	10.55	
Pump capacity (gpm)	950	
TDH (feet)	120	

Prefabricated Pump Station Design Criteria	
Parameter	Value
<b>Operating Condition</b>	At Start-Up
Pump Speed (rpm)	1760
Brake Horsepower	40.4
Pump Impeller Diameter (inches)	11 - 5/8
Speed Control	RVSS
Primary Level System	Pressure Transducer
Backup Level System	Floats
Motor Horsepower	50
Motor Voltage	230 volts / 3 phase
Available Power	3 phase

Prefabricated Pump Station Design Criteria		
Parameter	Value	
<b>Operating Condition</b>	At Start-Up	
Pump Station Location	1115 State Road	
Application	Raw Unscreened Domestic Sewage	
Pump Quantity	2	
Preferred Pump Station Manufacturer	Smith & Loveless	
Pump Station Model	R <sup>2</sup> WWMPS	
Pump Model	4B2X*1	
Suction Connection Size (inches)	8	
Discharge Connection Size (inches)	6	
Static Reprime Lift (ft)	14.64	
Pump capacity (gpm)	470	
TDH (feet)	52	
Pump Speed (rpm)	1760	
Brake Horsepower	8.4	
Pump Impeller Diameter (inches)	8 - 1/8	
Speed Control	None (Constant Speed)	
Primary Level System	Pressure Transducer	
Backup Level System	Floats	
Motor Horsepower	10	
Motor Voltage	230 volts / 3 phase	
Available Power	3 phase	

C. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

## 1.5 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTAL PROCEDURES:

- 1. Shop Drawings: Include design details for installation of the specified equipment, including the following:
  - a. Shop drawings illustrating construction details and dimensions. Shop drawings shall provide layout of the wet well, top slab, pump station enclosure, mechanical equipment, anchor bolt locations for station, and the arrangement of the station bypass piping and isolation valve(s). Pipe penetrations and station access clearances shall be dimensioned relative to the station centerline. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.
  - b. Catalog cut sheets reflecting characteristics for major items of equipment, materials of construction, and motor data.
  - c. Pump manufacturer's certified performance curves showing specified conditions (capacity in gpm, and TDH in feet), net positive suction head required (NPSHr), hydraulic brake horsepower and efficiency. Certified performance curves shall be based on actual shop tests of each pumping unit.
  - d. Buoyancy calculations demonstrating that the pump station resists flotation assuming the groundwater level is three feet above finished grade and the station is empty.
  - e. Certified results of hydrostatic testing.
  - f. Certified results of dynamic balancing.
  - g. Electrical ladder logic drawings.
  - h. Instrumentation Schematic showing inputs and outputs
- B. Submit color card identifying the available colors for the pump station enclosure. Submittal shall indicate if any cost upcharges or fabrication schedule impacts are associated with any particular color choice option.
- C. Submit qualifications for the Service Engineer summarized in Section 1.8A.2 of this Specification.
- D. Operating and Maintenance Manuals: Submit the following in accordance with Section 01300 SUBMITTAL PROCEDURES and Section 01730 OPERATION AND MAINTENANCE DATA:
  - 1. Submit materials for inclusion in Operating and Maintenance Manuals specified in Division 1. Include manufacturer's instructions for equipment installation, start-up, operation, preventative maintenance, servicing, and troubleshooting procedures. Include parts list for maintenance and servicing.
  - 2. In addition to the normal Operation and Maintenance Manuals required by contract, manufacturer shall provide a spare manual (marked preliminary if that is the case) to allow for proper installation

and operation prior to release of final Operation and Maintenance Manuals to the end user.

- E. Contract Closeout Submittals: Service records for repairs performed during construction.
- F. Submit a Manufacturer's Certification letter, on company letterhead and signed by an authorized representative, which certifies that the products and materials furnished for this project are in full compliance with the American Iron and Steel (AIS) requirements. A sample certification letter is provided in Section 00800 of these Specifications.

## 1.6 QUALITY ASSURANCE

- A. The pumps and pump station manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.
- B. Pump Performance Certifications
  - 1. All internal passages and impeller vanes shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.
  - 2. Prime Performance
    - a. A vacuum priming system shall be furnished to prime the main pumps. The system shall be as shown on the vacuum priming schematic and shall include two vacuum pumps, providing 100 percent standby. Vacuum pumps shall have corrosion-resistant internal components. The vacuum priming system shall be complete with large port vacuum control solenoid valves, prime level sensor, float-operated check valves to protect the vacuum pumps and all necessary shut-off valves as shown on the piping schematic. The float-operated check valves shall have a transparent body for visual inspection. All hoses and tubing used in the priming system shall be at least 3/8" nominal diameter. The air discharged from the vacuum pumps shall be piped into the wet well.
    - b. The solenoid valves used in the vacuum priming system shall be of the high flow, direct acting brass body type, with threaded ports, NBR seals and 300 Series stainless steel plunger, rod, plate, and springs. The minimum orifice diameter shall be 5/16". The solenoid valves shall be UL

Listed, with Class F coil rating and of suitable voltage and thermal capacity for the application.

- c. Liquid level in the pump priming chamber shall be monitored by a liquid level sensing probe incorporating frequency spectrum technology to evaluate the media with which it is in contact at several measurement points. At each measurement point the sensor shall take readings. Using a multi-variable sensing technology, collected over a spectrum sweep, the sensor shall create an outline of the medium, its residue and absence of medium. From these reference points the sensor shall be able to accurately determine the presence or absence of liquid, unaffected by foam, residue, or deposits. The liquid level sensor algorithm shall provide prime status in less than 100 milliseconds.
- d. Systems utilizing an electrode, mechanical means such as a float or protrusions into the pump, which may become fouled due to bridging or wrapping, or that require any type of electrical or moving parts inside the priming chamber, which may accumulate debris, short out, bind or fail will not be acceptable. Single or double medium sensing probes will be unacceptable.
- e. The level sensing probe shall be provided with light emitting diodes. This diagnostic tool shall indicate connectivity, prime status or a fault condition. The probe shall be complete sealed and have a 316L stainless steel housing for corrosion resistance. It shall be provided with a wiring connector of molded thermoplastic for impact and chemical resistance. The probe shall have a threaded electrical connector to facilitate easy removal.
- f. The priming system shall automatically provide positive lubrication of the mechanical seal each time a main pump is primed. To prevent excessive stoppage due to grease accumulation, no passageway in the priming system through which the pumped liquid must pass shall be smaller than the equivalent of a 2-1/2" opening.
- g. The vacuum priming system shall have two field selectable modes of operation. In the "On-Demand" mode, the priming system will operate only after a pump is called on to run, and if it is not primed. Once primed, the pump will be allowed to run. In the "Constant Prime" mode, both pumps are kept primed continuously, and ready to start immediately when called for.

- C. Factory System Test
  - 1. All internal components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall simulate actual performance anticipated for the complete station.
  - 2. Upon request from the engineer, the operational test may be witnessed by the engineer, and/or representatives of his choice, at the manufacturer's facility. All costs associated with travel and related expenses shall be paid by the Contractor.
- D. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

# 1.7 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01610, as specified. In addition, prepare and protect pump station for shipment as follows:
  - 1. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
  - 2. While shipping, mount equipment on padded cradles if shipped horizontally or on a suitable skid if shipped vertically.
  - 3. All fittings should be protected with suitable closure caps.
  - 4. Provide either rigid plugs inside ends to prevent deflection or wooden boxes for unflanged components.
  - 5. Do not ship components or other pieces loose inside pump station structure.
  - 6. Load pump station structure with at least 2 inches of clearance between bed of vehicle.
  - 7. Regardless of mode of transportation, firmly fasten and pad components to prevent shifting of load or flexing of components while in transit.
  - 8. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

- 9. Deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.
- B. Receiving
  - 1. Assume responsibility for equipment, material and spare parts just before unloading from carrier at site.
  - 2. Inspect and inventory items upon delivery to site.
  - 3. Unload, haul, and store items.
  - 4. Store and safeguard equipment, material and spare parts in accordance with manufacturer's recommendations.
  - 5. Store and safeguard equipment, materials and spare parts in accordance with manufacturer's recommendations

# 1.8 MANUFACTURER SERVICES

- A. Manufacturer Services
  - 1. Contractor shall coordinate the work schedule of the manufacturer's service personnel during construction, testing, start-up and acceptance.
  - 2. Provide services of a factory trained Service Engineer, specifically trained on the type of equipment specified. Submit qualifications of Service Engineer for approval. One man-day is an 8-hour day on-site. The minimum man-day requirements specified are exclusive of travel time and do not relieve Contractor of his obligation to provide sufficient service to place equipment in satisfactory operation and in accordance with the Manufacturer's instructions and warranty requirements. All man-days not used during the project shall be credited back to the Owner.
  - 3. Minimum Man-Day Requirements (assume separate visits required for each work phase):
    - a. Start-up, testing and calibration: 2 man-days
    - b. Operation and maintenance instruction: 1 man-day
  - 4. The Service Engineer field inspection shall be performed after equipment installation and pump testing.
  - 5. Independent Sales Representatives shall not be considered as substitutes for Shop Inspectors.
- 1.9 WARRANTY

- A. The equipment shall be warranted for a period of sixty (60) months from Engineer's letter of substantial completion, to be free from defects in workmanship, design or material. If the equipment should fail during the warranty period due to a defective part(s), it shall be replaced and the unit(s) restored to service at no expense to the Owner. See Section 01740 for additional warranty provisions.
- B. This warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with the warranties made under the general warranty requirements of Contract Documents.
- C. Time and materials used to correct defective equipment shall be provided at no additional cost to Owner and in addition to time periods specified above.
- D. The pump station manufacturer shall be responsible for the satisfactory operation of the entire pump station system.
- E. Warranties or guarantees by suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted.

# PART 2 – PRODUCTS

## 2.1 MANUFACTURER

A. Prefabricated pump station shall be manufactured by the Smith & Loveless Inc.

## 2.2 UNITARY RESPONSIBILITY

- A. Unless identified otherwise, in order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer.
- B. The following components of the pump station system, may be provided by a manufacturer that is not the pump station manufacturer. It is ultimately the responsibility of the Contractor to ensure that the pump station system components are designed together and will function as a single system. This responsibility and understanding shall be reflected by the Contractor through the Shop Drawing process:
  - 1. Pre-cast wet well;
  - 2. wet well cover / pump station concrete slab;
  - 3. pump station bypass system;

- 4. pump suction and discharge piping not in pump station manufacturer's scope of supply; and
- 5. cellular radio telemetry for alarm condition(s).

# 2.3 SERVICE CONDITIONS

- A. Service conditions shall be as follows:
  - 1. Pump station shall be designed to adequately and safely support all live and dead loads to which the structures will be subjected, and to withstand all reasonable conditions which may be encountered on the sites including typical seasonal weather seen in Westport, MA.
  - 2. Design calculations shall verify that the structures have been designed to withstand the burial and submergence anticipated for the station. The station structures shall have adequate wall, floor and roof thickness and steel reinforcement sufficient for the depth at finished surface elevation, as shown on the Drawings.
  - 3. The structures shall be designed to satisfactorily withstand uplift pressures with a minimum safety factor of 1.15.
  - 4. Roof slab/ceiling slab designs shall account for the loads imposed on the slab by the weight of pump station or other equipment that will be lifted from their positions for maintenance purposes by lifting hooks or other hoisting equipment installed in the slab.
  - 5. All designs shall be in accordance with applicable state building code standards.

# 2.4 PRE-CAST WET WELL STRUCTURE

- A. The pump station wet well shall be precast concrete, minimum 4000 psi compressive strength, with an inside diameter as indicated on the Drawings. The wet well shall be installed with steps. Base floor shall be integrally cast with the wall, for a minimum 4-foot section. Structure surfaces shall be pargeted with non-shrink non-metallic grout where wall joints, lift holes, or imperfections may exist. Horizontal joints shall be sealed with a double roll of mastic joint sealant such as Kent Seal No. 2, or equal. The wet well barrel sections and top slab shall be capable of sustaining AASHO H20 wheel loads, or 150 pounds per square foot live load, whichever is greater. All exterior wet well surfaces shall be bituminous coated.
- C. Penetrations: All wall penetrations shall be cored openings, sealed with Core-N-Seal joint sleeves, or equal, and the annular space filled with non-shrink, non-metallic grout.
- D. Metal Appurtenances: All metal appurtenances inside and outside the wet well

shall be stainless steel or aluminum, unless otherwise noted. Any aluminum in contact with a concrete surface shall be coated with bitumastic compound. No iron, carbon steel or galvanized parts shall be accepted, unless explicitly defined in these specifications.

- E. Access Manhole Frame and Cover: The cast iron frames and covers shall be standard frame and cover as specified in Section 02601 and as shown on the Drawings.
- F. Electrical Junctions: No electrical junctions, junction boxes or connections of any type shall be permitted inside the wet well. All junctions shall be made outside the wet well structure.
- G. Cable and Instrument Brackets: Any cable and instrument brackets required by the pump station manufacturer shall be provided with the pre-cast structure, and coordinated through the shop drawings. Brackets shall be stainless steel, or aluminum constructed to hold cables and instruments securely in place. Holder shall be capable of manual adjustment, to allow changing sensor elevation.

# 2.5 STATION ENCLOSURES

- A. The station shall be constructed in one complete factory built assembly. It shall be sized to rest on the top of the wet well as detailed in the construction drawings. The supporting floor shall be minimum 1/2" thick steel to prevent deflection and ensure an absolutely rigid support. The shell shall be of 1/4" minimum thickness steel plate formed and welded to create a minimum 6'-3" by 8'-0" equipment chamber with a minimum inside height of 6'-7" and a separate 3'-0" by 2'-1" manway for access to the wet well. All internal clearances shall meet or exceed N.E.C. requirements. Stations not meeting NEC requirements shall not be allowed. Steel plate shall meet or exceed ASTM A 36 specifications.
- B. The pump casings and discharge piping shall be mounted in relation to the station floor as detailed in the construction drawings. All valves, piping and fittings shall be capable of passing a 3" diameter spherical solid. All pump components and station piping, including the suction pipe connections, shall be removable without having to enter the wet well. The suction and discharge connections, where they pass through the floor, shall be sealed by gaskets, rather than being welded, to allow adjustment, replacement and prevent pipe strain.
- C. The equipment chamber shall be physically separated from the wet well. Wet well access shall be completely separate from the equipment chamber and shall be provided with the access manway exposed only to the atmosphere.
- D. The equipment chamber shall be provided with two separate fiberglass covers, one over the pumps and the other over the control section, hinged at the center

support channel. The fiberglass covers shall be formed with a drip lip around the edges. Lockable pneumatic shocks shall be provided to assist in opening the covers, support them in the open position and to restrain them under load. An aluminum ladder with a 3' safety extension bar shall be located in the station to provide easy access.

- E. Only one segment of the fiberglass cover need be opened for personnel access into the equipment chamber, but either or both may be opened for equipment access. A single cover will not be acceptable due to weight.
- F. The fiberglass two-piece cover shall be made of molded reinforced orthophthalic polyester resins with a minimum of 30% glass fibers with a minimum average length of 1-1/4". The outside of the enclosure shall be coated with a polyester protective in-mold coating for superior resistance to weathering, ultra-violet radiation, yellowing and chalking. The completed fiberglass enclosure shall be resistant to mold, mildew, fungus and corrosive liquids and gasses normally found in pump station environments.
- G. A 1/4" hinged aluminum manway cover located exterior to the pump chamber shall be provided. The manway shall be 25" x 36" minimum and be an integral part of the station head plate and shall provide access into the wet well. Both equipment chamber and wet well access covers shall be provided with arrangements for padlocking.
- H. The manway cover shall have a three color 7" x 10" (minimum size) corrosionresistant sign permanently affixed to it, reading "DANGER – Before Entering, Test For Explosive Atmosphere. Test For Oxygen Deficiency. Supply Fresh Air To Work Area".
- I. A lifting socket shall be welded to the wall for each pump. A stanchion with lifting arm shall be provided to support a hoist (provided by others) for removal of the motors, impellers and pumps.
- J. Two (2) 10" by 36" steel shelves shall be mounted on the wall opposite the control panel, for the operator's use or for auxiliary equipment mounting.
- K. Thermal magnetic air circuit breakers shall be provided for branch disconnect service and short-circuit protection of all auxiliary circuits, and motor circuit protectors with lockout capability shall be provided for each pump motor. Only instantaneous trip magnetic-type motor circuit protectors, matched to the motor inrush current, shall be used for the motor circuits, for added protection from low-level faults. Thermal magnetic circuit breakers will not be allowed for pump motor service. Magnetic RVSS with 24-volt coils and solid-state overload protection for each phase shall be provided for each pump motor to give positive protection against phase unbalance, thermal overload, phase loss and ground fault. Provide solid state overload protection for the fastest trip speed and for ground fault protection and motor starters using heater coils will not be acceptable. Each single-phase auxiliary motor shall be equipped with an

over-current protection device in addition to the branch circuit breaker, or shall be impedance protected. All switches shall be labeled and a coded wiring diagram shall be provided.

- L. A ventilating blower shall be provided, capable of delivering a minimum of 30 air changes per hour of outside air into the equipment chamber. The blower shall be rigidly mounted to the chamber shell and shall discharge into the station as shown on the plans. It shall be controlled by a percentage timer to provide continuous ventilation. The air intake and exhaust ports shall be 6" pipe with a gooseneck for weather protection and shall be screened to keep out debris and rodents.
- M. A low profile four tube fluorescent light fixture, with diffuser cover shall be provided to give adequate illumination for all areas within the equipment chamber. The fixture shall be equipped with quick start bulbs and low temperature ballast. A manual switch located in the equipment chamber shall be provided to turn the lights and ventilating blower on when the cover is closed.
- N. Station Heater:

A 1300/1500-watt, dual range, electric heater with automatic circulating fan, thermostat control and an On/Off switch is to be provided. The heater is to be operated by connection to the station convenience receptacle.

O. Motor Insulation:

The pump motors shall be vertical, solid shaft, NEMA P base, squirrel cage induction-type, suitable for three phase, 230 volt electric current. They shall have Class F insulation. Insulation temperature shall, however, be limited to Class B. The motors shall have normal starting torque and low starting current, as specified by NEMA Design B characteristics. They shall be open drip proof design with forced air circulation by integral fan. Openings for ventilation shall be uniformly spaced around the motor frame. Leads shall be terminated in a cast connection box and shall be clearly identified.

### 2.6 PUMP DESIGN

- A. Pumps shall be vertical, vacuum priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 GENERAL of this section.
- B. Materials and Construction Features
  - 1. The pumps shall be vertical, centrifugal non-clog type of heavy castiron construction, especially designed for the use of mechanical seals and vacuum priming. In order to minimize seal wear caused by linear movement of the shaft, the shaft bearing nearest the pump impeller

shall be locked in place so that end play is limited to the clearance within the bearing. To minimize seal wear resulting from shaft deflection caused by the radial thrust of the pump, the shaft from the top of the impeller to the lower bearing supporting the impeller shall have a minimum diameter of 1-7/8" for motor frame sizes 213 through 286; 2-1/8" for motor frame sizes 324 and 326; and 3" for frame 364 and larger. The dimension from the lowest bearing to the top of the impeller shall not exceed 6".

- 2. The oversized shaft incorporating oversized bearings and heavier bearing frame construction provides for extended mechanical seal, bearing and overall pump/motor life. Since the larger shaft with the specified minimum overhang is the key to heavier, more rigid construction throughout, no deviation from the specified shaft diameter or tolerances will be allowed.
- 3. The pump shall have an adapter providing a large water reservoir above the impeller to provide for positive exclusion of air from the impeller. The seal shall be inside this area to assure lubrication. Pumps which do not use hollow priming adapters for positive lubrication of the seal will not be acceptable.
- 4. The pump shall be constructed so as to permit priming from the lower pressure area behind the impeller. Priming from high-pressure connections, which tends to cause solids to enter and clog the priming system, will not be acceptable. The priming bowl shall be transparent, enabling the operator to monitor the priming level.
- 5. The pump shall be arranged so that the rotating element can easily be removed from the casing without disconnecting the electrical wiring or disassembling the motor, impeller, backhead or seal, so that any foreign object may be removed from the pump or suction line.
- 6. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:
  - a. The pump impeller shall be of the enclosed "X-Pellar" nonclog mono-port type made of close-grained cast-iron and shall be in dynamic balance when pumping wastewater. Two port impellers are specifically disallowed. The dynamic balance shall be obtained without the use of balance weights or liquid filled chambers. The impeller shall be designed to allow for the trimming of the impeller to meet design condition changes without altering the balance. The eye of the impeller, as well as the port, shall be large enough to permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. To further prevent clogging, the impeller port shall have

a minimum area of 10.6 in<sup>2</sup>. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

- b. The shaft shall be solid stainless steel through the mechanical seal to eliminate corrosion and abrasive rust particles.
  Removable shaft sleeves will not be acceptable if the shaft under the sleeve does not meet the specified minimum diameter.
- c. The bearing nearest the impeller shall be designed for the combined thrust and radial load. The upper bearing shall be free to move in a linear direction with the thermal expansion of the shaft and shall carry only radial loads.
- d. The pump shaft shall be sealed against leakage by a single mechanical seal constructed so as to be automatically drained and primed each time the pump is drained and primed. Water which lubricates the mechanical seal shall be automatically drained from around the seal if the pump loses prime in order to allow both the pump and the seal to be drained, thereby preventing freezing and breakage of the seal during power outages in sub-freezing temperatures. The seal shall be of carbon and ceramic materials with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramic shall be held in mating position with the stationary carbon by a stainless steel spring. The entire seal assembly shall be held in place by a bronze seal housing to prevent excessive heat buildup. Use of cast iron or other ferrous material for the seal housing, which will rust and damage the seal, shortening its life, will not be acceptable. The pump volute shall be furnished with mounting lugs and bolted to the station floor plate, forming a gas-tight seal.
- 7. The pump suction shall be drilled and tapped for a 125-pound American Standard flange for ready connection of the suction riser.
- C. Serviceability

- 1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.
- 2. No special tools shall be required for replacement of any components within the pump.
- D. Spare Parts Kit:
  - 1. A complete replacement pump shaft seal assembly shall be furnished with each pump station. The spare seal shall be packed in a suitable container and shall include complete installation instructions. A spare volute gasket and seal gasket shall be provided. A spare 24v DC control power supply unit shall be provided to be available as an emergency replacement.
  - 2. An instructional video presentation on the pump mechanical seal system in DVD format shall be included. The DVD shall contain a presentation on the following subjects: purpose and location of the mechanical seal, signs of a defective mechanical seal, how to remove the mechanical seal, troubleshooting seal failure causes, seal components, required tools, how to reinstall the seal, and how to place the pump back into service. The video shall include footage of an actual seal replacement.

## 2.7 VALVES AND PIPING

- A. Check Valve and Eccentric Plug valve:
  - 1. The discharge line from each pump shall be fitted with a clapper type check valve and eccentric plug valve. Size, location and quantity of check valves and plug valves shall be as shown on the plans. All passageways through the pumps and piping shall be capable of passing a 3" sphere. The check valve shall be of the spring loaded type with external lever arm and an easily replaced resilient seat for added assurance against vacuum leaks. Check valves shall have stainless steel shaft with replaceable bronze shaft bushings and shall be sealed with O-rings or an adjustable Teflon seal. Ball-type check valves without an external lever arm are not acceptable. An operating wrench shall be provided for the plug valve.
- B. Gauge Kit:
  - 1. A four-inch (4") Bourdon tube-type compound vacuum/pressure gauge with 3-1/2" dial, fitted with a brass stop valve and a manual air relief valve shall be provided for each pump. The gauges shall be mounted apart from the pumps, on a bracket attached to the control panel support structure, and connected to the pump discharge taps by flexible tubing, to minimize vibration. The range of each gauge shall be selected to place the normal operating discharge pressure reading in the middle

one-third of the scale and the gauge shall also be capable of measuring up to 30" HG of vacuum.

- 2. The dial shall be white with black markings and the gauge itself shall have an accuracy of 1% of scale. The gauge shall be American made, with a Zytel Nylon case with ½" blow-out plug, stainless steel bezel, acrylic lens and phosphorus bronze tube with brass socket.
- 3. Each compound gauge shall be filled with a viscous fluid to dampen vibration and pulsation effects on the needle reading. Temperature compensation shall be provided by an internal compensating diaphragm. Gauges shall be protected from the service fluid by a Buna-N elastomer "boot" diaphragm within the stem, and the Bourdon tube and the space between the Bourdon tube and the internal isolating diaphragm shall be filled with low temperature instrument oil, completely isolating the gauge components from the fluid being measured.
- C. Station Enclosure Low Temperature Alarm

The RTD installed in the panel for environmental control shall also provide a continuous signal of the panel ambient temperature, and the temperature shall be indicated on the panel display unit in degrees Fahrenheit. Pump station shall be supplied with a thermostat which shall monitor interior station temperature.

- D. Piping
  - 1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.
  - 2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.
  - 3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.
  - 4. Bolt holes shall be in angular alignment within 1/2 degree between flanges. Flanges shall be faced with a gasket finish.
- E. Supports and Thrust Blocks:
  - 1. Contractor must ensure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

# 2.8 DRIVE UNIT

A. Motors:

- 1. The pump motors shall be vertical, solid shaft, NEMA P base, squirrel cage induction-type, suitable for three phase, 60 cycle electric current.
- 2. The motors shall have 1.15 service factor. The service factor shall be reserved for the owner's protection. The motors shall not be overloaded beyond their nameplate rating, at the design conditions, nor at any head in the operating range as specified under Operating Conditions.
- 3. The motor pump shaft shall be centered, in relation to the motor base, within .005". The shaft runout shall not exceed .003".
- 4. The motor shaft shall equal of exceed the diameter specified under main pumps, at all points from immediately below the top bearing to the top of the impeller hub.
- 5. A bearing cap shall be provided to hold the bottom motor bearing in a fixed position. Bearing housings shall be provided with fittings for lubrication as well as purging old lubricant.
- 6. The motor shall be fitted with heavy lifting eyes or lugs, each capable of supporting the entire weight of the pump and motor.
- 7. The pump motors shall be Premium Efficiency type, per NEMA MG-1 table 12-12, Inverter Ready per NEMA Part 31.4.4.2, with cast-iron frames, and be UL Recognized or CSA Approved. The motor windings shall be 200 C Inverter Spike-Resistant magnet wire and the rotors shall have an epoxy coating for corrosion protection.

## 2.9 FINISH

All structural carbon steel and cast-iron surfaces shall be factory blasted with A. steel grit, in an environmentally controlled booth, to remove rust, mill scale, weld slag, etc. All weld spatter and surface roughness shall be removed by grinding. Surface preparation and cleanliness shall comply with SSPC-SP6 specifications. The surface profile shall be 2.0 mils (0.05 mm). Sandblasting is specifically prohibited. After blast cleaning, all surface contaminants, such as grease or oil, shall be removed before coating. Immediately following cleaning, a single 6 mil (0.15 mm) minimum dry film thickness coating of VERSAPOX®, a self-priming Cycloaliphatic Amine Epoxy shall be factory applied. This coating shall be as formulated by Smith & Loveless specifically for this type of application and service. Finish coating shall be accomplished prior to shipment of the equipment from the factory and shall comply fully with the intent of these specifications. A touch-up kit shall be provided by the equipment manufacturer for repair of any mars or scratches occurring during shipping and installation. This kit shall contain detailed instructions for use. Stainless steel, aluminum and other corrosion-resistant surfaces shall not be coated. Carbon steel surfaces not otherwise protected shall be coated with a suitable non-hardening rust preventative compound. A heavy synthetic rubber mat shall be cemented to the station floor by the Manufacturer to protect the coating on the steel floor. Two 17-pound magnesium anode packs shall be provided for cathodic protection. The anode packs shall be provided with 30' long insulated copper leads. Copper lugs shall be provided by the Manufacturer on opposite sides of the station for anode connections.

B. Pumps, piping, and exposed steel framework shall be cleaned prior to painting. The factory finish shall allow for over-coating and touch up after final installation.

# 2.10 ELECTRICAL CONTROL COMPONENTS

- A. The pump station control panel shall be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.
- B. Electrical power to be furnished to the site will be 3 phase, 60 hertz, 230/480 volts, 4 wire, with 14 ka rms symmetrical available. Electrical power shall be maintained within plus or minus 10 percent. Control voltage shall not exceed 132 volts.
- C. Panel Enclosure
  - 1. The control equipment shall be mounted in a NEMA Type 4 steel enclosure with two hinged, lockable doors and a steel barrier partition down the middle. One side of the divider shall house the three-phase circuits (motor starters and circuit protectors, etc.), and the other shall house the single-phase control circuits and low voltage components. The microprocessor and low voltage controls shall be accessible without exposing the three-phase high voltage supply, and the pump station controller shall be operable without opening the enclosure door. The control panel shall be mounted to the station wall at a convenient height.
  - 2. All components within the control panel shall be UL listed or recognized, and the complete station control panel itself shall be labeled as a UL 508A General Use Industrial Control Panel. The electrical equipment in the panel shall be protected by a surge protective device.
  - 3. Complete control system engineering shall be supplied by the pump manufacturer and shall include system drawings showing all control units as they are interwired. Diagrams of individual units will not be acceptable.

- 4. Each control assembly shall be furnished with main terminals and ground lug for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the loads. The main terminals shall be mounted to allow incoming wire bending space in accordance with article 373 of the National Electric Code (NEC). A separate terminal strip shall be provided for 115 volt, single phase control power and shall be segregated from the main terminals. Ten percent of the control terminals shall be furnished as spares.
- 5. A duplex GFI protected convenience outlet shall be provided in the station for operation of 120-volt AC devices.
- 6. Individual NEMA 4 oil-tight Hand-Off-Automatic selector switches shall be provided for each pump. The switches shall be 3-position rotary-type with spring return on the Hand position, and mounted on the top of the station control panel for easy access from either the front or the top.
- 7. To control the operation of the pumps with variations of liquid level in the wet well, and monitor the station control, environmental and alarm functions, a specially preprogrammed, dedicated microprocessor-based control system shall be provided.
- 8. The controller shall interface with the wet well level transducer, panel display unit, motor starters, environmental system, accessories and alarm functions through isolated digital and analog input and output ports as required. The digital controls shall operate on 24 volts or less, to eliminate shock hazard. The 24-volt power supply shall be overload protected to be "crowbar safe" and will return to operation when a short is removed. Program integrity shall be maintained by battery-backed RAM.
- 9. A NEMA 4 rated display unit shall be mounted through the front of the panel to provide operator input to and visual output from the microprocessor controller. This interface shall be a 7" wide screen graphic interface with DSTN 65K-color Liquid Crystal Display with backlighting and resistive-type touch screen, , for data input and programming. The display shall have a "sleep" feature to prolong screen life. A minimum of 11 (eleven) menu screens shall be included for display and management of pump and station control functions including, but not limited to:

## **Standard Features**

- Graphical pump running indication
- General alarm indication
- Individual alarm indicators for each alarm function (with time and date)

- Lead pump indication
- Alarm silencing
- Digital indication of air temperature
- Digital and graphical indication of wet well level
- Digital indication of elapsed run time for each pump
- Digital indication of elapsed run time for parallel pump operation
- Digital indication of level control and alarm settings
- Date & time indication with set time functionality
- Heater/blower running indication
- Alarm logging, coded for "time active" or "return time" time cleared for the last 500 events by date and time
- "Help" screens Wet well simulation
- Prime mode selection (CONSTANT PRIME®/On demand prime)

# **Field Programming Functions**

- Select English or Spanish language display mode
- Reset wet well On, Off and alarm levels or return to default settings
- Reset heater or vent fan thermostat set points or return to default settings
- Select sequenced or timed pump alternation and select alternation time interval
- Select any pump to remain as lead pump
- Silence audible alarm
- Reset running time meters
- Set date/time
- Wet well level simulation from touch screen, overriding submersible pressure transducer signal
- Prime mode selection (CONSTANT PRIME®/On demand prime)
- D. Circuit Breakers and Operating Mechanisms
  - 1. Thermal magnetic air circuit breakers shall be provided for branch disconnect service and short-circuit protection of all auxiliary circuits, and motor circuit protectors with lockout capability shall be provided for each pump motor. Only instantaneous trip magnetic-type motor circuit protectors, matched to the motor inrush current, shall be used for the motor circuits, for added protection from low-level faults. Thermal magnetic circuit breakers will not be allowed for pump motor service.
  - 2. UL listed, solid-state reduced voltage starters (RVSS) shall be supplied for each pump motor to be capable of a soft start and soft stop. The starters shall have built in overload protection as well as

built in bypass contactors. One set of Form C auxiliary contacts shall be supplied on the starter. The starters shall have a built-in Digital Signal Processor utilizing a low impedance run circuit. The starters shall be easily programmable by using a standard screwdriver. To provide the fastest trip speed and for ground fault protection, only solid state overload protection will be used, and motor starters using heater coils will not be acceptable. Each single-phase auxiliary motor shall be equipped with an over-current protection device in addition to the branch circuit breaker, or shall be impedance protected. All switches shall be labeled, and a coded wiring diagram shall be provided.

- E. Phase Monitor
  - 1. A relay with double pole, double throw contacts shall be provided to monitor and protect against phase loss (single phasing), under voltage (brownouts) and phase reversal (improper sequence). It shall automatically reset when three-phase service returns to normal.

Adjustable Operating Voltage	Drop Out Voltage	
158 - 224	171 - 243	
430 - 480	387 - 432	

- F. Control Circuit Components
  - 1. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.
  - 2. Individual NEMA 4 oil-tight Hand-Off-Automatic selector switches shall be provided for each pump. The switches shall be 3-position rotary-type with spring return on the Hand position, and mounted on the top of the station control panel for easy access from either the front or the top.
  - 3. Provide a PLC station monitoring package that include the following accessory items
    - Pump overload trip alarm from starter overload trip
    - Time delay to prevent simultaneous pump starts
    - Phase failure/reversal monitor with pump motor shutdown on fault
    - Control power failure alarm
    - Digital flow rate indication panel display, based on cycle times and wet well levels
    - Four-inch (4") liquid filled compound pressure gauges with integral diaphragm isolators for each pump

- 4. The control system shall be designed to allow alternation of the pumps by either a time clock or alternation at the end of each pumping cycle. Selection of the alternation method and setting of the interval for timed alternation shall be easily done without opening the panel. The panel display shall indicate which pump is currently the lead pump.
- 5. The panel display shall be capable of indicating the total running time, in hours and tenths of an hour, of each pump individually, as well as the total time that both pumps have been running in parallel. Provision shall be made so that it is possible to reset the timers to zero, if necessary.
- 6. A resistance temperature device (RTD) shall be provided to monitor the ambient temperature in the pump station, and to control the operation of the ventilation blower. The RTD shall also provide a continuous readout of the station ambient temperature, which shall be indicated on the panel display unit in degrees Fahrenheit.
- G. Convenience GFCI Receptacles:
  - 1. Two (2) duplex ground fault receptacles providing 115 VAC, 60 Hz, single phase current, will be mounted on the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal-magnetic circuit breaker.
- H. A 7-1/2 KVA insulating-type transformer shall be provided to supply power for lights, controls and auxiliary devices. The transformer shall have 208/240/480 volt primary, 120/240 volt secondary, Class F insulation, with temperature rise not to exceed 115oC above 40oC ambient. The core and coil assembly shall be given a double dip and bake. The coil shall be protected by a metal housing to prevent damage. The transformer shall be protected by a separate circuit breaker on the supply side.
- I. Pump Start Delay
  - a. The control circuit shall be equipped with a time delay to prevent simultaneous motor starts between the lead pump and the lag pump.
- J. Alarms:

To facilitate good station monitoring and maintenance practices, the following features shall be incorporated:

1. Provide a pump failure to pump alarm (check valve switch type) to sense failure to deliver normal flow for any reason, including failure to prime. Each pump shall be provided with a sealed sensor switch

mounted in a protective ABS enclosure. The sensor shall be the MULTI-SENSOR by Smith and Loveless. The enclosure shall be mounted with an adjustable universal mounting bracket to the external arm of each discharge check valve. The mounting bracket shall allow the adjustment of the sensor switch with a single locking pivot adjustment. A red LED indicating light shall be provided on each switch unit to facilitate accurate setting of the switch for proper operation. The sensor switch shall monitor the movement of the check valve arm and thereby detect failure of the pump to deliver normal operating flow when called on to run. A programmed time delay shall be provided to prevent an alarm signal during the pump startup period.

- 2. A "Maximum Number of Starts per Hour" may be programmed into the unit, which, if exceeded, will signal an alarm. The controller shall further log the number of pump starts in the last hour and the last week, to aid in analyzing station operation and identifying flow anomalies.
- 3. To sense failure to prime, each pump shall be provided with a programmable timer to sense excessive time to prime and send an alarm signal, during the pump startup period.
- 4. A high-water alarm level setting shall also be provided through the transducer and controller for remote or local alarm indication.
- 5. In the Constant Prime mode, the controller shall monitor the frequency of reprime starts in one hour, and if over a pre-set maximum, shall signal an alarm to signal a vacuum leak.
- 6. Automatic reminders of scheduled service to the pump, motors or station, in accordance with the Manufacturer's operation and maintenance instructions, shall be displayed on the HMI screen, to facilitate proper and timely maintenance.
- 7. The panel display shall be capable of indicating the total running time, in hours and tenths of an hour, of each pump individually, as well as the total time that both pumps have been running in parallel. Provision shall be made so that it is possible to reset the timers to zero, if necessary.
- 8. The digital pump controller shall take the signal from the level transducer and provide a continuous readout of the wet well level in feet and tenths of a foot (meters), through the panel display unit. The controller shall log the history of wet well levels over time for up to one week, for analysis.
- 9. The RTD installed in the panel for environmental control shall also provide a continuous signal of the panel ambient temperature, and the

temperature shall be indicated on the panel display unit in degrees Fahrenheit.

- 10. An integral timer shall be provided to perform a wet well cleaning cycle to discharge floatables and solids accumulations at pre-set intervals (daily to weekly) or manually. The cleaning cycle shall over-ride the "off" level, and pump to a pre-set cleanout off level set point. The automatic wet well cleaning cycle includes a clock start time set point and is adjustable from once a day to once a week. The automatic wet well cleaning cycle feature can also be disabled by the user if needed.
- 11. An integral timer shall be provided to perform a cleaning cycle to flush solids accumulations from the force main at pre-set intervals (daily to weekly) or manually. When the cleaning cycle is started then both pumps shall pump the wet well down to "off". The automatic force main cleaning cycle includes a clock start time set point, and is adjustable from once a day to once a week. The automatic force main cleaning cycle feature can also be disabled by the user if needed.
- K. Wiring
  - 1. The pump station, as furnished by the manufacturer, shall be completely wired, factory tested, approved and certified by the manufacturer, except for power feed lines to the main entrance terminal blocks and final connections to remote alarm devices. All wiring shall be labeled with thermal transfer self-laminating labels and a coded wiring diagram shall be provided.
  - 2. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electrical Code (NEC).
  - 3. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:

a.	Line and Load Circuits, AC or DC power	Black
b.	AC Control Circuit Less Than Line Voltage	Red
c.	DC Control Circuit	Blue
d.	Interlock Control Circuit, from External Source	Yellow
e.	Equipment Grounding Conductor	Green
f.	Current Carrying Ground	White
g.	Hot With Circuit Breaker Open	Orange
-	-	_

4. Motor branch and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.

- 5. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.
- L. Conduit: Factory installed conduit shall conform to following requirements:
  - 1. All conduit and fittings to be UL listed.
  - 2. Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
  - 3. Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electrical Code.
  - 4. Conduit shall be sized according to the National Electrical Code.
- M. Grounding
  - 1. Station manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.
  - 2. The contractor shall provide an earth driven ground connection to the pump station at the main grounding lug in accordance with the National Electrical Code (NEC).
- N. Equipment Marking
  - 1. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:
    - a. Equipment serial number
    - b. Control panel short circuit rating
    - c. Supply voltage, phase and frequency
    - d. Current rating of the minimum main conductor
    - e. Electrical wiring diagram number

- f. Motor horsepower and full load current
- g. Motor overload heater element
- h. Motor circuit breaker trip current rating
- i. Name and location of equipment manufacturer
- 2. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.
- 3. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

## 2.11 LIQUID LEVEL CONTROL

- A. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.
- B. The level control system shall select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle or if one pump runs as the lead pump for an excessive time.
- C. Upon operator selection of automatic operation, the PLC shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the PLC shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the PLC shall start the second pump when the liquid reaches the "lag pump start level" so that both pumps are operating.
- D. Level control range shall be 0 to 12.0 feet of water.
- E. Submersible Transducer System (Submersible Transducer)
  - 1. The liquid level in the wet well shall be monitored by a submersible hydrostatic pressure transducer with stainless steel sensor diaphragm, providing a 4-20 mA signal to the pump control unit. The body of the transducer shall be made of stainless steel. The transducer shall have dual arrestor technology for lightning and surge protection. The pressure transducer shall have a permanent hermetically sealed connection to a polyurethane cable, which shall support the transducer 12"from the bottom of the wet well, and shall pass through a cord grip seal in the station wall. The pressure transducer unit shall be rated for wastewater or potable water service.
  - 2. The digital pump controller shall take the signal from the level transducer and provide a continuous readout of the wet well level in

feet and tenths of a foot, through the panel display unit. It shall also be the means of setting the pump on and off points and alarm levels. As a minimum, the controller shall be capable of digitally setting "On" levels for lead and lag pumps, an "Off" level, and alarm levels. Provisions shall be made for the pumps to operate in parallel should the level in the wet well continue to rise above the starting level for the low-level pump. A high water alarm setting shall also be provided for remote or local alarm indication.

- 3. Three (3) displacement switches shall be provided to automatically operate the pump in back-up mode, in case of failure of the digital control system or the submersible level transducer. The back-up system shall be entirely independent of the digital system. A 30' cord shall be provided with each switch. The cord shall have a corrosion-resistant vinyl jacket and be multi-stranded in order to prevent fatigue. The displacement switch cords and the cable for the submersible pressure transducer shall enter the wet well through cord grip seals mounted to a removable, gasketed wall plate. The wall plate shall allow the displacement switches and transducer to be adjusted or removed and replaced without having to enter or reach into the wet well.
- F. Independent Redundant Float System (Intrinsically Safe)
  - 1. Intrinsically safe relays to provide low current isolated switching for the float switches shall be provided. A galvanic barrier shall provide intrinsically safe isolation for the submersible level transducer when used in hazardous areas.

### PART 3 – EXECUTION

- 3.01 Examination
  - A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

### 3.02 Installation

A. Perform wet well installation and leakage testing in accordance with the sewer manhole SPECIFICATION SECTION 02601.

- B. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.
- C. Suction pipe connections must be vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.
- D. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.
- E. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.
- 3.03 Field Quality Control
  - A. Operational Test
    - 1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.
    - 2. After construction debris and foreign material has been removed from the wet well, contractor shall supply potable water volume adequate to operate station through a minimum of four (4) pumping cycles. Observe and record operation of pumps, suction and discharge gauge readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.
  - B. Co-ordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. The technician will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

- C. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.
- D. The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture. Station is to be stored and maintained per manufacturer's written instructions.

END OF SECTION

#### SECTION 11369

### DRUM SCRUBBER FOR ODOR CONTROL

### PART 1 - GENERAL

#### 1.01 INTENT

A. The Contractor shall provide all equipment and work indicated below to furnish a fully functional odor control unit.

#### 1.02 PERFORMANCE

- A. The drum scrubber will operate at 99.5% contaminant removal efficiency until media is depleted.
- B. The Drum Scrubber shall be able to process 100 cfm of air without exceeding a filtration area of 2.2 ft<sup>2</sup> and a terminal pressure drop of 4.2 iwg.
  - 1. Filtration area is defined as the internal cross-sectional area of the unit perpendicular to airflow.

### 1.03 SUBMITTALS

- A. Submittals shall include the following:
  - 1. Certified shop drawings showing all details of equipment and dimensions.
  - 2. Descriptive literature, bulletins and/or catalogs of equipment including the last five installations of similar equipment.
  - 3. The weight of each major item of equipment.
  - 4. Design loads to the foundation for review and approval prior to fabrication.
  - 5. A bill of materials for equipment.
  - 6. A list of the manufacturer's recommended spare parts. Include gaskets, seals, etc., on the list.
  - 7. Complete data on the head loss for the air flow through the vessel at the design air flow rate and at the maximum head loss prior to carbon change-out.
  - 8. Complete data on the media showing it to be in conformance with this Section.
- B. In the event that it is impossible to conform with certain details of this Section, describe completely all non-conforming aspects.
- C. Operation and Maintenance Data
  - 1. Operating and maintenance instructions shall be furnished to the Engineer. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings,

DRUM SCRUBBER FOR ODOR CONTROL 11369 - 1 equipment lists, descriptions, etc., that are required to instruct operating personnel that are unfamiliar with such equipment.

#### 1.04 WARRANTY

A. Their drum scrubber shall be free from defects in material and workmanship under normal use and service for the duration of twelve (12) months from start-up. See Section 01740 Warranties and Bonds.

#### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. This specification defines the requirements for a Drum Scrubber (DS). Purafil model number DS-100, as manufactured by Purafil, Inc., or equal shall be provided.
- B. The Drum Scrubber shall contain a vertically oriented media bed measuring a minimum of 2 ft. (0.61 m) in depth.
- C. The Drum Scrubber shall contain dry chemical media selected by the manufacturer for the application.
- D. The airflow capacity shall be 100 CFM (170 m<sup>3</sup>/hr) at a terminal pressure drop of 4.2 IWG (1045 Pa) through any, mist eliminators, media bed, post-filters, and exhaust. This includes 1 iwg (249 Pa.) external static pressure.

#### 2.02 CONFIGURATION

A. The configuration shall be arranged so that the contaminated air shall flow through the inlet plenum and through the Mist Eliminator. Then the contaminated air shall flow through a HDPE diffuser column, plastic tower packing media, polymedia filter, and pass upward through the media bed. Treated air shall discharge out of the top of the vessel.

### 2.03 COMPONENTS

- A. The Drum Scrubber shall be a cylindrical container with the tub approximately having dimensions of 21.8 inches (552 mm) in diameter x 52.5 inches (1334 mm) in height.
- B. 3 ft<sup>3</sup> of Odorcarb Ultra media
- C. 2 ft<sup>3</sup> of Odormix SP media
- D. Direct-drive Blower with slide-gate damper on outlet to adjust airflow
- E. Mist Eliminator (ME) filter in an LDPE housing
- F. 4" diameter Fernco inlet to drum

#### DRUM SCRUBBER FOR ODOR CONTROL 11369 - 2

- G. 0.75 inch (19 mm) diameter drain connector
- H. Dwyer Series 2000 Magnehelic Pressure Gauge for the Mist Eliminator (ME) filter
- I. Hold down brackets

### 2.04 MATERIALS

- A. The Drum Scrubber drum shall be fabricated of low-density polyethylene (LDPE).
- B. The Drum Scrubber lid shall be fabricated of fiberglass reinforced plastic (FRP)
- C. Housing materials shall be weatherproof and suitable for outdoor operation.
- D. Polymedia filter shall be synthetic polyester fibers bonded with fire retardant resin.
- E. Tower packing media shall be thermoplastic.
- F. Aluminum nameplate with order number and serial number.
- G. Fasteners shall be stainless steel.

#### 2.05 MIST ELIMINATOR (ME) SECTION

- A. A mist eliminator housing of LDPE construction shall be provided with the Drum Scrubber.
- B. The mist eliminator shall be a polypropylene mesh filter consisting of 6 layers of 16/96 KIMRE mesh.
- C. Pressure taps and gages shall be installed to permit a local read out of the pre-filter pressure drop.
- D. An inlet transition shall be provided by the vessel manufacturer, the size shall be determined by the engineer/owner.
- 2.06 BLOWER
  - A. The blower, shall be externally mounted, aluminum construction, direct-drive and sized to deliver 100 CFM through the scrubber at 4.2 IWG (1045 Pa.).
  - B. The Drum Scrubber shall be designed for outdoor operation.
  - C. The motor shall be a 0.5 hp, 115 volt / 1 ph / 60 Hz TEFC motor.
  - D. The motor shall be pre-wired with an 8ft. (2.44 m) grounded power cord.

#### 2.07 MEDIA BED SECTION

A. A media bed measuring at least 2 ft deep shall be contained in the vessel (tub) housing. The bed shall include 3 cu ft (120 lbs) of Odorcarb Ultra media and 2 cu ft (80 lbs) of Odormix SP media.
B. Media 1 - 3 ft<sup>3</sup> of Odorcarb Ultra media as manufactured by Purafil, Inc. Odorcarb Ultra has the following characteristics:

1. Minimum Removal Capacities

Contaminant Gas	g/cc	Weight %
Hydrogen Sulfide (H <sub>2</sub> S)	0.3008	47.00

- 2. Density 40 lbs per cubic ft (.64 g/cc) +/-5%
- 3. Air Speed up to 100 fpm (0.51 m/s) in bulkfill applications
- 4. 99.5% (min) initial removal efficiency
- C. Media 2 2 ft<sup>3</sup> of Odormix SP media as manufactured by Purafil, Inc. Odormix SP Media is made from an equal mix (by volume) of Purafil's Odoroxidant SP media and Odorkol media. Odormix SP has the following characteristics:

1. Minimum Removal Capacities

Contaminant Gas	g/cc	Weight %
Sulfur Dioxide (SO <sub>2</sub> )	0.0520	8.13
Nitrogen Dioxide (NO <sub>2</sub> )	0.1434	22.41
Toluene ( $C_6H_5CH_3$ )	0.0792	12.38

- 2. Density 40 lbs per cubic ft (.64 g/cc) +/-5%
- 3. Air Speed up to 100 fpm (0.51 m/s) in bulkfill applications
- 4. 99.5% (min) initial removal efficiency
- D. All media shall be non-toxic and non-hazardous before and after it is spent.
- E. All media shall be UL classified for flammability.
- F. All media shall have proof that is made and produced in the United States for additional verification of product performance.
- G. All media shall be testable for capacity and life.
- H. All media shall be thoroughly tested prior to shipment according to ISO 9001-2015 approved processes.
- I. Impregnates shall be applied during pellet formation, such that the impregnate is uniformly distributed throughout the pellet volume.

# 2.08 INSTRUMENTATION

A. Differential Pressure: One gauge is included with the scrubber to permit local read-out of pressure drop through the mist eliminator.

DRUM SCRUBBER FOR ODOR CONTROL 11369 - 4 B. Gauge to be Magnehelic type as manufactured by Dwyer (Series 2000) or approved equal.

# 2.09 MONITORING

A. For odor applications that involve hydrogen sulfide (H<sub>2</sub>S), it is recommended to monitor the H<sub>2</sub>S concentration levels at the outlet of the scrubber with a Purafil OnGuard IOT

# 2.10 ANALYTICAL SERVICES

- A. Media Sampling and Analysis
  - 1. The manufacturer shall be able to provide in-house lab analysis for media samples to predict the remaining service life of system media. Media analysis and report will be provided as needed.

# 2.11 MANUFACTURER

- A. The manufacturer shall have a minimum of ten (10) year experience in the design, fabrication, and testing of systems that are 99.5+% efficient at removing gaseous contaminants.
- B. The manufacturer shall be a single source provider of equipment, media, and testing services and be certified to ISO-9001:2015 standards.

# PART 3 – EXECUTION (NOT USED)

# END OF SECTION 11369

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DRUM SCRUBBER FOR ODOR CONTROL 11369 - 6

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### SECTION 16000

## ELECTRICAL

### (FILED SUB-BID REQUIRED)

## PART 1 - GENERAL

#### 1.1 FILED SUB BID

- A. Bidding procedures shall be in accordance with latest edition of Massachusetts General Laws, Chapter 149, Section 44, including provisions for pre-qualification; and Chapter 30, Section 39M. Time and place for submission of sub-bids is given in Advertisement for Bids.
- B. Sub-bids for work under this section shall be for complete work of this section and shall be filed in a sealed envelope with Awarding Authority, at time and place specified in Advertisement for Bids. The following shall appear on the face of the envelope:

[JOB TITLE]

[NAME OF BIDDER]

SUB-BID FOR SECTION 16000, ELECTRICAL

- C. Every sub-bid submitted for work under this section shall be on forms furnished by Awarding Authority, as required by Section 44 of Mass. General Laws, and specified in Advertisement for Bids.
- E. Additional Requirements:
  - 1. Sub-bidder's attention is directed to Massachusetts G.L. Chapter 149 §44H, as amended, which provides in part as follows:
    - a. Each sub-bidder shall list in Paragraph E of the "Form for Sub-bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the section of the Specifications for that sub trade requires such listing, provided that, in the absence of a contrary provision in the specifications, any sub-bidder may, without listing any bid price, list his own name or part thereof and perform that work with persons on his own payroll, if such sub-bidders, after sub-bid openings, shows to the satisfaction of the Awarding Authority that he does customarily perform such class of work with persons on his own payroll and is qualified to do so. This section of the specifications requires that the following classes of work shall be listed in Paragraph E under the conditions indicated herein.

#### 1.2 GENERAL PROVISIONS

- A. The GENERAL REQUIREMENTS, DIVISION 1, and BIDDING AND CONTRACT REQUIREMENTS, DIVISION 0, are hereby made a part of this Specification Section.
- B. Examine all drawings and all sections of the specifications and requirements and provisions affecting the work of this section.
- C. The work listed in the following sections shall be made part of this Specification Section:

16543	Underground Ducts, Handholes and Manholes
16574	Short Circuit, Coordination and Arc Flash Study
16321	Generator – Diesel
16360	Automatic Transfer Switch

## 1.3 SCOPE OF WORK

- A. This project includes the construction of (4) new wastewater pump stations as part of an ongoing wastewater force main extension project in Westport, Massachusetts.
  - 1. Base Contract
    - a. 35 State Road
    - b. 233 State Road
  - 2. Bid Alternate A
    - a. 833 State Road
  - 3. Bid Alternate B
    - a. 1115 State Road
- B. The building is to be commissioned and Contractor shall provide all labor required to fully test and demonstrate that all systems operate as designed.
- C. The work under this section shall include the furnishing of all materials, labor, equipment and supplies and the performance of all operations to provide complete working systems, in general, to include the following items:
  - 1. Identification
  - 2. Raceways and Conduit
  - 3. Wire and Cable (600V)
  - 4. Wiring Devices and Plates
  - 5. Outlet Boxes
  - 6. Junction Boxes, Pull Boxes and Wireways
  - 7. Safety Disconnect Switches
  - 8. Panelboards
  - 9. Dry Type Transformers
  - 10. Fuses
  - 11. Lamps and Light Fixtures
  - 12. Lighting Controls
  - 13. Building Grounding System
  - 14. Battery Powered Emergency Lighting System
  - 15. Sleeving
  - 16. Fire Seal and Fireproof Sealant
  - 17. Supervision and Approval

- 18. Electrical Connections to Process Equipment provided under other sections or by Owner.
- 19. Relocation of existing electrical components that interfere with new construction and removal and disposal of obsolete components.
- 20. Testing
- 21. Operating and maintenance instructions and manuals
- 22. Coordination drawings
- 23. Shop drawings
- 24. Record (as-built) drawings
- D. Work of this section is generally shown on the Electrical Drawings.

#### 1.4 RELATED WORK

- A. Principal classes of Work related to the Work of this section are listed in the Specification Table of Contents, and are specified to be performed under the indicated sections of the specifications. Refer to the indicated sections for description of the extent and nature of the indicated Work, and for coordination with related trades. This listing may not include all related Work items. It is the responsibility of the Contractor to coordinate and schedule the Work of this section with that of all other trades.
- B. The following work is not included in this section and will be provided under other sections:
  - 1. Furnishing and installation of motors.
  - 2. Structural supports necessary to distribute loading from equipment to roof or floor except as specified.
  - 3. Temporary light, power, water, heat, gas and sanitary facilities for use during construction and testing. Refer to Division 1, General Conditions.
  - 4. Excavation and backfill.
  - 5. Concrete work including concrete housekeeping pads and blocks for vibrating and rotating equipment, and ductbank envelopes.

#### 1.5 PRODUCTS FURNISHED, BUT NOT INSTALLED UNDER THIS SECTION

- A. Furnish the following items for installation under other sections and provide wiring and connections as required:
  - 1. Anchor bolts for poured-in-place light standard bases (furnish templates for placement) for installation under Division 3.
  - 2. Pre-cast manholes and handholes for installation under Division 2.
  - 3. Pipe sleeves for placement into formwork by the General Contractor.

## 1.6 PRODUCTS INSTALLED AND WIRED, BUT NOT FURNISHED UNDER THIS SECTION

- A. Install and provide wiring connections for the following items furnished under other sections:
  - 1. Pump Station.

#### 1.7 DEFINITIONS

A. As used in this section, the following items are understood to have the following meaning:

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- 1. *"Contractor or Subcontractor*", unless otherwise qualified, shall mean the installer of the work specified under this section.
- 2. *"Furnish"* shall mean purchase and deliver to the project site, complete with every necessary appurtenance.
- 3. *"Install"* shall mean unload at the delivery point at the site and perform all work necessary to establish secure mounting and proper operation at the proper location in the project.
- 4. *"Provide"* shall mean "Furnish" and "Install".
- 5. *"Work"* shall mean all labor, materials, equipment, apparatus, controls, accessories and all other items required for a proper and complete installation.
- 6. *"Concealed"* shall mean hidden from sight in chases, furred-in spaces, shafts, hung ceilings, embedded in construction or in a crawl space. Areas to be concealed as part of tenant alterations to the building shall also be considered in this definition.
- 7. *"Exposed"* shall mean not installed underground or concealed as defined above.
- 8. *"Furnished by Others"* shall mean materials or equipment purchased under other sections of the general contract and installed by this section of the specifications by this trade Contractor.
- 9. *"Owners Representative"* shall be the party responsible to make decisions regarding all contractual obligations in reference to the Scope of Work for the Owner.
- 10. *"Date of Substantial Completion"* shall indicate the date where the work has been formally accepted as evidenced by completed final punch list or where the work has reached the stage that the Owner obtains beneficial use and commences utilization of the installed systems for business or occupancy purposes. The GENERAL REQUIREMENTS, DIVISION 1, shall supersede this definition where specifically defined.

# 1.8 CODES, REFERENCES AND PERMITS

- A. Materials, installation of systems and equipment provided under this section shall be done in strict accordance with the Department of Public Safety, Department of Environmental Protection, State Building Code and any other Codes and Regulations having jurisdiction including but not limited to:
  - 1. All Applicable NFPA Standards
  - 2. National Electrical Code (NEC).
  - 3. Occupational Safety and Health Administration (OSHA)
  - 4. State and Local Building Codes
  - 5. Underwriters' Laboratories, Inc. (UL)
- B. Unless otherwise specified or indicated, materials, workmanship and equipment performance shall conform with the latest governing edition of the following standards, codes, specifications, requirements, and regulations, except when more rigid requirements are specified or are required by applicable codes but not limited to:
  - 1. American National Standards Institute (ANSI)
  - 2. American Society of Mechanical Engineers (ASME).
  - 3. American Society of Testing and Materials (ASTM)
  - 4. Illuminating Engineering Society (IES)
  - 5. Institute of Electrical and Electronics Engineers (IEEE)
  - 6. Insulated Cable Engineers Association (ICEA)
  - 7. National Electrical Contractors Association (NECA)
  - 8. National Electric Manufacturers Association (NEMA)
  - 9. Thermal Insulation Manufacturers Association (TIMA)

- C. Codes, laws and standards provide a basis for the minimum installation criteria acceptable. The drawings and specifications illustrate the scope required for this project, which may exceed minimum codes, laws and standards.
- D. Give all notices, file all plans, obtain all permits and licenses, and obtain all necessary approvals from authorities having jurisdiction. Deliver all certificates of inspection to the authorities having jurisdiction. No work shall be covered before examination and approval by the Owner's Representative, inspectors, and authorities having jurisdiction. Replace imperfect or condemned work to conform to requirements, satisfactory to Owner's Representative, and without extra cost to the Owner. If work is covered before inspection and approval, this Contractor shall pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

# 1.9 GENERAL REQUIREMENTS

- A. Nameplates
  - 1. Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.
- B. Equipment Guards
  - 1. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be completely enclosed or guarded. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be guarded or covered with insulation of type specified for service.

#### 1.10 MATERIAL AND EQUIPMENT STANDARDS

- A. Where equipment or materials are specified with the name of a manufacturer, such specification shall be deemed to be used for the purpose of establishing a standard for that particular item. No equipment or material shall be used unless previously approved by the Owner's Representative.
- B. Substitutions may be offered for review provided the material, equipment or process offered for consideration is equal in every respect to that indicated or specified. The request for each substitution must be accompanied by complete specifications together with drawings or samples to properly appraise the materials, equipment or process. The Contractor shall highlight and list all applicable specification requirements which the substituted material deviates from.
- C. If a substitution of materials or equipment in whole or in part is made, this Contractor shall bear the cost of any changes necessitated by any other trade as a result of said substitution.
- D. All materials, equipment and accessories provided under this section shall be new and unused products of recognized manufacturers as approved.

# 1.11 SUBMITTALS

- A. Conform to the requirements of Division 1, General Conditions, for schedule and form of all submittals unless specifically noted otherwise in this section. Coordinate this submittal with submittals for all other finishes. Shop drawings and design layouts shall be prepared by licensed installing Contractor s and shall note the name(s), license number(s) and license expiration date(s) of the Contractor (s) installing electrical systems.
- B. Definitions:
  - 1. Shop Drawings are information prepared by the Contractor to illustrate portions of the work in more detail than indicated in the Contract Documents.
  - 2. Acceptable Manufacturers: The mechanical design for each product is based on the single manufacturer listed in the schedule or shown on the drawings. In Part 2 of the specifications, certain Alternate Manufacturers are listed as being acceptable. In addition, the MATERIAL AND EQUIPMENT STANDARDS paragraph potentially allows for substitutions as being acceptable. These are acceptable only if, as a minimum, they:
    - a. Meet all performance criteria listed in the schedules and outlined in the specifications. For example, to be acceptable, an emergency generator must deliver equal kW / KVA at equal or greater efficiency using equal or less fuel as the emergency generator listed in the schedules.
    - b. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either the space or the product. Clearances to walls, ceilings, and other equipment will be at least equal to those shown on the design drawings. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Engineer has determined that the manufacturer's products will fit within the available space this determination is solely the responsibility of the Contractor.
    - c. For rooftop mounted equipment and equipment mounted in areas where structural matters are a concern, the products must have a weight no greater than the product listed in the schedules or specifications.
    - d. Products must adhere to all architectural considerations including, but not limited to; being of the same color as the product scheduled or specified, fitting within the architectural enclosures and details, and for lighting – being the same size and of the same physical appearance as scheduled or specified products.
- C. Submittal Procedures, Format and Requirements
  - 1. Review submittal packages for compliance with Contract Documents and then submit to Owner's Representative for review. Submit enough sets of shop drawings such that, after review, two (2) sets will be kept by the reviewer, with only the remaining sets returned with reviewer's marks and comments.
  - 2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
    - a. Title
    - b. Equipment number
    - c. Name and location of project
    - d. Names of Owner, Engineer and Seller
    - e. Names of manufacturers, suppliers, vendors, etc.
    - f. Date of submittal
    - g. Whether original submittal or resubmitted
  - 3. Shop Drawings showing manufacturer's product data shall contain detailed dimensional drawings (minimum  $\frac{1}{4}$  inch 1 foot scale) including plans and

sections (where physical clearance could be an issue). Provide larger scale details as necessary.

- 4. Submit accurate and complete description of materials of construction, manufacturer's published performance characteristics, sizes, weights, capacity ratings (performance data, alone, is not acceptable), electrical requirements, starting characteristics, wiring diagrams, and acoustical performance for complete assemblies. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.
- 5. Provide Shop Drawings showing details of piping connections to all equipment. If connection details are not submitted and connections are found to be installed incorrectly, this Contractor shall reinstall them within the original contract price.
- 6. Provide complete data for all auxiliary services and utilities required by submitted equipment. This shall include fuel, cooling and exhaust requirements and points of connections.
- 7. Provide a complete description of all controls and instrumentation required including electrical power connection drawing for all components and interconnection wiring to starters, detailed information on starters, control diagrams, termination diagrams, and all control interfaces with a central control system.
- 8. Provide installation and erection information including; lifting requirements, and any special rigging or installation requirements for all equipment.
- 9. The Owner's Representative shall approve all materials before commitment for materials is made.
- D. Specifications and Schedule Compliance Statement
  - 1. The manufacturer shall submit a point by point statement of compliance with each specification criteria listed in each paragraph for those submittals listed in Paragraph E: Product Data that are noted with an asterisk (\*).
  - 2. The statement of compliance shall consist of a list of all paragraphs (line by line) identified in Part 2 and applicable Part 3 of the specification for which the submitted product in the opinion of the manufacturer complies, deviates, or does not meet.
  - 3. Where the proposed submittal complies fully, the word "comply" shall be placed opposite the paragraph number.
  - 4. Where the proposed submittal does not comply, or accomplishes the stated function in a manner different from that described, a full description of the deviation shall be provided.
  - 5. Verify each field of the associated schedule where associated technical data is presented on the drawings. Where the submitted material does not 'comply" provide the value the submitted equipment will achieve based upon the specified conditions.
  - 6. Where a full description of a deviation is not provided, it shall be assumed that the proposed system does not comply with the paragraph in question and the product will be rejected.
  - 7. Submissions which do not include a point by point statement of compliance as specified shall be disapproved.
- E. Product Data: Submit complete manufacturer's product description and technical information including:
  - 1. Identification
  - 2. Raceways and Conduit
  - 3. Wire and Cable (600V)
  - 4. Wiring Devices and Plates

- 5. Outlet Boxes
- 6. Junction Boxes, Pull Boxes and Wireways
- 7. Safety Disconnect Switches
- 8. Panelboards
- 9. Dry Type Transformers
- 10. Fuses
- 11. Lamps and Light Fixtures
- 12. Lighting Controls
- 13. Building System Grounding Components
- 14. Lightning Protection
- 15. Fire Seal and Fireproof Sealant
- 16. Seismic Restraints
- 17. Identification, labels and tags.
- F. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.
  - 1. Access panel shop drawings shall be submitted to the Construction Supervisor for approval.
  - 2. Do not submit multiple product information in a single bound manual.
  - 3. Three-ring binders shall not be accepted.
- G. Deviations:
  - 1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the deviation to the attention of the Owner's Representative.
  - 2. Without letters flagging the deviation to the Owner's Representative, it is possible that the Engineer may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Owner's Representative, the Seller shall hold the Engineers, his consultants and the Owner harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Engineer has reviewed or approved shop drawings containing the deviation, and will be strictly enforced.
  - 3. Approval of proposed deviations, if any, will be made at discretion of Engineer.
- H. Schedule: Incorporate shop drawing review period into construction schedule so that Work is not delayed. This Contractor shall assume full responsibility for delays caused by not incorporating the following shop drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time shop drawing is submitted or resubmitted with the exception that twenty (20) working days, exclusive of transmittal time are required for the following:
  - 1. Coordination drawings.
  - 2. If more than five (5) shop drawings of a single trade are received in one (1) calendar week.
- I. Responsibility
  - 1. Intent of Submittal review is to check for capacity, rating, and certain construction features. The Contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other sections. Work shall comply with approved submittals to extent that they agree with Contract Documents. Submittal review

ELECTRICAL 16000 – 8 shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of Contract Documents. The Engineer's noting of some errors while overlooking others will not excuse the Contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

- 2. Inform Contractor, manufacturers, suppliers, etc. of scope and limited nature of review process and enforce compliance with contract documents.
- J. In the event that the Contractor fails to provide Shop Drawings for any of the products specified herein:
  - 1. The Contractor shall furnish and install all materials and equipment herein specified in complete accordance with these specifications.
  - 2. If the Contractor furnishes and installs material and/or equipment that is not in complete accordance with these specifications, he shall be responsible for the removal of this material and/or equipment. He shall also be responsible for the replacement of this material and/or equipment with material and/or equipment that is in complete accordance with these specifications, at the direction of the Owner's Representative.
  - 3. Removal and replacement of materials and/or equipment that is not in complete compliance with these specifications shall be done at no extra cost to the Owner.
  - 4. Removal and replacement of materials and/or equipment that is not in complete compliance with these specifications shall not be allowed as a basis for a claim of delay of completion of the Work.
- K. Mark dimensions and values in units to match those specified.
- L. Submit Material Safety Data Sheets (MSD) on each applicable product with submittal.

### 1.12 OPERATION AND MAINTENANCE DATA

- A. Commence preparation of the Operating and Maintenance (O&M) manuals immediately upon receipt of "Approved" or "Approved as Noted" shop drawings and submit each section within one (1) month. The final submission shall be no later than two (2) months prior to the projected date of Substantial Completion of the Project.
- B. Each O&M document shall include the manufacturer's web address for equipment specific O&M information for Internet access by the Owner.
- C. The manual shall consist of three (3) sets of manuals and include three (3) sets of CDs, which shall contain the scanned content of the entire manual. The manual shall highlight the actual equipment used and <u>not</u> be a master catalog of all similar products of the manufacturer. The manual shall be submitted for review prior to creation of the CDs.
- D. The Manual shall contain the following:
  - 1. Operations Manual
    - a. Systems description including all relevant information needed for day-today operations and management including start-up and shut-down instructions.
    - b. Wiring diagrams, schematics, logic diagrams and sequence of operations that accurately depict the controls system.

- c. Depiction of each interface screen where programmable logic and visual displays are provided. Descriptors shall be provided to define displayed data, alarms, etc.
- d. A single sheet (for ease of removal) of all access codes and passwords necessary to access all levels of control and programming.
- e. Trouble shooting guide defining common alarms/problems with possible cause and effect.
- 2. Maintenance Manual
  - a. Define all maintenance activities required to ensure system operation within manufacturers specified parameters. Provide table of all required activities plotted vs. interval with adequate fill-in-space for "activity completion date" and "comments". Where multiple instrument readings are required, provide data sheet formatted to accommodate activity.
  - b. Define recommended spare parts inventory with part numbers and source defined for ordering by the Owner. Identify lead time on all parts, source location and cost.
  - c. Provide copy of all warranty information with associated date of substantial completion (commencement of warranty) and end date of coverage. Define all components/subsystems specifically included and excluded.
- 3. Provide O&M manuals for each of the following:
  - a. Generator
  - b. Transfer Switch

### 1.13 COORDINATION

- A. Refer to Division 1, General Conditions, for coordination requirements applicable to this section, unless specifically noted otherwise in this section.
- B. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as required.
- C. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other sections. Any conflicts shall be referred immediately to the Owner's Representative for decision to prevent delay in installation of work. All work and materials placed in violation of this clause shall be readjusted to the Owner's Representative's satisfaction at no expense to the Owner.
- D. Where work of this section will be installed in close proximity to work of other sections or where there is evidence that the work of this section may interfere with work of other sections, assist in working out space conditions to make satisfactory adjustment. Prepare and submit for approval 3/8" scale or larger working drawings and sections, clearly showing how the work is to be installed in relation to the work of other sections. If the work of this section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to protect conditions without extra charge.
- E. Keep fully informed as to the shape, size and position of all openings required for all apparatus, conduit, cable, sleeves, etc., and give information in advance to allow construction of required openings. Furnish all sleeves, pockets, supports and incidentals, and coordinate with the General Contractor for the proper setting of same.

- F. All distribution systems which require pitch or slope such as condensate drains and water piping shall have the right of way over those which do not. Confer with other trades as to the location of pipes, ducts, lights and apparatus and install work to avoid interferences.
- G. Make reasonable modifications in the work as required by structural interferences, or by interference with work of other trades, or for proper execution of the work without extra charge.

## 1.14 RECORD DRAWINGS

- A. Refer to DIVISION 1, General Conditions, for record drawings and procedures to be provided under this section, unless specifically noted otherwise in this section.
- B. Record Drawings (red-line drawings) will be updated by this Contractor daily for review with the monthly requisition. The record drawing shall be an accurate depiction of the systems as completed, including dimensions (vertical/horizontal) of concealed components off fixed building elements.
- C. The Electrical Foreman shall maintain complete and separate set of prints of Contract Drawings at job site at all times and shall 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.
- D. At completion of work the Electrical Contractor shall prepare a complete set of record drawings on AutoCAD showing all systems as actually installed. The Architectural background AutoCAD files will be made available for the Contractor's copying, at his expense, to serve as backgrounds for the drawings. The Electrical Contractor shall transfer changes from field drawings onto AutoCAD drawings and submit copy of files and three sets of prints to Owner's Representative for comments as to compliance with this section. CADD layering as established by the A&E design team shall be maintained with any and all changes done by the Contractor.
- E. The Engineer is not granting to the Contractor any ownership or property interest in the CADD Drawings by the delivery of the CADD Disks to the Contractor. The Contractor's rights to use the CADD disks and the CADD Drawings are limited to use for the sole purpose of assisting in the Contractor's performance of its contractual obligations under its contract with respect to the Project. The Engineer is granting no further rights. Any reuse or other use by the Contractor will be at the Contractor's sole risk and without liability to the Engineer. The Contractor hereby waives and releases any losses, claims, damages, liabilities of any nature whatsoever, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor. The Contractor, to the maximum extent permitted by law, hereby agrees to indemnify, defend and hold the Engineer harmless from all loses, claims, damages, liabilities, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor. The Contractor, to the maximum extent permitted by law, hereby agrees to indemnify, defend and hold the Engineer harmless from all loses, claims, damages, liabilities, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor.
- F. Record Drawings, shall show "as-built" condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and model numbers of final equipment installation.
- G. The Electrical Contractor shall submit the record set for approval by the engineer a minimum of four (4) weeks prior to seeking the permanent certificate of occupancy.

### 1.15 COORDINATION DRAWINGS

- A. Provide a set of Electrical coordination drawings for use in verifying required code clearances of all electrical equipment and for use in coordinating installation of equipment with other trades. Where practical, the CADD layering as established by the Engineering team for the construction documents, shall be utilized in the preparation of all coordination drawings. Where CADD layering deviates from the Engineering team's layering convention, submit the proposed layering system for approval. The CADD layering used shall provide, as a minimum, the flexibility of illustrating trade specific items similar to the established Engineering team layering standard.
- B. The intent of the coordination drawings is to identify and resolve installation conflicts prior to fabrication and installation of any MEP trade.
- C. The Process Contractor's floor plans shall be the basis for floor plan coordination. The Electrical Contractor's reflected ceiling plans shall be the basis for reflected ceiling plan coordination. All other trades shall provide the Electrical Contractors with their Drawings / Layers for incorporation into one (1) set of coordinated multi-trade drawings.
- D. The CADD Drawings prepared by the Engineer contains representations of certain elements of the Project, and are not necessarily complete, nor are the CADD Drawings comparable or identical to final construction drawings. The Architect and Engineer make no representations or warranties with respect to the accuracy or completeness of the CADD Drawings. The Engineer does not recommend that the Contractor use the CADD Drawings in connection with the preparation of shop drawings. Should the Contractor choose to do so, however, the Contractor shall carefully review and compare the CADD Drawings with the corresponding final construction drawings to verify their accuracy and identify all discrepancies, differences, and inconsistencies in design, locations, dimensions, scope, and all other respects between the CADD Drawings and the corresponding final construction drawings. The Contractor, shall base the preparation and submission of shop drawings, and in general, shall base the performance of all its obligations with respect to the Project upon the information contained in the final construction drawings and not the CADD drawings. Nothing shall be construed as to relieve the Contractor of any of its obligations (such as, by way of illustration, the obligation to make field measurements or to coordinate drawings) under its contract with respect to the Project.
- E. Electrical Coordination Drawings shall be prepared as outlined below.
  - 1. Prepare Electrical Coordination Drawings showing all Electrical work to be installed as part of Section 16000. The Coordination Drawings shall be created using AutoCAD and shall have a scale of <sup>1</sup>/<sub>4</sub> inch or 3/8 inch.
  - 2. The Electrical Coordination Drawings shall show distribution equipment (switchboards, panelboards, transformers, motor control centers, etc), feeders, light fixtures, cable tray and conduit racks. Drawings shall include dimensions and elevation tags for all equipment, devices and material.
  - 3. After incorporating all trades, resolve any areas of conflicts between trades under the direction of the General Contractor / Construction Manager and submit fully coordinated drawings to the Owner's Representative.
  - 4. Do not install any of this work prior to the preparation and Engineer's review of the final Coordination Drawings. If Electrical work proceeds prior to the final Coordination Drawings, any change to the Electrical work to correct the interferences and conflicts which result will be made by this Contractor at no additional cost to the Owner.

- 5. Coordination Drawings are for this Contractor's and Owner's Representative's use during construction and shall not be construed as replacing any shop, "asbuilt", or Record Drawings required elsewhere in these Contract Documents.
- 6. Owner's Representative's review of Coordination Drawings shall not relieve this Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

# 1.16 WARRANTIES

- A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities which the manufacturer and the Electrical Contractor may have by law or by provisions of the Contract Documents.
- B. All materials, equipment and work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of one-year (1) commencing with the Date of Substantial Completion. Where individual equipment sections specify longer warranties, provide the longer warranty. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.
- C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the drawings.
- D. Upon receipt of notice from the Owner of the failure of any part of the systems during the warranty period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

# 1.17 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- A. It is the intention of the specifications and drawings to call for complete, finished work, tested and ready for continuous operation. Any apparatus, appliance, material or work not shown on the drawings, but mentioned in the specifications or vice-versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be provided by this Contractor without additional expense to the Owner.
- B. The drawings are generally diagrammatic. The locations of all items that are not definitely fixed by dimensions are approximate only. The exact locations must be determined at the project and shall have the approval of the Owner's Representative before being installed. This Contractor shall follow drawings, including his shop drawings, in laying out work and shall check the drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions. Where space conditions appear inadequate, notify the Owner's Representative before proceeding with the installation. This Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.
- C. Any requests for information (RFI) for resolving an apparent conflict or unclarity, or a request for additional detail, shall include a sketch or equivalent description of Contractor's proposed solution.

D. Size of conduits, cable trays, raceways and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the drawings, all necessary parts to make complete approved working systems ready for use, shall be furnished without extra charge. All work shall be installed in an approved workmanlike manner.

### 1.18 INSPECTION OF SITE CONDITIONS

A. Prior to submission of bid, visit the site and review the related construction documents to determine the conditions under which the Work has to be performed and send a report, in writing, to the Owner's Representative, noting any conditions which might adversely affect the Work of this section of the specifications.

## 1.19 SURVEY AND MEASUREMENTS

- A. Base all required measurements, horizontal and vertical, from referenced points established WITH the Owner's Representative. The Electrical Contractor shall be responsible for correctly laying out the Work required under this section of the specifications.
- B. In the event of discrepancy between actual measurements and those indicated, notify the Owner's Representative in writing and do not proceed with the related work until instructions have been issued.

### 1.20 DELIVERY, STORAGE AND HANDLING

- A. No materials shall be delivered or stored on site until corresponding Shop Drawings have been approved.
- B. All manufactured materials shall be delivered to the site in original packages or containers bearing the manufacturer's labels and product identification.
- C. Protect materials against dampness. Store off floors, under cover and adequately protected from damage.
- D. Inspect all equipment and materials, upon receipt at the job site, for damage and conformance to approved shop drawings.

### 1.21 PROTECTION OF WORK AND PROPERTY

- A. This Contractor shall be responsible for the care and protection of all work included under this section until the completion and final acceptance of this Contract.
- B. Protect all equipment and materials from damage from all causes including, but not limited to, fire, vandalism and theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment at no additional cost to the Owner.
- C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen under this section and make good damage thus caused.

D. Damaged materials are to be removed from the site; no site storage of damaged materials will be allowed.

### 1.22 SUPERVISION

A. Supply the service of a competent Supervisor with a minimum of five (5) years of experience in Electrical construction supervision who shall be in charge of the Electrical work at the site.

## 1.23 SAFETY PRECAUTIONS

- A. Life safety and accident prevention shall be a primary consideration. Comply with all of the safety requirements of the Owner and OSHA throughout the entire construction period of the project.
- B. Furnish, place and maintain proper guards and any other necessary construction required to secure safety of life and/or property.

## 1.24 SCHEDULE

A. Construct work in sequence under provisions of Division 1 and as coordinated with the Owner's Representative.

#### 1.25 HOISTING, SCAFFOLDING AND PLANKING

A. The work to be done under this section of the specifications shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, cranes, helicopters, scaffolds, staging and planking as required for the work.

#### 1.26 CUTTING AND PATCHING

- A. Include all coring, cutting, patching, and fireproofing necessary for the execution of the work of this section. Structural elements shall not be cut without written approval of the Architect. This Contractor shall be responsible for taking all precautions required to identify hidden piping, conduits, etc. before any core drilling and/or cutting of slabs commences, including X-raying the affected slabs. Provide fire stopping to maintain the fire rating of the fire resistance-rated assembly. All penetrations and associated fire stopping shall be installed in accordance with the fire stopping manufacturer's listed installation details and be listed by UL or FM.
- B. All work shall be fully coordinated with all phases of construction, in order to minimize the requirements for cutting and patching.
- C. Form all chases or openings for the installation of the work of this section of the specifications, or cut the same in existing work and see that all sleeves or forms are in the work and properly set in ample time to prevent delays. Be responsible that all such chases, openings, and sleeves are located accurately and are of the proper size and shape and consult with the Owner's Representative and all other trades concerned in reference to this work. 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 approval of the Owner's Representative.

- D. Fit around, close up, repair, patch, and point around the work specified herein to match the existing adjacent surfaces and to the satisfaction of the Owner's Representative.
- E. Fill and patch all openings or holes left in the existing structures by the removal of existing equipment which is part of this section of the specifications.
- F. All of this work shall be carefully done by workmen qualified to do such work and with the proper and smallest tools applicable.
- G. Any cost caused by defective or ill-timed work required by this section of the specifications shall be borne by this Contractor.
- H. When, in order to accommodate the work required under this section of the specifications, finished materials of other trades must be cut or fitted, furnish the necessary drawings and information to the trades whose materials must be cut or fitted.

#### 1.27 SLEEVES, INSERTS AND ANCHOR BOLTS

- A. Coordinate with other trades the location of and maintaining in proper positions, sleeves, inserts and anchor bolts to be supplied and/or set in place under this section of the specifications. In the event of incorrectly located preset sleeves, inserts and anchor bolts, etc., all required cutting and patching of finished work shall be done under this section of the specifications.
- B. All pipes passing through floors, walls, ceilings or partitions shall be provided with fire stopping to maintain the fire rating of the structure. All penetrations and associated fire stopping shall be installed in accordance with the fire stopping manufacturer's listed installation details. Provide sleeves for all penetrations where required by the listed detail, for the penetration of all mechanical room floors and where specifically required on the drawings.
- C. Field drilling (core drilling), when required, shall be performed under this section of the specifications, after receipt of approval by the Owner's Representative.
  - 1. When coring cannot be avoided, provide ¼ inch pilot hole prior to coring. When coring through floor or slab, verify location of core on floor below and protect and piping, ductwork, wiring, furniture, personnel, etc., below the location of the core.

#### 1.28 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

- A. Provide all supplementary steel, factory fabricated channels and supports required for the proper installation, mounting and support of all Electrical equipment, piping, etc., required by the specifications.
- B. Supplementary steel and factory fabricated channels shall be firmly connected to building construction in a manner approved by the Owner's Representative as shown on the drawings or herein specified.
- C. The type and size of the supporting channels and supplementary steel shall be determined by the Contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

- D. All supplementary steel and factory fabricated channels shall be installed in a neat and workmanlike manner parallel to the walls, floors and ceiling construction. All turns shall be made with 90 degree and 45 degree fittings, as required to suit the construction and installation conditions.
- E. All supplementary steel including factory fabricated channels, supports and fittings shall be galvanized steel, aluminum or stainless steel where exposed or subject to rust producing atmosphere. Factory fabricated channels shall be manufactured by Unistrut, H-strut, Powerstrut or approved equal.

## 1.29 HAZARDOUS MATERIALS

- A. Removed batteries shall be recycled by a facility approved by the Owner's Representative. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment.
- B. Removed fluorescent and HID lamps shall be recycled by a facility approved by the Owner's Representative. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment.
- C. All ballasts in lighting fixtures to be disposed shall be verified to be PCB free. All ballasts manufactured prior to 1979 and not labeled as PCB free shall be considered to contain PCB's. Provide written verification to the Owner's Representative that confirms PCB free waste. Where PCB free waste cannot be verified, ballasts shall be recycled by a facility approved by the Owner's Representative, with PCB components eliminated by a high temperature incineration. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment. All handling shall conform to EPA requirements. Provide breakout cost for this scope.
- D. Where it has been identified that asbestos-containing material exists within the scope limits, refer to the Asbestos Abatement specification section for requirements.

#### 1.30 ACCESSIBILITY

A. All work provided under this section of the specification shall be installed so that parts requiring periodic inspection, maintenance and repair are accessible. Work of this trade shall not infringe upon clearances required by equipment of other trades, especially code required clearances to electrical gear. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to written approval from the Owner's Representative.

#### 1.31 SEISMIC RESTRAINT REQUIREMENTS

- A. Submit working plans and calculations reviewed, signed and stamped by a professional engineer who is registered in the State where the project is located and has specific experience in seismic calculations, certifying that the plans meet all seismic requirements established by authorities having jurisdiction over the project.
- B. For each seismic restraint, provide certified calculations to verify adequacy to meet the following design requirements:
  - 1. Ability to accommodate relative seismic displacements of supported item between points of support.

- 2. Ability to accommodate the required seismic forces.
- C. For each respective set of anchor bolts provide calculations to verify adequacy to meet combined seismic-induced sheer and tension forces.
- D. For each weldment between structure and item subject to seismic force, provide calculations to verify adequacy.
- E. Restraints shall maintain the restrained item in a captive position without short circuiting the vibration isolation.

#### 1.32 PROJECT CLOSEOUT

- A. Certificates Of Approval
  - 1. Upon completion of all work, provide certificates of inspections from the following equipment manufacturers stating that the authorized factory representatives have inspected and tested the operation of their respective equipment and found the equipment to be in satisfactory operating condition and installed per the manufacturers installation instructions and requirements.
    - a. Panelboard
    - b. Standby Generator
    - c. Automatic Transfer Switch
- B. Construction Observations By The Engineer
  - 1. The engineer shall make progress site visits during construction and one (1) substantial completion (punch list) site visit for determining substantial completion.
  - 2. The Trade Contractors and the General Contractor are required to inspect their own work and make any corrections to the work to comply with the specifications and the contract documents. It is not the responsibility of the engineer to develop lists of incomplete work items.
  - 3. Progress Site Visits
    - a. The purpose of the progress site visit by the engineer is to observe if the work is proceeding in accordance with the contract documents.
    - b. The engineer will prepare a field report which will note in general the work completed since the last observation visit, work found not to be in accordance with the contract documents and work not corrected since the previous observation visit.
- C. Substantial Completion
  - 1. When the Contractor considers the Work under this section is substantially complete, the Contractor shall submit written notice, through the General Contractor, with a detailed list of items remaining to be completed or corrected and a schedule of when each remaining work item will be completed. Should the engineer determine the list of remaining work does not constitute substantial completion the engineer will notify the Architect and/or Owner and he will not make a substantial completion site visit.
  - 2. The following items shall be completed prior to the written request for substantial completion site visit:
    - a. Certification of successful operation of all systems.
    - b. Training of the Owner's personnel in the operation of the systems.

- c. Record Drawings in accordance with the contract specifications.
- d. Operation and Maintenance manuals.
- e. Testing reports.
- f. Manufacturer's certificates of approvals.
- g. Emergency contact list for reporting of malfunctioning equipment during the warranty period.
- h. Contractors Project Completion certificate.
- 3. Should the Engineer, during the substantial completion visit, observe that the Work is substantially complete, s/he will provide a written listing of the observed deficiencies referred herein as the Punch List. The Punch List will provide for a place for the Contractor and General Contractor to sign off and date each item individually indicating that the observed deficiency item has been corrected.
- 4. Should the Engineer, during the substantial completion site visit, observe that the Work is not substantially complete, s/he will provide, a written list of the major deficiencies and a reason for the work not being considered substantially complete.
- 5. If the work is found not to be substantially complete then the engineer shall be reimbursed for his time to reobserve the work. A reobservation fee shall be charged to the Contractor through the contractual agreement for any further observations by the engineer.
- 6. The Contractor shall remedy all deficiencies listed in the punch list within the time frame required by the contract.
- D. Engineer's Construction Completion Certification
  - 1. Where required by the applicable code, the Engineer's Construction Completion Certification will be issued by NV5 when all life safety and health related issues are complete, all required functional tests are complete and all reports are complete. The following is a minimum listing of the required systems to be tested with reports generated indicating they are complete and ready for use:
    - a. Standby Generator
    - b. Automatic Transfer Switch
  - 2. There shall be <u>NO</u> outstanding items identified on the punch list for scope within any of these categories.
- E. Final Completion
  - 1. The following items shall be submitted prior to the written request for Final completion:
    - a. Revised Substantial Completion items to be resubmitted in accordance with the review process comments.
    - b. Warranties commencing the date of Substantial completion
    - c. Individual Signed and dated Punch List acknowledging completion of all punch list items
  - 2. When the Contractor considers all of the punch list work items complete, the Contractor shall submit written notice through the General Contractor that all Punch List items are complete and resolved and the work is ready for final observation site visit. The signature lines for completion of each punch list item shall be signed by the Contractor indicating the work is complete and signed by the General Contractor indicating s/he has inspected the work and found it to be complete. Should the Engineer find the work to be finally complete and all Punch List items are complete the Engineer will make a recommendation to the Architect or Owner. If the Engineer has found the punch list work to be

incomplete during final inspection a written listing of the observed deficiencies will be prepared by the Engineer.

- 3. If the work is not fully complete then the engineer shall be reimbursed for his time to reobserve the work. A reobservation fee shall be charged to the Contractor through the contractual agreement for any reobservations by the Engineer.
- F. Re-observation Fees
  - 1. The re-observation fee shall be \$1200.00 per visit.
- G. Contractor's Project Completion Certificate
  - 1. Upon completion of work and prior to request for Certificate of Occupancy, each Trade Contractor and the General Contractor shall issue a certificate stating that work has been installed generally consistent with construction documents and all applicable codes. NV5 can furnish a blank Contractor's certificate form upon request. The certificate shall certify:
    - a. Execution of all work has been in accordance with the approved construction documents.
    - b. Execution and control of all methods of construction was in a safe and satisfactory manner in accordance with all applicable local, state and federal statutes and regulations.
  - 2. The certificate shall include the following information:
    - a. Project.
    - b. Permit Number.
    - c. Location.
    - d. Construction Documents.
    - e. Date on Plans and specifications submitted for approval and issuance of the Building Permit.
    - f. Addendum(a) and Revision Dates.
  - 3. The certificate shall be signed by the Contractor and include the following:
    - a. Signature.
    - b. Date.
    - c. Company.
    - d. License Number.
    - e. License Expiration Date.

# PART 2 - PRODUCTS

- 2.1 NOT USED
- 2.2 IDENTIFICATION
  - A. Nameplates
    - 1. Nameplates shall be laminated black Bakelite with minimum ¼ inch high white recessed letters.
    - 2. Nameplates shall be securely attached to the equipment. Utilize mechanical fasteners such as galvanized steel or brass screws for exterior applications. High strength adhesives or cements may be used for interior applications.

# 2.3 RACEWAYS AND CONDUIT

- A. Rigid Galvanized Steel (RGS) Conduit
  - 1. RGS shall be zinc-coated steel that conforms to ANSI C80.1, UL Specification No. 6 and Federal Specification WW-C-581e by Allied Tube and Conduit, Republic Steel, Wheatland Tube or approved equal.
  - 2. RGS fittings shall be threaded. Split couplings or non-threaded fittings shall not be used.
  - 3. Nipples and Close Nipples shall be RGS, length as noted or as required to conform to field conditions.
- B. Polyvinyl Chloride (PVC) Non-metallic Conduit
  - 1. PVC conduit and fittings shall be Schedule 40 or Schedule 80, 90°C. UL Listed equal to Carlon Plus 40 or Plus 80. PVC shall meet NEMA Specification TC-2, TC-3 and UL-651.
  - 2. PVC, fittings and solvent cement shall be by single approved manufacturer.
  - 3. PVC shall be sunlight resistant and listed for exposed or outdoor usage.
- C. Fiberglass Reinforced Epoxy (FRE) Conduit Schedule 40 or Schedule 80 UL Listed equal to FRE Composites Inc. Type ID, SW and HW for below ground and above ground applications. FRE shall comply with UL 1684.
- D. Miscellaneous Conduit Fittings
  - 1. Elbows shall be standard radius unless noted otherwise. Where Large Radius elbows are specified, provide forty-eight (48) inch radius unless noted otherwise.
  - 2. Bushings shall be threaded pressed steel hot dipped galvanized with conduit end stop and integrally molded noncombustible phenolic insulated surface rated for 150°C.
  - 3. Bonding bushings shall be threaded pressed steel hot dipped galvanized with conduit end stop and integrally molded noncombustible phenolic insulated surface rated for 150°C with a lay-in tin plated copper grounding lug.
  - 4. Exposed conduit expansion fittings shall be hot-dipped galvanized malleable iron with external bonding jumper equal to O.Z./Gedney Type EX for RGS or Type TX for EMT (four (4) inch maximum expansion).
  - 5. Provide water-tight gland sealing assemblies with pressure bushings equal to OZ/Gedney Type WSK for new cast-in-place installations or Type CSCM for retrofit (core drilling of existing walls) as required for below grade wall and floor penetrations.
- E. Flexible Metallic Conduit
  - 1. Liquidtight Metal Conduit shall be UL Listed fabricated from a spiral wound strip of heavy gauge, corrosion resistant, hot dipped galvanized steel equal to Electriflex Company Type LA. The jacket shall be flame retardant, sunlight resistant PVC extruded over the spiral wrap. Sizes through 1 ¼ inch shall have an integral copper bonding strip.
  - 2. Liquidtight fittings shall be UL listed zinc plated insulated throat.
  - 3. Flexible metal conduit shall be UL Listed non-jacketed steel fabricated from a spiral wound strip of heavy gauge, corrosion resistant, hot dipped galvanized steel equal to Electri-flex Company Type BR.
- F. Wireways shall be minimum 16-gauge steel with all straight runs having hinged springlatched covers. Finish shall be painted over a corrosion resistant phosphate pretreatment to protect against corrosion. Interior parts shall be smooth and free of sharp

edges and burrs. Provide wireway as identified on the drawings for NEMA 1, 3R or 12 service. Wireways shall be equal to Square D and UL Listed.

### 2.4 WIRE AND CABLE (600V)

- A. Provide single-conductor, annealed copper wire and cable with insulation rated for 600 V, of sizes specified and scheduled on drawings, by General Electric, Southwire, Okonite or approved equal, for secondary service, feeders, branch and system wiring. Wire sizes shown and specified are American Wire Gauge for copper conductors.
- B. The use of aluminum conductors is not allowed.
- C. Wire #10 and larger shall be stranded; #12 and smaller shall be solid. Wire and cable shall have THWN-THHN or XHHW insulation for branch circuit and feeder conductors. Type RHWUSE shall be used for all conductors installed in below grade raceways for generator applications only.
- D. Conductor Color-coding
  - 1. Service entrance, branch circuit and feeder conductors shall be color-coded. Conductors #12 and #10 shall be colored with a factory applied solid or striped compound coating (black, red, blue, brown, orange or yellow). Neutrals and equipment grounds shall have solid compound or solid color coating (white, gray and green), except that neutrals with colored stripe shall be used where required by code. Phase conductors #8 and larger with stripes, bands or hash marks shall have background color other than white, green and gray.
  - 2. Alternative field-applied color coding methods may be used for wire #8 or larger, with color code as specified in other sections of this specification. Coloring shall be applied by the use of flame-retardant vinyl tape, equal to 3M Scotch 35.
- E. Splices and Terminations
  - 1. Ampacity and temperature rating of splices and connectors shall be equal to or greater than those of associated wires and cables.
  - 2. Make splices in branch circuit or feeder wiring from #12 to #10 with UL-listed, solderless screw on connectors rated 600 V.
  - 3. Make splices in branch circuit or feeder wiring above #10 with UL-listed 90°C, 600V, compression butt splice barrel equal to Burndy YS-L HYLINK.
  - 4. Conductor terminations shall be standard bolt-on lugs with hex screws listed for attachment of copper wire and cable to panelboards, switchboards, disconnect switches and other electrical equipment.
  - 5. Make terminations for stranded conductors on screw terminals with UL Listed 105°C, 600V PVC insulated barrel compression locking fork tongue terminal equal to Burndy TP-LF VINYLUG.
  - 6. Make bus terminations for conductors #6 and larger with UL-listed 90°C, 600V, compression standard barrel length lugs equal to Burndy YA-L for conductor sizes to #4/0. Connectors for cable 250 KCMil and larger shall be with UL-listed 90°C, 600V, compression long barrel length two hole lugs equal to Burndy YA-2N. Lugs shall be high conductivity seamless copper electro-tin plated for corrosion protection.
- F. Wire management shall be provided by self-extinguishing self-locking nylon ties with -65 to 350°F. range for bundling conductors.
- G. Arc-proofing

- 1. Provide flexible, flame-retardant, organic-composition-coated elastomer arcproofing tape equal to 3M Scotch 77 on power cable in manholes and handholes, suitable to withstand 200 A arc for 30 seconds. Tape shall be self-extinguishing and shall not support combustion. Cover with glass cloth tape equal to 3M Scotch 69 as a binder.
- 2. Tape shall have been tested with 186-hour distilled water exposure and 3% salt water and shall be ultra-violet and weather resistant.
- H. Cable pulling compounds shall be UL Listed and be suitable for use with the specified cable insulation system. The compound shall reduce the coefficient of friction, while not adding any long term issues to the installation such as premature aging of the insulation system, added flammability or drying in such a manner as to stick the cable in place in the raceway.

## 2.5 WIRING DEVICES AND PLATES

- A. Provide wiring devices by single manufacturer. Catalog designations of Cooper are specified, unless noted otherwise, to establish standards of quality for materials and performance. Colors of devices as specified below are White for standard applications. Refer to the drawings for color requirements that vary from White. Equal products by Leviton, Pass & Seymour or Hubbell will be accepted. Provide published manufacturers cross-reference sheet highlighted with the device specified and that being submitted with all device product data for approval.
- B. Wall switches shall be of the totally enclosed tumbler type. Wiring terminals shall be spring loaded terminal screws for back or side wiring. Switches shall be rated 20-ampere 277 V for use on alternating current only. The yoke shall have a grounding terminal with a green hex head screw. Pilot lights indicated shall consist of red lighted handle, illuminated when the switch is on.
- C. Toggle Switches shall be heavy duty, UL listed, specification grade as follows:
  - 1. Single-pole shall be No. 2221W
- D. Miscellaneous Switches:
- E. Receptacles:
  - 1. Receptacles shall be nylon faced with rigid, glass reinforced nylon bodies. Wiring terminals shall be spring loaded terminal screws for back or side wiring. Receptacles shall be rated 20-ampere 125 volt. The yoke shall have a grounding terminal with a green hex head screw.
  - 2. Duplex receptacles shall be UL Federal Specification WC-596 Specification Grade Extra Hard Duty 125V, 20A, 2 P, 3 W as follows:
    - a. General Use shall be No. 5362W (White)
    - b. Corrosive Environment shall be No. 5362CRY (Yellow)
    - c. GFCI Interior shall be No. GF20W (White)
    - d. GFCI Exterior shall be GF20BK (Black) UL listed Weather Resistant
  - 3. Special purpose outlets shall be provided as indicated on the drawings at the ratings listed on the schedules and notes.
- F. Wiring Device Plates:
  - 1. Provide 0.032 inch nominal brushed Type 430 stainless steel device plates by the manufacturer of the wiring device for all flush mounted switches and

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receptacles installed in dry locations and where not subjected to physical abuse. Ganged plates shall be of one-piece construction to accommodate the required number of installed devices. Oversized plates to cover wall finish blemishes adjacent to the device box shall not be used.

- 2. Provide heavy-duty cast aluminum horizontally mounted weatherproof covers for GFCI receptacles where weatherproof devices are specified equal to Hubbell No. WP26MH. Cover shall be attached to FS box with four (4) screws and spring back to the closed position upon removal of the cord set. Fasteners chrome-plated brass.
- 3. Receptacle device plates for other than 20 amp, 120 V, 2 W, circuits shall be provided with typed clear plastic label (equal to P-Touch) mounted to the device plate indicating voltage characteristics, panelboard and circuit number of outlet

# 2.6 OUTLET BOXES

- A. Outlet and switch boxes on concealed work shall be at least 4 inch square, galvanized pressed steel conforming to UL 514A. Where installed in plaster, boxes shall be fitted with galvanized steel plaster covers of required depth to finish flush with finished wall or ceiling. Outlet boxes shall be by Steel City Electric Company, Appleton Electric Company, or approved equal.
- B. Outlet boxes installed in masonry walls or in concrete decking shall be UL Listed for the application.
- C. Outlet boxes for interior surface mounted locations where RGS is specified where exposed to moisture, at kitchen and cafeteria equipment, adjacent to water or steam connections, and where indicated as weatherproof on drawings shall be cast malleable iron with an aluminum polymer enamel coating equal to Appleton Type FD. Conduit entries shall be threaded cast hubs. Device covers shall be coated malleable iron with moisture sealing gasket and stainless steel fasteners.
- D. Outlet boxes for exterior surface mounting shall be cast aluminum alloy with an aluminum polymer enamel coating equal to Appleton Type FD. Conduit entries shall be threaded cast hubs. Device covers shall be cast aluminum alloy with moisture sealing gasket and stainless steel fasteners.
- E. All boxes shall have at least one (1) tapped and threaded grounding hole for connection of a 10-32 grounding screw.
- F. Box depth shall accommodate code required volume for the specified installation. Through wall boxes shall not be used.
- G. Outlet boxes for various systems including but not limited to fire alarm, paging and master clocks shall be sized as required by the manufacturer. Boxes shall be cast where exposed to physical damage or installed in an exposed exterior location.

## 2.7 JUNCTION AND PULL BOXES

A. Provide galvanized steel junction and pull boxes where indicated and as necessary to facilitate installation. Steel shall be minimum 16 gauge. Junction and pull boxes shall be of code required dimensions. Cover shall be of the same type and thickness material as the box construction.

- B. Junction and pull boxes intended for dry interior locations shall be NEMA 1 enclosures with accessible, removable screw-on covers. Covers shall be secured with corrosion-resistant screws with keyhole slots to accommodate easy removal.
- C. Junction and pull boxes intended for wet or exterior locations shall be NEMA 3R enclosures with hinged gasketed covers. Interior and exterior shall be finished with a gray enamel powder coat over the galvanized metal. Hinge shall be galvanized steel with stainless steel pin. Covers shall be secured with corrosion-resistant zinc plated lockable pull catches.
- D. Custom fabricated medium to large junction and pull boxes shall have internal structural steel bracing welded to form a rigid assembly adequate to maintain alignment and shape in shipment and installation.

# 2.8 SAFETY DISCONNECT SWITCHES

- A. Switches shall be three-pole heavy-duty type rated for 600V in NEMA 1 (interior dry applications) and NEMA 3R (exterior applications) enclosures unless noted otherwise on the drawings. All switches shall be horsepower rated and suitable for service entrance use. Provide with solid neutral where four wire circuits are indicated and with 200% solid neutral where neutrals are sized for 200% full load ampacity.
  - 1. Operating mechanisms shall be quick-make/quick-break. Current-carrying parts shall be high-conductivity copper. Contacts shall be silver-tungsten or plated. Provide positive pressure fuse clips and switch operating mechanism suitable for continuous use at rated capacity without auxiliary springs in current path. Switches shall withstand available fault current or let-through current before operating, without damage or rating change.
  - 2. Terminations shall be suitable for copper or aluminum conductors 60°/75° C rated. Clear shielding shall prevent accidental contact with energized line terminals.
  - 3. The cover shall be mechanically interlocked to prevent access unless the disconnect is in the OFF position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. Padlocking facilities shall be provided to positively lock the disconnect in the OFF position with from one (1) to three padlocks with the door open or closed.
  - 4. The enclosure shall be given a phosphatizing pretreatment. The paint finish shall be manufacturer's standard color and shall pass 600 hours of corrosion resistance testing per ASTM B 117.
- B. Fused switches shall have short circuit ratings no less than 100,000 amperes RMS, with capabilities to 200,000 amperes when used with Class J, L or R fuses at 480V from 400A to 1200A.
- C. Manual Motor Starters shall have quick make, quick break toggle mechanisms with allowance for up to 10% field adjustment in nominal overload heater values. Manual Motor Starters shall be NEMA 1 (interior dry applications) and NEMA 3R (exterior applications) enclosed unless noted otherwise on the drawings. Provide Cutler Hammer type MS manual starters for applications up to 1 HP at 240V single phase and type B100 for up to 1 HP at 277V single phase. Permanent provisions shall be included to allow locking the disconnect in the OFF position.

### 2.9 PANELBOARDS

- A. General
  - 1. Provide dead-front lighting and power panelboards where shown on drawings and as scheduled.
  - 2. Panelboards shall meet or exceed requirements of NEMA Standard Publication PB-1, and UL-50 and 67. Panelboards shall be UL-listed.
  - 3. Where panelboards are used as service entrance equipment, they shall comply with all NEC and UL requirements for service. The panelboard shall include a UL service entrance label, incoming line isolation barriers and a removable neutral bond to ground for solidly grounded wye systems.
  - 4. Enclosures shall be at least twenty (20) inches wide made of galvanized steel. Gutter space shall be in accordance with NEC requirements for the specified combination of devices and accessories. Fronts shall be reinforced steel with concealed hinges and concealed trim adjusting screws. Trim clamps are unacceptable. Where two (2) section panels are required, bolt boxes together to form one (1) unit. Trim shall be two-piece construction with doors of equal size over each section. Trims shall be cleaned, primed and painted gray ANSI 61.
  - 5. For panelboards up to 400 amps, provide cabinets with flush hinges and combination catch and lock to cover circuit breaker handles. Provide a directory card with a clear plastic cover mounted inside the door. Power and lighting panels shall have heavy-duty, continuous, section vertical-hinged to box section for access to wiring gutters in addition to trim door. All locks shall be keyed alike. Panelboards greater than 400 amps shall be provided with a four-piece front to cover wiring gutter and wiring access areas.
  - 6. Nameplates shall be in accordance with other sections of this specification.
  - 7. The manufacturer shall warrant equipment to be free from defects in materials and workmanship for one (1) year from date of installation or eighteen (18) months from date of purchase, whichever occurs first.
  - 8. Panels shall be equal to Eaton- Pow-R-Line 2a for 400 A and below unless more than one (1) 125 A or larger branch breaker and/or space is specified. Eaton Pow-R-Line 4 or 5P (or equal) panelboards shall be provided for all applications greater than 400 amps and to accommodate multiple branch breakers greater than 125 amps. Approved equal panelboards by GE, Siemens or Square D will be considered.
  - 9. Where specifically indicated on the drawings for Selective Coordination, provide fused panelboards equal to Eaton Pow-R-Line 2aF. All fuses in the system where selective coordination is required shall be manufactured by the same manufacturer.
- B. Bussing
  - 1. Main bus bars of panels shall be copper, rated to carry at least full rating of the panel as identified on the schedules.
  - 2. Split solid neutral bus, with rated capacity equal to the phase bus, shall be plated and located in main compartment for all incoming neutral cables to be same length. Neutral bus shall be 200% rated where double sized neutrals are indicated and/or where the panel is supplied via a K-rated transformer.
  - 3. Provide separate equipment ground bus for each panelboard. Where an isolated ground is specified, provide an additional isolated ground bus, which shall be insulated from the panel enclosure and equipment ground.
  - 4. Panelboards shall have a short circuit current rating equal to or greater than circuit breaker AIC ratings schedule on the drawings. Where series ratings are allowed, as per the schedule on the drawings, a label shall be affixed to the panel stating the conditions of the UL Series rating including:
    - a. Size and type of upstream device
    - b. Branch devices that are acceptable

- c. UL Series short-circuit rating
- 5. All lugs shall be UL listed tin-plated aluminum suitable for copper or aluminum cable for sizes indicated on the drawings. Provide oversized lugs to accommodate designed cable sizes or increase gutter space to allow use of solid stud compression lugs where necessary. All terminations shall be suitable for 75°C cable.
- 6. Provide bus connections for future overcurrent devices with suitable insulation and bracing to maintain proper short circuit rating and voltage clearances. All required hardware shall be installed and be in place for ready insertion of future breaker without the need to relocate adjacent units. Future spaces shall accommodate frame sizes up to 50% of the main bus ampacity.
- C. Overcurrent Devices
  - 1. Molded case circuit breakers shall be bolt-on devices. Multi-pole breakers shall have internal common trip crossbars for simultaneous tripping of each pole.
  - 2. Trip units shall be:
    - a. Thermal magnetic below 400A frame unless solid state sensing specifically indicated on the drawings.
    - b. Solid state trip units shall be provided on all molded case breakers at 400A frame and above. Trip units shall be equal to Eaton Digitrip 310.
  - 3. All breakers shall have handle trip indication and a trip indicator in the window of the circuit breaker housing.
  - 4. Internal accessories shall be UL Listed for field installation without removing the circuit breaker cover. Internal accessories shall be common to all frame sizes. Shunt trips, auxiliary contacts, and other accessories shall be factory installed.
- D. Submittals
  - 1. The manufacturer shall provide copies of the following documents for review and evaluation in accordance with general requirements of Division 1 and Division 16:
    - a. Product Data on specified product
    - b. Shop Drawings on specified product
    - c. Certified trip curves for each specified product
    - d. Nameplate list
    - e. Short circuit and coordination study shall be submitted with the equipment shop drawings to ensure rating conformity to study conclusions. Submittals made without the study shall be rejected.
    - f.

#### 2.10 LIGHTING FIXTURES

- A. Provide lighting fixtures, equipment and components where shown on drawings, as listed in fixture schedules and as specified, wired and assembled. Provide approved aligned canopies, hangers and other appurtenances as required, for a complete and functional system.
- B. Refer to the lighting fixture schedule for specific ballast requirement. In general:
  - 1. LED luminaires shall have a luminous efficacy of at least 90 lumens/watt, a color temperature of 3500 K (unless noted otherwise on the plans), a CRI of at least 80, an estimated life of at least 50,000 hours at 70% lumen maintenance, and shall include a minimum five (5) year warranty on the entire luminaire including

drivers. The luminaire and LEDs shall have been tested in accordance with LM-79 and LM-80  $\,$ 

- C. Refer to the lighting fixture schedule for specific lamp type, CRI and color.
- D. Refer to fixture schedule for specific lamp and ballast requirements which may deviate from this specification.
- E. Verify ceiling constructions, and provide frames, rings and other accessories suitable for construction encountered.

# PART 3 - EXECUTION

## 3.1 DEMOLITION

- A. General
  - 1. Refer to the drawings for demolition scope applicable to the project.

## 3.2 IDENTIFICATION

- A. Nameplates
  - 1. Provide nameplates on all equipment listed in other sections of this specification including but not limited to switchboards, substations, panelboards, transformers, junction and pull boxes, disconnect switches, motor starters and motor control centers, contactors, time clocks, remote control stations, fire alarm panels, smoke detector remote test/alarm stations and fire alarm annunciators.
  - 2. Nameplates shall designate equipment tag number as defined on the drawings, system voltage where applicable, circuit number, device controlled and system function. Refer to typical nameplate detail on the drawings for additional requirements.
  - 3. Submit a complete list of proposed nameplates prior to order to ensure conformance to design criteria. Submittal shall include nomenclature, size and layout of each tag.
  - 4. Samples of stickers together with color schedules shall be submitted during the submittal phase of this project.
- B. Equipment Identification
  - 1. Equipment identification designations shall be taken from equipment schedules and coordinated with the Owner's facility group to assure designations match up with Owner's maintenance management system identification database.

### 3.3 RACEWAYS AND CONDUIT

- A. General
  - 1. Unless specified or shown on drawings otherwise, install raceways and conduits concealed. Raceways and conduits may be run exposed on unfinished walls and basement ceilings with exposed structure, in mechanical rooms, electric rooms, attics and roof spaces.

- 2. Run concealed raceways and conduits in as direct lines as possible with minimum number of bends of longest possible radius. Install exposed raceways and conduits parallel to or at right angles to building lines.
- 3. Raceway and conduit runs shall be mechanically and electrically continuous from supply to outlet. Conduit shall enter and be secured to metallic enclosures with lock nut and bushing inside. Provide additional exterior lock nut for RGS connections. Bushings shall be the bonding type for conduit connections to metallic enclosures with concentric or eccentric knockouts. Lock nuts and bushings will not be required where conduits are screwed into threaded hubs.
- 4. Size raceways and conduits as required by NEC unless oversized raceways and conduits are shown on the drawings. Raceways and conduits shall be <sup>3</sup>/<sub>4</sub> inch minimum.
- 5. Install conduit systems complete before installation of conductors. Blow through and swab after plaster is finished and dry, and before conductors are installed.
- 6. Raceways and conduits supports shall be rigidly attached to the building structure utilizing corrosion resistant components suitable for use with the selected raceway or conduit. Refer to the seismic restraint sections of this specification for any additional requirements.
- 7. Field bending, cutting and threading shall be executed with the proper tools, resulting in bends and shortened conduits and raceways that are equivalent to factory fabricated and purchased components.
- 8. Provide standoff clips for conduits on exterior and wet location walls.
- 9. Protect all vertical conduit runs from the entrance of foreign material before installation of conductors and the final closure of the raceway system. All spare conduits (vertical and horizontal runs) shall be sealed with a bushing and appropriate insert to prohibit entrance of debris or vermin. Affix a label that indicates "Spare Conduit to \_\_\_\_\_\_" at each seal. Label shall be in accordance with the labeling section of this specification.
- B. Rigid Galvanized Steel (RGS) Conduit
  - 1. RGS may be used for all raceway applications outlined for EMT and PVC. RGS shall be used in locations where subject to accidental damage or abuse and for all above grade exterior applications unless other wiring methods are specified on the drawings. All circuit conductors in excess of 600 V shall be installed in RGS.
  - 2. RGS shall not be used in corrosive environments.
  - 3. All RGS fittings shall be threaded. Utilize Erickson couplings where joining two (2) threaded conduits that cannot be rotated.
- C. Intermediate Metal Conduit (IMC) is not approved.
- D. Electrical Metallic Tubing (EMT) is not approved.
- E. Polyvinyl Chloride (PVC) Non-metallic Conduit
  - 1. PVC may be used for installation in concrete or direct burial applications where not subject to damage.
  - 2. PVC shall not be used for penetrations from concrete slabs. Transition to RGS shall be made a minimum of two (2) inches below the slab finished surface, prior to penetration.
  - 3. All connections shall utilize solvent and glue in accordance with the recommendations of the conduit manufacturer.
- F. Electrical Non-Metallic Tubing (ENT) is not approved.
- G. Miscellaneous Conduit Fittings

- 1. Expansion/Deflection Fittings: Raceways and conduit buried or secured rigidly on opposite sides of building expansion joints and long runs of exposed conduit subject to expansion and contraction due to variations in temperature shall have expansion fittings. Raceways and conduit shall cross building expansion joints at right angles. Provide separate external copper bonding jumper secured with grounding straps on each end of fitting. Fittings shall safely deflect and/or expand/contract to twice the distance of potential movement.
- 2. Penetrations of all below grade exterior walls and flooring shall require approval by the Engineer and Architect. Submit proposed penetration points, size openings and penetration methods to Engineer and Architect. Penetrations shall utilize sealing fittings appropriately sized for the application. Duct bank penetrations are excluded from this requirement.
- 3. Sealing Fittings shall be installed wherever conduits pass from warm to cold locations to minimize condensation within the conduit. Sealing fittings shall be installed with RGS penetration of the wall and terminate in a suitably sized junction box.
- 4. Refer to other specification sections for requirements pertaining to sealing for hazardous atmospheres.
- H. Flexible Metallic Conduit
  - 1. Provide flexible metallic conduits for connections to electrical equipment and to equipment furnished under other Divisions that are subject to movement, vibration or misalignment and/or where noise transmission must be eliminated or reduced.
  - 2. Flexible metallic conduit shall be liquid-tight under the following conditions:
    - a. Exterior locations
    - b. Moisture or humidity-laden atmospheres
    - c. Environments where seepage or dripping of water, grease, oil or other fluids is possible. All mechanical equipment rooms and penthouses, kitchens and;
    - d. Corrosive atmospheres
- I. Wireways shall be provided where specifically shown on the drawings or where the group mounting of controllers, disconnects, enclosures, etc warrant the use for elimination of multiple short conduit runs. Wireways shall be provided complete with all required appurtenances necessary to have a totally enclosed system rated for the environment. Wireways shall not be installed in any location where subject to accidental damage or abuse.
- J. Raceway and Conduit Installation in Concrete Slabs
  - 1. Raceways and conduit may be installed in slabs where specifically allowed on the drawings. Maximum outside diameters of raceways in slabs shall not exceed 1/3 slab thickness. No more than two <sup>3</sup>/<sub>4</sub> inch raceways shall cross in floor slab at a single point. Lateral spacing of parallel raceways shall be at least six (6) inches on centers. Submit raceway layout plan for approval to Architect and Engineer and obtain signoff from the structural engineer of the actual installation before pouring slabs. All in slab installations shall be photographed, with prints and negatives appropriately marked and turned over to the Owner at job completion.
  - 2. Raceways and conduit shall not be placed in slabs less than three (3) inches thick.
- 3.4 WIRE AND CABLE (600V)

- A. Homerun designations on the drawings are diagrammatic only. Install branch circuits and feeders from the power source to the attachment point as required for a complete system. Provide slack wire for connections to equipment installed by others. Refer to schedules and risers where specific conductor and associated raceway sizes are not indicated on the floor plans.
- B. Connect branch circuit homerun with two (2) or three (3) circuits and common neutral only where specifically shown on the drawings. Circuits with common neutrals shall not be connected to the same phase to ensure cancellation of the return current in the neutral conductor.
- C. Install wires and cable in raceways as specified. All conductor sizing is based upon no greater than three (3) current carrying conductors in a conduit. Installation of up to six (6) circuits (no greater than twelve current carrying conductors) in a single conduit will be allowed if the conductor sizing is increased to the required ampacity to accommodate derating factors required by the NEC and NFPA 70.
- D. The minimum wire size shall be #12 unless #14 specifically allowed on the drawings for wiring of controls. Branch circuits longer than 75 feet for 120 V and 175 feet for 277 V from panel to last outlet shall be increased a minimum of one (1) size above that shown on the drawings to minimize voltage drop to less than 3%.
- E. Conductors shall be identified at all accessible locations in the following manner:
  - 1. Color code secondary service, feeders and branch circuit conductors as follows:

208/120 Volts	<u>Phase</u>	480/277 Volts
Black	А	Brown
Red	В	Orange
Blue	С	Yellow
White	Neutral	Gray
Green	Ground	Green

- 2. Provide nonferrous wire markers, embossed or printed to correspond with the drawings. Labels shall be permanently marked so that the source of the branch circuit or feeder may be readily identified. Hand written labels are not acceptable. Embossed tag equal to 3M Scotch Code STL-TAG or SCS-TM shall be applied with two (2) miniature cable ties or slipped through both end holes. Heat bonded tag equal to 3M Scotch Code SCS-HB shall be permanently affixed with a heat gun.
- F. Splices and Terminations
  - 1. No more than twelve splices of current carrying conductors or six (6) circuits, whichever is greater, shall be allowed in a single enclosure or junction box.
  - 2. Splices and terminations shall be sized to the specified conductor. The insulation shall be cut back with the appropriate tools such that the conductors are not nicked or damaged.
  - 3. The compression tool shall be appropriate for the installation of the provided lug or butt splice to ensure pressure necessary for a proper connection is applied.
  - 4. Terminations shall not be stacked or bent unless specifically listed for the application.
- G. Arc-proofing shall be applied to all feeders greater than 100 Amperes where multiple circuits are installed in common enclosures such as handholes, manholes and junction boxes. Apply tape in single, half-lapped layer as required by manufacturer's
recommendations. Secure with strips of red plastic film tape on 208Y/120V conductors and yellow plastic film tape on 480Y/277V conductors.

- H. Cable Pulling
  - 1. Pull cables that share conduit at same time into completely installed raceway. Conductors shall not be pulled in raceways with existing wiring.
  - 2. Submit cable pulling calculations for engineers' approval prior to all mechanically assisted pulls. Attach pull ropes to conductors with basket-weave grips on pulling eyes. Provide means to measure tension during entire pull. Utilize pulling compounds to lessen friction in accordance with the manufacturer's recommendations.
  - 3. Mechanically assisted pulls shall utilize equipment specifically designed for the purpose such as ropes, electric wench, pulleys, etc. The use of a motorized vehicle to assist in a cable pull is prohibited.

## 3.5 WIRING DEVICES AND PLATES

- A. Branch circuitry shall be attached to all devices using the attachment screw or utilizing back wiring chambers that utilize screws for compressing the connection on the wire. Quick stab features that do not require a positive screw on attachment for the conductor are not acceptable.
- B. Receptacle devices for other than 20 A, 120 V, 2 W, circuits shall be provided with tags indicating voltage characteristics and circuit number of outlet that match the nameplate or engraving required on the faceplate.
- C. All switches illustrated together on drawings shall be installed in ganged configuration with single faceplate unless specifically noted otherwise.

#### 3.6 OUTLET BOXES

- A. Fasteners for mounting boxes in damp or wet locations shall be stainless steel.
- B. Pressed steel boxes shall not be used for exposed surface mounted locations below 8 feet-0 inches AFF.

#### 3.7 JUNCTION AND PULL BOXES

- A. Junction box covers shall be accessible. Do not install junction boxes above suspended ceilings except where ceiling is removable or where an access panel is provided.
- B. Pull boxes connected to concealed conduits shall be mounted with covers flush with finished wall or ceiling.
- C. Pull boxes exposed to rain or in damp/wet locations shall be weatherproof NEMA 3R unless noted otherwise on the drawings.
- D. No pull box shall be within two (2) feet of another.
- E. Provide clamps, grids, cable ties and other non-conductive or combustible appurtenances to secure cables. No cable shall be unsupported for more than thirty (30) inches. Cables shall not touch or be unsupported within one (1) inch of the box cover.

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- F. Each junction and pull box shall have a suitable laminated plastic nameplate with white cut letters identifying power source, voltage and driven load of the associated branch circuits or feeders.
- G. Submit box sizing calculations to confirm all box dimensions are in accordance with code requirements with product data prior to installation.

## 3.8 SAFETY DISCONNECT SWITCHES

- A. Provide safety disconnects as required and indicated on the drawings. Each motor shall be provided with a local disconnecting means in accordance with code requirements.
- B. Manual motor starters may be used for 120, 208, 240, or 277V, single-phase motors up to 1 HP. Switches shall disconnect all ungrounded conductors. Overload heating elements shall be properly sized and coordinated for the associated motor in accordance with code and manufactures recommendations.
- C. Disconnect switches for all applications with available fault current in excess of 10,000 amperes RMS symmetrical shall be fusible. Fuses shall be Class J, L or R and rejection clips shall be installed in the fuse holders to prohibit the installation of non-current limiting fuses.
- D. Each disconnect switch shall have a suitable laminated plastic nameplate with white cut letters identifying power source, voltage and driven load.

### 3.9 PANELBOARDS

- A. Storage
  - 1. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.
  - 2. Low voltage panelboards shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between -30 °C and +25 °C. Indoor locations shall be protected to prevent moisture from entering enclosure.
- B. Installation
  - 1. Provide  $\frac{1}{2}$  inch spacers for panelboards mounted at exterior walls below grade to establish  $\frac{1}{2}$  inch air space behind panel.
  - 2. Inspect installed panelboard(s) for anchoring, alignment, grounding and physical damage. Clean interiors to remove construction debris, dirt and shipping materials.
  - 3. Check tightness of all electrical connections with calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.
  - 4. Adjust all circuit breakers and doors for free mechanical operation as described in manufacturer's instructions.
  - 5. Adjust circuit breaker trip and time delay settings to values determined by the short circuit and coordination study.
  - 6. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering.

- C. Circuit breakers used as a motor disconnecting means, and not in sight of the motor and the driven machinery location, shall be capable of being locked in the open position.
- D. Circuit breakers supplying fire alarm equipment and any others loads noted on the schedules shall be capable of being locked in the ON position. The locking means shall not inhibit the ability of the circuit breaker from performing its protective function.

# 3.10 LIGHTING FIXTURES

- A. Lamps
  - 1. Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.
  - 2. Lamps shall be handled with cotton gloves to avoid finger print markings.
  - 3. Florescent lamps on dimmed circuits shall be "seasoned" by operating for at least 100 hours at full intensity to render lamp impurities inert.
  - 4. Incandescent and tungsten halogen lamps shall not be operated other than for initial testing, before final inspection.

# B. Fixtures

- 1. General
  - a. Do not install fixtures until work of other trades that may damage fixtures is completed.
  - b. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified.
  - c. Handling of reflectors shall be done only with cotton gloves to avoid imprinting fingerprints on reflective surfaces.
- 2. Accessories
  - a. Installation and support of fixtures shall as a minimum be in accordance with the NFPA 70 and manufacturer's recommendations.
  - b. Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.
  - c. Open type fluorescent fixtures with exposed lamps shall have a wirebasket type guard.
- 3. Suspended and Pendant Fixtures
  - a. Suspended fixtures shall be provided with adjustable swivel hangers in order to ensure a plumb installation.
  - b. Single unit suspended fluorescent fixtures shall have twin-stem hangers.
  - c. Multiple unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be ten (10) feet.
  - d. Provide threaded rod to rigidly support the weight of the fixture independently of the ceiling support system. Threaded rod shall be concealed where fixture installed in an area with suspended ceilings. Support luminaries on a minimum of two (2) points (one at each end) to prevent rotation. Threaded rod, pendants or factory supplied fixture accessories (such as rods or chains) four (4) feet or longer excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart.
  - e. Branch circuitry shall be routed to the outlet box utilizing the wiring methods outlined on the drawings and as described in these

specifications. Flexible raceway may be installed to each fixture from an overhead junction where concealed above a ceiling. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

- 4. Support
  - a. Do not suspend or support lighting fixtures, threaded rod and safety chains from hung ceiling, conduit or duct. Support fixtures with threaded rod and safety chain from structural members only. Provide supplemental steel (factory fabricated channel equal to Unistrut) where required to span structural steel members.
  - b. Provide supplemental steel below ducts where fixture locations coincide with HVAC duct or mechanical piping runs and access to structure is inhibited.
  - c. Supplemental steel shall be rigidly supported from structure. Where suspension is required, support supplemental steel with threaded rods to structure. Sizing of all supplemental support components is the responsibility of the Contractor.

## 3.11 BASIC ACCEPTANCE TESTS

- A. General Scope
  - 1. This section covers the required field tests and inspections to assess the suitability for initial energization of electrical power distribution equipment and systems. Failed components shall be replaced and retested for no additional cost to the project.
  - 2. The purpose of this specification is to assure that all tested electrical equipment and systems are operational and within applicable standards and manufacturer's tolerances and that the equipment and systems are installed in accordance with design specifications.
  - 3. All testing shall be performed by the Contractor responsible for the installation of the systems or by an independent testing organization under contract with the Contractor.
  - 4. All equipment utilized for testing shall have a valid calibration sticker. All test reports shall indicate the equipment utilized and its associated calibration due date.
  - 5. Coordinate all required shutdowns with the Owner. Any and all testing required after the Owner has taken occupancy (temporary or permanent) shall be assumed to be conducted during premium time.
  - 6. A written record of all tests and a final report summarizing the findings shall be submitted for approval prior to energizing any electrical power distribution equipment and systems. All equipment shall be left in clean operational condition.
- B. Inspection and Test Procedures

The following tests shall be conducted using the noted section of the latest edition of NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems as a reference:

1. Switchboard and Panelboard Assemblies – Visually inspect the equipment inside and out, check attachment to wall or floor, verify bus joint tightness, exercise all active components and perform continuity testing and megger phase to phase, neutral and ground. Minimum resistance shall be 100 megohms when 480V equipment tested at 1000VDC or 25 megohms when 208V equipment tested at 500VDC. Tabulate readings for each test. NETA ATS-7.1

- 2. Dry Type Transformers Visually inspect the transformer inside and out, verify vibration isolation installation, verify installation of the grounding bonding jumper, verify termination joint tightness, measure no load and partially loaded voltage and adjust taps as necessary. NETA ATS-7.2
- 3. Low Voltage Cables All feeders illustrated on the one line diagram shall be inspected and tested in accordance with the referenced standard. Visually inspect cables for physical damage, color code and proper termination. Check continuity for proper labeling and megger for insulation resistance. Megger test voltage shall be 1000VDC for one (1) minute with no values less than 50 megohms. Tabulate readings for each feeder. NETA ATS-7.3
- 4. Low Voltage, Molded and Insulated Case Circuit Breakers with frame size greater than 225 amperes and/or with adjustable trip units shall be tested and adjustable settings dialed to match the coordination study criteria. Perform an insulation resistance test at 1000VDC (thermal magnetic) or 500VDC (solid state) for one (1) minute from pole to pole and pole to ground, resistance values shall not be less than 100 megohms. Perform resistance test across open and closed breaker contacts of each phase. Test trip settings tolerance with primary current injection. Tabulate readings for each breaker. NETA ATS-7.6
- 5. Disconnect the main bonding jumper at the service and at each separately derived system and verify single connection between the grounded and grounding conductor. Reconnect all disconnected bonding connections. Test the grounding electrode system for resistance to earth to verify a maximum of 25 ohms. NETA ATS-7.13

END OF SECTION 16000

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## **SECTION 16321**

## **GENERATOR - DIESEL**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 16000 shall apply to this section unless specifically noted otherwise.

#### 1.2 SUMMARY

- A. Section includes packaged engine-generator sets for **standby** power supply with the following features:
  - 1. Outdoor enclosure
  - 2. Acceptance Testing
- B. Related Sections include the following:
  - 1. Division 16000 Electrical.
  - 2. Section 16360 Transfer Switches for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
- C. Engine driven electrical generating systems shall be as manufactured by
  - 1. Caterpillar
  - 2. Cummins
  - 3. Kohler
- D. Obtain packaged generator sets and all associated auxiliary components through one source from a single manufacturer.

#### 1.3 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each required component provide manufacturer's standard cut sheet containing technical details, listings and general information illustrating compliance with these specification requirements.
- B. Provide the following detailed documentation for review and evaluation:

- 1. The manufacturer shall provide copies of following documents for review and evaluation in accordance with general requirements of Division 01 and Division 26:
  - a. Factory published specification sheet indicating standard and optional accessories, ratings, etc. Weights of all equipment shall be highlighted.
  - b. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, silencer, exhaust flex, main circuit breaker, etc.
  - c. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems shall be included.
  - d. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, etc. Air flow requirements shall be for cooling and combustion air in CFM at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 °F.
  - e. Fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  - f. Generator electrical data including resistances, reactances, time constants, temperature and insulation data, thermal damage curve, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
  - g. Certified trip curves for each circuit breaker.
  - h. Certified copies of all Type (Design) and Verification Test Reports for prototype units.
  - i. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, and remote alarm indications.
  - j. Control panel schematics.
  - k. Calculations indicating acceptable performance of the submitted unit starting and running the specified load.
- 2. Report of exhaust emissions showing compliance with applicable regulations.
- 3. Third party certified noise test data on an equal or similar enclosure design.
- 4. Manufacturers and dealers written warranty.
- 5. Seismic Qualification Certificates for engine-generator set, accessories, and components.

# 1.5 CLOSEOUT SUBMITTALS

- A. Submit test report confirming acceptance of all Installation inspections and tests as outlined in Part 3 of this specification.
- B. Submit operation and maintenance data based on factory and field-testing, operation and maintenance of specified product.
- C. Submit maintenance manuals and recommended spare parts list required to conform to industry standard maintenance guidelines. Instructions shall include but not be limited to:
  - 1. Instructions for replacing any renewable components of the system.
  - 2. Instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.
  - 3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

### 1.6 QUALITY ASSURANCE

- A. The system design and installation shall conform to the following standards
  - 1. All equipment shall be UL listed for its intended purpose, including UL 2200.
  - 2. All applicable NFPA standards, including but not limited to: 70 and 110.
  - 3. State Building Code.
  - 4. All requirements of the Authority Having Jurisdiction (AHJ)
- B. The equipment supplier and the Contractor shall demonstrate a minimum five (5) years' experience in the successful design and installation of standby generation systems similar in size and scope to that required for this project.

## 1.7 WARRANTY

- A. The installer and manufacturer's warranty shall be for a minimum period of five (5) years from the date of the final acceptance test approval.
- B. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

## 1.8 COORDINATION

A. Coordinate sizes and locations of actual equipment provided. Provide sketches to illustrate submitted equipment will fit within the allocated space where the dimensions of the submitted equipment exceed those illustrated on the drawings for the basis of design.

# PART 2 - PRODUCTS

## 2.1 GENERAL

- A. Provide factory assembled water cooled diesel engine-driven electric generating system rated for emergency standby service. The automatic transfer switch(es) specified in other sections of this specification shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination. Refer to the drawings for service ratings at 60 Hz.
- B. The system shall automatically start and accept full rated load within ten (10) seconds of being signaled to start.
- C. Engine generator and accessories including control panel, engine starting batteries and output circuit breaker(s) shall be mounted within a sound attenuated weatherproof enclosure. Refer to the enclosure specification section for additional details.
- D. Specified kW is for continuous service during utility source interruption, as established in ISO 8528-3 at 86°F. Rating shall be substantiated by manufacturer's standard published curves. Special and maximum ratings will not be accepted.
- E. Supplier shall have been engaged regularly in generator or engine manufacture, or both, for at least twenty-five (25) years. The generator manufacturer and local dealer shall be ISO 9001 certified.

- F. The supplier shall maintain a full time in-house parts and service organization so that parts and service are readily available, twenty-four (24) hours/day seven (7) days/week. Qualified, factory trained service personnel shall be available within four (4) hours of notification.
- G. Prototype testing shall certify the acceptable performance of the generating set series. The test shall prove acceptance, as a system, of the design and integration of all components. Proposed system shall be a current factory production model. Prototype testing shall confirm:
  - 1. Fuel consumption at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 2. Exhaust emissions.
  - 3. Mechanical and exhaust noise levels.
  - 4. Governor speed regulation at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 5. Generator temperature rise in accordance with NEMA MG1-22.40
  - 6. Harmonic analysis, voltage waveform deviation and telephone influence factor.
  - 7. Generator short circuit capacity.
  - 8. Cooling system capacity.
- H. Provide manufacturer's load analysis calculation confirming that the generating set submitted is compatible with loads to be applied.
  - 1. Generator-Set Performance: Steady-State Voltage Operational Bandwidth: 3% of rated output voltage from no load to full load.
  - 2. Transient Voltage Performance: Not more than 20% variation for 50% step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three (3) seconds.
  - 3. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
  - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  - 5. Transient Frequency Performance: Less than 5% variation for 50% step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five (5) seconds.
  - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5% total and 3% for single harmonics. Telephone influence factor, determined according to NEMA MG1, shall not exceed 50%.
  - 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250% of rated full-load current for not less than ten (10) seconds and then clear the fault automatically, without damage to generator system components.
  - 8. Below requires ten (10) second maximum start time under specific conditions and includes startup only, not load assumption.
  - 9. Start Time: Comply with NFPA 110, Type 10, system requirements. The proposed generator set shall be factory EPA Certified <u>for</u> <u>stationary</u>
    - emergency use and be in compliance with the Commonwealth of Massachusetts Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier emissions standards per ISO 8178 – D2 Emissions Cycle at specified EKW/BHP rating. Utilization of the "Transition Program for Equipment Manufacturers" also known at "Flex Credits" to achieve Tier certification is not in compliance with MA Regulation "310 CMR 7.02 U Plan Approval and Emission Limitations" and will not be accepted.
- I. The manufacturer's warrantee shall be for a minimum period of five (5) years from the date of initial system start-up and acceptance or 1,500 operating hours, whichever occurs first. The warrantee shall include repair parts, expendables (lubricating oil, filters,

antifreeze, etc.), labor and travel expenses necessary for repairs at the job site. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

## 2.2 ENGINE

- A. The engine shall be diesel fueled, four (4) cycle, water-cooled, either vertical in-line or Vtype, with dry exhaust manifolds, operating with nominal speed not exceeding 1800 RPM. It shall have 4 cylinders with a minimum cubic inch displacement of **269**.
- B. Frequency regulation shall be lsochronous, regulated to within +/- 0.25% from no load to full load.
- C. All fuel piping shall be black iron or flexible fuel hose rated for this service. Flexible fuel lines rated 300°F and 100 PSI.
- D. The engine shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions, 110°F ambient air entering the room or enclosure (where an enclosure is specified), and permanent anti-freeze solution of 5 ethylene-glycol-based antifreeze and water with anticorrosion additives as recommended by engine manufacturer.to protect equipment to −15°F without derating the unit. Antifreeze shall have a service life of 3000 hours without maintenance. The generator set supplier is responsible for providing a properly sized cooling system based on the installed static pressure restriction.
- E. Provide thermostatically-controlled electric-immersion type engine jacket water heater, be sized by the manufacturer to maintain jacket water temperature at 90°F, 208 V, single-phase, 60 HZ mounted, piped and prewired to terminal strip.
- F. Lube oil pump shall be mechanically driven positive displacement. Lube oil system shall be piped through an oil cooler and a full flow filter with replaceable cartridge. Filter and Strainer shall be rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
- G. Fuel oil pump shall be mechanically driven positive displacement with dual full flow filters and replaceable cartridge. One filter shall be isolated while the other is on-line. Fuel system shall have a manual-priming pump. Fuel piping shall be arranged to prohibit loss of prime with an anti-siphon check valve at the fuel pump suction piping. Filter and Strainer shall be rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
- H. Air intake shall be via a heavy duty replaceable dry element filter and "blocked filter" indicator.
- I. Provide lubricating oil pressure gauge, water temperature gauge, battery charge rate ammeter and running time meter mounted in common panel with engine controls, alternator controls and alternator instruments.
- J. A critical type silencer (25-34 DBA at 500Hz exhaust noise reduction), companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be

imposed on the engine. The muffler and all indoor exhaust piping shall be "lagged" by the Contractor to maintain a surface temperature not to exceed 150°F. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

## 2.3 ALTERNATOR

- A. The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling to ensure permanent alignment. The insulation material shall meet NEMA standards for Class H insulation and be impregnated in a polyester varnish or vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (130 °C rise by resistance over 40°C ambient). Stator windings shall be random wound two-thirds pitch. Subtransient resistance shall not exceed 12%.
- B. The excitation system shall be of brushless construction. The permanent magnet brushless exciter shall be independent of main stator windings, shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes. Generator shall have the ability to sustain short circuit current for ten (10) seconds of 300% of rated current to allow protective devices to operate.
- C. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/-0.5% for any constant load between no load and full load. The regulator shall be three phase sensing, totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, overexcitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed. System shall reduce voltage automatically if load demand exceeds engine capacity and remove excitation when generator is overloaded for more than ten (10) seconds. Voltage regulator shall be, volts-per-hertz and include over voltage and under voltage protection.
  - 1. Maintain voltage within 20% on one step, full load
  - 2. Maintain frequency within 10% and stabilize at rated frequency within two (2) seconds.
- D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
  - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110% of full-rated load for sixty (60) seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
  - 2. Under single or three-phase fault conditions, regulates generator to 300% of rated full-load current for up to ten (10) seconds.
  - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- E. The alternator output shall be wired via a generator mounted 3 pole molded case circuit

breaker, trip rating as indicated on the drawings. Breaker shall utilize an electronic LSI solid state trip. Unit breaker shall each be housed in a steel NEMA 1 enclosure mounted on a separate support stand vibration isolated from the engine / generator arrangement.. Refer to the one line diagram for breaker information. Bus bars, sized for the cable type shown on drawing, shall be supplied on the load side of breaker.

### 2.4 VIBRATION ISOLATION

A. Provide linear vibration mounts between engine generator set and structural sub-base as recommended by equipment manufacturer. Unit shall be suitable for installation on any level surface.

## 2.5 STARTING

- A. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
- B. Provide 12 V lead acid batteries as recommended by equipment manufacturer, sized to provide no less than three cranking cycles without recharging. Provide unit mounted battery rack fabricated of metal with acid-resistant finish and thermal insulation, hold down and battery cables.
- C. A current limiting automatic-equalizing and float battery charger shall be furnished to recharge batteries. Unit shall comply with UL 1236 and include the following features:
  - 1. Equalizing-charging rate of 10 amps shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - 2. Adjust float and equalize voltages for variations in ambient temperature from minus 40 °F to 140 °F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - 3. Maintain constant output voltage regardless of input voltage variations up to plus or minus 10%.
  - 4. Ammeter and Voltmeter shall be flush mounted in door. Meters shall indicate charging rates.
  - 5. Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - 6. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
- D. Provide battery blanket heater to maintain battery temperature between 50°F and 90°F.

#### 2.6 CONTROL PANEL

A. Provide a generator set mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, cycle cranking, AC metering (0.5% true RMS accuracy) with phase selector switch, shutdown sensors and alarms with horn and reset, adjustable cool-down timer and emergency stop push-button and engine run time meter (non-resettable).

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- B. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged door.
- C. The panel itself shall be mounted on a separate support stand isolated from the engine / generator arrangement. Panel / breaker arrangements mounted on the generator set in such a way that access to the AC Generator terminal box is restricted in any way whatsoever are not acceptable.
- D. Provide the following readouts:
  - 1. Engine oil pressure
  - 2. Coolant temperature
  - 3. Engine RPM
  - 4. System DC Volts
  - 5. Engine running hours
  - 6. Generator AC volts
  - 7. Generator frequency
  - 8. Generator AC amps
- E. Provide the following indications for protection and diagnostics according to NFPA 110 Level 1:
  - 1. Low oil pressure
  - 2. High water temperature
  - 3. Low coolant level
  - 4. Overspeed
  - 5. Overcrank
  - 6. Emergency stop depressed
  - 7. Approaching high coolant temperature
  - 8. Approaching low oil pressure
  - 9. Low coolant temperature
  - 10. Low voltage in battery
  - 11. Control switch not in auto position
  - 12. Low fuel main tank
  - 13. Battery charger AC failure
  - 14. High battery voltage
  - 15. Fuel tank rupture
  - 16. Engine running
- F. Diagnostics capabilities shall identifying both system and component level issues. The diagnostic codes shall be maintained in a history log specifying the number of occurrences, and second/minute/hr at which they occur.
- G. Provide the following control functions:
  - 1. Terminals located inside the control panel for REMOTE EMERGENCY STOP
  - 2. ON / OFF / AUTO control switch
- H. Provide a minimum of four (4) programmable output dry contacts for connection to the Owner's security or ATC system. Three (3) of the four (4) outputs shall be programmed to alarm "Engine Running", "Summary Alarm" and "Generator not in Automatic".

#### 2.7 ANNUNCIATOR

A. Provide an annunciator to meet the requirements of NFPA 110, Level 1, installed in

enclosure suitable for surface mounting. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.

#### 2.8 I/O MODULE

A. Provide one (1) twelve-point remote I/O modules for redundant monitoring of NFPA110, Level 1 alarms by the Owner's security or ATC system. The remote I/O modules shall interconnect with the ECP on the remote annunciator network wiring and be located in the building adjacent to the Owner's data collection panel.

#### 2.9 SOUND ATTENUATED WEATHERPROOF ENCLOSURE.

- A. Engine generator set, generator control panel, engine starting batteries and internally mounted exhaust silencer shall be enclosed in factory-assembled, rainproof-weather-protective skid-base enclosure with full floor panel. The enclosure shall have a resulting sound level of 67 DBA at twenty-three (23) feet. The enclosure and generator shall be UL2200 labeled.
- B. Enclosure will consist of a roof, fuel tank and rupture basin base, two (2) side walls, and two (2) end walls, of highly corrosion resistant construction made from galvanized steel. Stainless steel flush fitting latches and hinges tested and proven to withstand extreme conditions of corrosion. The sheet steel components shall be pre-tested with zinc phosphate prior to polyester powder coating at 392 °F. Roof bows shall be cambered to aid in rain runoff.
- C. An integral fuel tank underframe and rupture basin shall be supplied, consisting of the following:
  - 1. A rupture basin utilizing minimum 7 gauge steel channel perimeter walls and bottom.
  - 2. A U.L. listed (per U.L. 142) above-ground **255** gallon capacity (48 hours @ 100% load) rectangular tank of minimum 12 gauge steel construction.)
  - 3. The tank shall have venting and emergency venting (to roof) per U.L. 142, lockable fill, low level and high level alarm contacts, and an electric analog level gauge.
  - 4. The fill valve shall have an overfill prevention type, equal to the "Stopper" OPW 61f stop.
  - 5. The rupture basin shall have a float contact to indicate tank rupture.
  - 6. The entire system shall be leak tested prior to installation.
- D. Intake openings shall be screened to prevent the entrance of rodents. The system shall include a cooling and combustion air inlet silencer system, an equipment enclosure section, and a cooling air discharge silencer section.
- E. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls. They shall be reinforced for rigidity and set is a welded frame to ensure proper operation. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if

necessary and/or top hung and supported by gas struts.

- F. Battery racks and batteries shall be factory-installed and wired. Exhaust silencer, flexible exhaust connector and condensate drain valve shall be factory-installed.
- G. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves and capped with pipe nipples on flanged connectors. Radiator access shall be through a hinged, lockable cover on enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.
- H. Owner shall select finish color of enclosure.
- I. Provide a remote manual stop break-glass station to allow emergency shutdown of the unit. The station shall be integrated into and located on the exterior of the enclosure. It shall be accessible from the exterior, no greater than 6'-0" AFG

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Placement of the generator shall be the responsibility of the electrical Contractor. Coordinate placement with the Owner's Representative and obtain all associated permits and permissions necessary for blockage of public way, interference with parking, etc.
- B. Fill all fluid levels (including fuel where applicable) to maximum recommended levels by the manufacturer prior to testing and after testing completed.

#### 3.2 START-UP AND TESTING

- A. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following four (4) hour load test:
  - 1. Verify that the equipment has been properly installed.
  - 2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, all remote annunciator points, etc.
  - 3. Test all alarms and safety shutdown devices for proper operation and annunciation.
  - 4. Check all fluid levels.
  - 5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
  - 6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
  - 7. Connect the generator to building load and verify that the generator will start and run all designated loads. Testing shall be performed in accordance with NFPA 110 from a "cold start" condition. Each of the following shall be observed and recorded upon opening of the Normal supply circuit breaker to the ATS:
    - a. Time delay on start
    - b. Cranking time until the prime mover starts and runs
    - c. Time required to reach operating speed
    - d. Voltage and frequency overshoot
    - e. Time required to reach steady state conditions with all switches transferred to the emergency position
    - f. Voltage, frequency and current
  - 8. The system shall be tested under load for a period of two (2) hours. The following

GENERATOR DIESEL – 35 STATE RD 16321 – 10 readings shall be taken at fifteen (15) minute intervals:

- a. Oil pressure
- b. Coolant temperature
- c. Battery charge rate
- d. AC volts
- e. AC Amperes- all phases
- f. Frequency
- g. Kilowatts
- h. Kilovolt-amperes
- i. Ambient Temperature
- 9. Allow system to cool for five (5) minutes.
- 10. The system shall be tested for a period of two (2) hours with the use of a portable resistive/reactive loadbank at 100% rated load. Load shall be applied upon reaching rated RPM in one step. All data specified above shall be recorded for this segment until completion of the two-hour test.
- 11. The Generator Distributor shall provide a written test report upon completion of testing. Report shall specifically indicate the successful completion of each item referenced above and submit all recordings in a format similar to NFPA 110 tables.
- B. All costs associated with the referenced testing, including fuel consumption, load bank rental, temporary cables from the generator to the load bank, etc. shall be included in the bid price.
- 3.3 TRAINING
  - A. Provide a one (1) day of on-site training to instruct the Owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

### END OF SECTION 26321

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## SECTION 16321

### **GENERATOR - DIESEL**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 16000 shall apply to this section unless specifically noted otherwise.

#### 1.2 SUMMARY

- A. Section includes packaged engine-generator sets for **standby** power supply with the following features:
  - 1. Outdoor enclosure
  - 2. Acceptance Testing
- B. Related Sections include the following:
  - 1. Division 16000 Electrical.
  - 2. Section 16360 Transfer Switches for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
- C. Engine driven electrical generating systems shall be as manufactured by
  - 1. Caterpillar
  - 2. Cummins
  - 3. Kohler
- D. Obtain packaged generator sets and all associated auxiliary components through one source from a single manufacturer.

#### 1.3 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each required component provide manufacturer's standard cut sheet containing technical details, listings and general information illustrating compliance with these specification requirements.
- B. Provide the following detailed documentation for review and evaluation:

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- 1. The manufacturer shall provide copies of following documents for review and evaluation in accordance with general requirements of Division 01 and Division 26:
  - a. Factory published specification sheet indicating standard and optional accessories, ratings, etc. Weights of all equipment shall be highlighted.
  - b. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, silencer, exhaust flex, main circuit breaker, etc.
  - c. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems shall be included.
  - d. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, etc. Air flow requirements shall be for cooling and combustion air in CFM at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 °F.
  - e. Fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  - f. Generator electrical data including resistances, reactances, time constants, temperature and insulation data, thermal damage curve, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
  - g. Certified trip curves for each circuit breaker.
  - h. Certified copies of all Type (Design) and Verification Test Reports for prototype units.
  - i. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, and remote alarm indications.
  - j. Control panel schematics.
  - k. Calculations indicating acceptable performance of the submitted unit starting and running the specified load.
- 2. Report of exhaust emissions showing compliance with applicable regulations.
- 3. Third party certified noise test data on an equal or similar enclosure design.
- 4. Manufacturers and dealers written warranty.
- 5. Seismic Qualification Certificates for engine-generator set, accessories, and components.

# 1.5 CLOSEOUT SUBMITTALS

- A. Submit test report confirming acceptance of all Installation inspections and tests as outlined in Part 3 of this specification.
- B. Submit operation and maintenance data based on factory and field-testing, operation and maintenance of specified product.
- C. Submit maintenance manuals and recommended spare parts list required to conform to industry standard maintenance guidelines. Instructions shall include but not be limited to:
  - 1. Instructions for replacing any renewable components of the system.
  - 2. Instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.
  - 3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

### 1.6 QUALITY ASSURANCE

- A. The system design and installation shall conform to the following standards
  - 1. All equipment shall be UL listed for its intended purpose, including UL 2200.
  - 2. All applicable NFPA standards, including but not limited to: 70 and 110.
  - 3. State Building Code.
  - 4. All requirements of the Authority Having Jurisdiction (AHJ)
- B. The equipment supplier and the Contractor shall demonstrate a minimum five (5) years' experience in the successful design and installation of standby generation systems similar in size and scope to that required for this project.

## 1.7 WARRANTY

- A. The installer and manufacturer's warranty shall be for a minimum period of five (5) years from the date of the final acceptance test approval.
- B. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

## 1.8 COORDINATION

A. Coordinate sizes and locations of actual equipment provided. Provide sketches to illustrate submitted equipment will fit within the allocated space where the dimensions of the submitted equipment exceed those illustrated on the drawings for the basis of design.

# PART 2 - PRODUCTS

## 2.1 GENERAL

- A. Provide factory assembled water cooled diesel engine-driven electric generating system rated for emergency standby service. The automatic transfer switch(es) specified in other sections of this specification shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination. Refer to the drawings for service ratings at 60 Hz.
- B. The system shall automatically start and accept full rated load within ten (10) seconds of being signaled to start.
- C. Engine generator and accessories including control panel, engine starting batteries and output circuit breaker(s) shall be mounted within a sound attenuated weatherproof enclosure. Refer to the enclosure specification section for additional details.
- D. Specified kW is for continuous service during utility source interruption, as established in ISO 8528-3 at 86°F. Rating shall be substantiated by manufacturer's standard published curves. Special and maximum ratings will not be accepted.
- E. Supplier shall have been engaged regularly in generator or engine manufacture, or both, for at least twenty-five (25) years. The generator manufacturer and local dealer shall be ISO 9001 certified.

- F. The supplier shall maintain a full time in-house parts and service organization so that parts and service are readily available, twenty-four (24) hours/day seven (7) days/week. Qualified, factory trained service personnel shall be available within four (4) hours of notification.
- G. Prototype testing shall certify the acceptable performance of the generating set series. The test shall prove acceptance, as a system, of the design and integration of all components. Proposed system shall be a current factory production model. Prototype testing shall confirm:
  - 1. Fuel consumption at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 2. Exhaust emissions.
  - 3. Mechanical and exhaust noise levels.
  - 4. Governor speed regulation at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 5. Generator temperature rise in accordance with NEMA MG1-22.40
  - 6. Harmonic analysis, voltage waveform deviation and telephone influence factor.
  - 7. Generator short circuit capacity.
  - 8. Cooling system capacity.
- H. Provide manufacturer's load analysis calculation confirming that the generating set submitted is compatible with loads to be applied.
  - 1. Generator-Set Performance: Steady-State Voltage Operational Bandwidth: 3% of rated output voltage from no load to full load.
  - 2. Transient Voltage Performance: Not more than 20% variation for 50% step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three (3) seconds.
  - 3. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
  - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
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  - 9. Start Time: Comply with NFPA 110, Type 10, system requirements. The proposed generator set shall be factory EPA Certified <u>for stationary</u> emergency use and be in compliance with the Commonwealth of Massachusetts
    - <u>emergency use and be in compliance with the Commonwealth of Massachusetts</u> Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier emissions standards per ISO 8178 – D2 Emissions Cycle at specified EKW/BHP rating. Utilization of the "Transition Program for Equipment Manufacturers" also known at "Flex Credits" to achieve Tier certification is not in compliance with MA Regulation "310 CMR 7.02 U Plan Approval and Emission Limitations" and will not be accepted.
- I. The manufacturer's warrantee shall be for a minimum period of five (5) years from the date of initial system start-up and acceptance or 1,500 operating hours, whichever occurs first. The warrantee shall include repair parts, expendables (lubricating oil, filters,

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## 2.2 ENGINE

- A. The engine shall be diesel fueled, four (4) cycle, water-cooled, either vertical in-line or Vtype, with dry exhaust manifolds, operating with nominal speed not exceeding 1800 RPM. It shall have 4 cylinders with a minimum cubic inch displacement of **269**.
- B. Frequency regulation shall be lsochronous, regulated to within +/- 0.25% from no load to full load.
- C. All fuel piping shall be black iron or flexible fuel hose rated for this service. Flexible fuel lines rated 300°F and 100 PSI.
- D. The engine shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions, 110°F ambient air entering the room or enclosure (where an enclosure is specified), and permanent anti-freeze solution of 5 ethylene-glycol-based antifreeze and water with anticorrosion additives as recommended by engine manufacturer to protect equipment to -15°F without derating the unit. Antifreeze shall have a service life of 3000 hours without maintenance. The generator set supplier is responsible for providing a properly sized cooling system based on the installed static pressure restriction.
- E. Provide thermostatically-controlled electric-immersion type engine jacket water heater, be sized by the manufacturer to maintain jacket water temperature at 90°F, 208 V, single-phase, 60 HZ mounted, piped and prewired to terminal strip.
- F. Lube oil pump shall be mechanically driven positive displacement. Lube oil system shall be piped through an oil cooler and a full flow filter with replaceable cartridge. Filter and Strainer shall be rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
- G. Fuel oil pump shall be mechanically driven positive displacement with dual full flow filters and replaceable cartridge. One filter shall be isolated while the other is on-line. Fuel system shall have a manual-priming pump. Fuel piping shall be arranged to prohibit loss of prime with an anti-siphon check valve at the fuel pump suction piping. Filter and Strainer shall be rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
- H. Air intake shall be via a heavy duty replaceable dry element filter and "blocked filter" indicator.
- I. Provide lubricating oil pressure gauge, water temperature gauge, battery charge rate ammeter and running time meter mounted in common panel with engine controls, alternator controls and alternator instruments.
- J. A critical type silencer (25-34 DBA at 500Hz exhaust noise reduction), companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be

imposed on the engine. The muffler and all indoor exhaust piping shall be "lagged" by the Contractor to maintain a surface temperature not to exceed 150°F. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

## 2.3 ALTERNATOR

- A. The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling to ensure permanent alignment. The insulation material shall meet NEMA standards for Class H insulation and be impregnated in a polyester varnish or vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (130 °C rise by resistance over 40°C ambient). Stator windings shall be random wound two-thirds pitch. Subtransient resistance shall not exceed 12%.
- B. The excitation system shall be of brushless construction. The permanent magnet brushless exciter shall be independent of main stator windings, shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes. Generator shall have the ability to sustain short circuit current for ten (10) seconds of 300% of rated current to allow protective devices to operate.
- C. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/-0.5% for any constant load between no load and full load. The regulator shall be three phase sensing, totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, overexcitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed. System shall reduce voltage automatically if load demand exceeds engine capacity and remove excitation when generator is overloaded for more than ten (10) seconds. Voltage regulator shall be, volts-per-hertz and include over voltage and under voltage protection.
  - 1. Maintain voltage within 20% on one step, full load
  - 2. Maintain frequency within 10% and stabilize at rated frequency within two (2) seconds.
- D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
  - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110% of full-rated load for sixty (60) seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
  - 2. Under single or three-phase fault conditions, regulates generator to 300% of rated full-load current for up to ten (10) seconds.
  - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- E. The alternator output shall be wired via a generator mounted 3 pole molded case circuit

breaker, trip rating as indicated on the drawings. Breaker shall utilize an electronic LSI solid state trip. Unit breaker shall each be housed in a steel NEMA 1 enclosure mounted on a separate support stand vibration isolated from the engine / generator arrangement.. Refer to the one line diagram for breaker information. Bus bars, sized for the cable type shown on drawing, shall be supplied on the load side of breaker.

### 2.4 VIBRATION ISOLATION

A. Provide linear vibration mounts between engine generator set and structural sub-base as recommended by equipment manufacturer. Unit shall be suitable for installation on any level surface.

## 2.5 STARTING

- A. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
- B. Provide 12 V lead acid batteries as recommended by equipment manufacturer, sized to provide no less than three cranking cycles without recharging. Provide unit mounted battery rack fabricated of metal with acid-resistant finish and thermal insulation, hold down and battery cables.
- C. A current limiting automatic-equalizing and float battery charger shall be furnished to recharge batteries. Unit shall comply with UL 1236 and include the following features:
  - 1. Equalizing-charging rate of 10 amps shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - 2. Adjust float and equalize voltages for variations in ambient temperature from minus 40 °F to 140 °F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - 3. Maintain constant output voltage regardless of input voltage variations up to plus or minus 10%.
  - 4. Ammeter and Voltmeter shall be flush mounted in door. Meters shall indicate charging rates.
  - 5. Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - 6. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
- D. Provide battery blanket heater to maintain battery temperature between 50°F and 90°F.

#### 2.6 CONTROL PANEL

A. Provide a generator set mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, cycle cranking, AC metering (0.5% true RMS accuracy) with phase selector switch, shutdown sensors and alarms with horn and reset, adjustable cool-down timer and emergency stop push-button and engine run time meter (non-resettable).

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- B. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged door.
- C. The panel itself shall be mounted on a separate support stand isolated from the engine / generator arrangement. Panel / breaker arrangements mounted on the generator set in such a way that access to the AC Generator terminal box is restricted in any way whatsoever are not acceptable.
- D. Provide the following readouts:
  - 1. Engine oil pressure
  - 2. Coolant temperature
  - 3. Engine RPM
  - 4. System DC Volts
  - 5. Engine running hours
  - 6. Generator AC volts
  - 7. Generator frequency
  - 8. Generator AC amps
- E. Provide the following indications for protection and diagnostics according to NFPA 110 Level 1:
  - 1. Low oil pressure
  - 2. High water temperature
  - 3. Low coolant level
  - 4. Overspeed
  - 5. Overcrank
  - 6. Emergency stop depressed
  - 7. Approaching high coolant temperature
  - 8. Approaching low oil pressure
  - 9. Low coolant temperature
  - 10. Low voltage in battery
  - 11. Control switch not in auto position
  - 12. Low fuel main tank
  - 13. Battery charger AC failure
  - 14. High battery voltage
  - 15. Fuel tank rupture
  - 16. Engine running
- F. Diagnostics capabilities shall identifying both system and component level issues. The diagnostic codes shall be maintained in a history log specifying the number of occurrences, and second/minute/hr at which they occur.
- G. Provide the following control functions:
  - 1. Terminals located inside the control panel for REMOTE EMERGENCY STOP
  - 2. ON / OFF / AUTO control switch
- H. Provide a minimum of four (4) programmable output dry contacts for connection to the Owner's security or ATC system. Three (3) of the four (4) outputs shall be programmed to alarm "Engine Running", "Summary Alarm" and "Generator not in Automatic".

#### 2.7 ANNUNCIATOR

A. Provide an annunciator to meet the requirements of NFPA 110, Level 1, installed in

enclosure suitable for surface mounting. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.

#### 2.8 I/O MODULE

A. Provide one (1) twelve-point remote I/O modules for redundant monitoring of NFPA110, Level 1 alarms by the Owner's security or ATC system. The remote I/O modules shall interconnect with the ECP on the remote annunciator network wiring and be located in the building adjacent to the Owner's data collection panel.

#### 2.9 SOUND ATTENUATED WEATHERPROOF ENCLOSURE.

- A. Engine generator set, generator control panel, engine starting batteries and internally mounted exhaust silencer shall be enclosed in factory-assembled, rainproof-weather-protective skid-base enclosure with full floor panel. The enclosure shall have a resulting sound level of 67 DBA at twenty-three (23) feet. The enclosure and generator shall be UL2200 labeled.
- B. Enclosure will consist of a roof, fuel tank and rupture basin base, two (2) side walls, and two (2) end walls, of highly corrosion resistant construction made from galvanized steel. Stainless steel flush fitting latches and hinges tested and proven to withstand extreme conditions of corrosion. The sheet steel components shall be pre-tested with zinc phosphate prior to polyester powder coating at 392 °F. Roof bows shall be cambered to aid in rain runoff.
- C. An integral fuel tank underframe and rupture basin shall be supplied, consisting of the following:
  - 1. A rupture basin utilizing minimum 7 gauge steel channel perimeter walls and bottom.
  - 2. A U.L. listed (per U.L. 142) above-ground **255** gallon capacity (48 hours @ 100% load) rectangular tank of minimum 12 gauge steel construction.)
  - 3. The tank shall have venting and emergency venting (to roof) per U.L. 142, lockable fill, low level and high level alarm contacts, and an electric analog level gauge.
  - 4. The fill valve shall have an overfill prevention type, equal to the "Stopper" OPW 61f stop.
  - 5. The rupture basin shall have a float contact to indicate tank rupture.
  - 6. The entire system shall be leak tested prior to installation.
- D. Intake openings shall be screened to prevent the entrance of rodents. The system shall include a cooling and combustion air inlet silencer system, an equipment enclosure section, and a cooling air discharge silencer section.
- E. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls. They shall be reinforced for rigidity and set is a welded frame to ensure proper operation. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if

GENERATOR DIESEL – 233 STATE RD 16321 – 9 necessary and/or top hung and supported by gas struts.

- F. Battery racks and batteries shall be factory-installed and wired. Exhaust silencer, flexible exhaust connector and condensate drain valve shall be factory-installed.
- G. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves and capped with pipe nipples on flanged connectors. Radiator access shall be through a hinged, lockable cover on enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.
- H. Owner shall select finish color of enclosure.
- I. Provide a remote manual stop break-glass station to allow emergency shutdown of the unit. The station shall be integrated into and located on the exterior of the enclosure. It shall be accessible from the exterior, no greater than 6'-0" AFG

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Placement of the generator shall be the responsibility of the electrical Contractor. Coordinate placement with the Owner's Representative and obtain all associated permits and permissions necessary for blockage of public way, interference with parking, etc.
- B. Fill all fluid levels (including fuel where applicable) to maximum recommended levels by the manufacturer prior to testing and after testing completed.

#### 3.2 START-UP AND TESTING

- A. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following four (4) hour load test:
  - 1. Verify that the equipment has been properly installed.
  - 2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, all remote annunciator points, etc.
  - 3. Test all alarms and safety shutdown devices for proper operation and annunciation.
  - 4. Check all fluid levels.
  - 5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
  - 6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
  - 7. Connect the generator to building load and verify that the generator will start and run all designated loads. Testing shall be performed in accordance with NFPA 110 from a "cold start" condition. Each of the following shall be observed and recorded upon opening of the Normal supply circuit breaker to the ATS:
    - a. Time delay on start
    - b. Cranking time until the prime mover starts and runs
    - c. Time required to reach operating speed
    - d. Voltage and frequency overshoot
    - e. Time required to reach steady state conditions with all switches transferred to the emergency position
    - f. Voltage, frequency and current
  - 8. The system shall be tested under load for a period of two (2) hours. The following

GENERATOR DIESEL – 233 STATE RD 16321 – 10 readings shall be taken at fifteen (15) minute intervals:

- a. Oil pressure
- b. Coolant temperature
- c. Battery charge rate
- d. AC volts
- e. AC Amperes- all phases
- f. Frequency
- g. Kilowatts
- h. Kilovolt-amperes
- i. Ambient Temperature
- 9. Allow system to cool for five (5) minutes.
- 10. The system shall be tested for a period of two (2) hours with the use of a portable resistive/reactive loadbank at 100% rated load. Load shall be applied upon reaching rated RPM in one step. All data specified above shall be recorded for this segment until completion of the two-hour test.
- 11. The Generator Distributor shall provide a written test report upon completion of testing. Report shall specifically indicate the successful completion of each item referenced above and submit all recordings in a format similar to NFPA 110 tables.
- B. All costs associated with the referenced testing, including fuel consumption, load bank rental, temporary cables from the generator to the load bank, etc. shall be included in the bid price.
- 3.3 TRAINING
  - A. Provide a one (1) day of on-site training to instruct the Owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

### END OF SECTION 26321

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## SECTION 16321

### **GENERATOR - DIESEL**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 16000 shall apply to this section unless specifically noted otherwise.

#### 1.2 SUMMARY

- A. Section includes packaged engine-generator sets for **standby** power supply with the following features:
  - 1. Outdoor enclosure
  - 2. Acceptance Testing
- B. Related Sections include the following:
  - 1. Division 16000 Electrical.
  - 2. Section 16360 Transfer Switches for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
- C. Engine driven electrical generating systems shall be as manufactured by
  - 1. Caterpillar
  - 2. Cummins
  - 3. Kohler
- D. Obtain packaged generator sets and all associated auxiliary components through one source from a single manufacturer.

#### 1.3 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each required component provide manufacturer's standard cut sheet containing technical details, listings and general information illustrating compliance with these specification requirements.
- B. Provide the following detailed documentation for review and evaluation:

- 1. The manufacturer shall provide copies of following documents for review and evaluation in accordance with general requirements of Division 01 and Division 26:
  - a. Factory published specification sheet indicating standard and optional accessories, ratings, etc. Weights of all equipment shall be highlighted.
  - b. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, silencer, exhaust flex, main circuit breaker, etc.
  - c. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems shall be included.
  - d. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, etc. Air flow requirements shall be for cooling and combustion air in CFM at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 °F.
  - e. Fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  - f. Generator electrical data including resistances, reactances, time constants, temperature and insulation data, thermal damage curve, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
  - g. Certified trip curves for each circuit breaker.
  - h. Certified copies of all Type (Design) and Verification Test Reports for prototype units.
  - i. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, and remote alarm indications.
  - j. Control panel schematics.
  - k. Calculations indicating acceptable performance of the submitted unit starting and running the specified load.
- 2. Report of exhaust emissions showing compliance with applicable regulations.
- 3. Third party certified noise test data on an equal or similar enclosure design.
- 4. Manufacturers and dealers written warranty.
- 5. Seismic Qualification Certificates for engine-generator set, accessories, and components.

# 1.5 CLOSEOUT SUBMITTALS

- A. Submit test report confirming acceptance of all Installation inspections and tests as outlined in Part 3 of this specification.
- B. Submit operation and maintenance data based on factory and field-testing, operation and maintenance of specified product.
- C. Submit maintenance manuals and recommended spare parts list required to conform to industry standard maintenance guidelines. Instructions shall include but not be limited to:
  - 1. Instructions for replacing any renewable components of the system.
  - 2. Instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.
  - 3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

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### 1.6 QUALITY ASSURANCE

- A. The system design and installation shall conform to the following standards
  - 1. All equipment shall be UL listed for its intended purpose, including UL 2200.
  - 2. All applicable NFPA standards, including but not limited to: 70 and 110.
  - 3. State Building Code.
  - 4. All requirements of the Authority Having Jurisdiction (AHJ)
- B. The equipment supplier and the Contractor shall demonstrate a minimum five (5) years' experience in the successful design and installation of standby generation systems similar in size and scope to that required for this project.

## 1.7 WARRANTY

- A. The installer and manufacturer's warranty shall be for a minimum period of five (5) years from the date of the final acceptance test approval.
- B. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

## 1.8 COORDINATION

A. Coordinate sizes and locations of actual equipment provided. Provide sketches to illustrate submitted equipment will fit within the allocated space where the dimensions of the submitted equipment exceed those illustrated on the drawings for the basis of design.

# PART 2 - PRODUCTS

## 2.1 GENERAL

- A. Provide factory assembled water cooled diesel engine-driven electric generating system rated for emergency standby service. The automatic transfer switch(es) specified in other sections of this specification shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination. Refer to the drawings for service ratings at 60 Hz.
- B. The system shall automatically start and accept full rated load within ten (10) seconds of being signaled to start.
- C. Engine generator and accessories including control panel, engine starting batteries and output circuit breaker(s) shall be mounted within a sound attenuated weatherproof enclosure. Refer to the enclosure specification section for additional details.
- D. Specified kW is for continuous service during utility source interruption, as established in ISO 8528-3 at 86°F. Rating shall be substantiated by manufacturer's standard published curves. Special and maximum ratings will not be accepted.
- E. Supplier shall have been engaged regularly in generator or engine manufacture, or both, for at least twenty-five (25) years. The generator manufacturer and local dealer shall be ISO 9001 certified.

- F. The supplier shall maintain a full time in-house parts and service organization so that parts and service are readily available, twenty-four (24) hours/day seven (7) days/week. Qualified, factory trained service personnel shall be available within four (4) hours of notification.
- G. Prototype testing shall certify the acceptable performance of the generating set series. The test shall prove acceptance, as a system, of the design and integration of all components. Proposed system shall be a current factory production model. Prototype testing shall confirm:
  - 1. Fuel consumption at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 2. Exhaust emissions.
  - 3. Mechanical and exhaust noise levels.
  - 4. Governor speed regulation at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 5. Generator temperature rise in accordance with NEMA MG1-22.40
  - 6. Harmonic analysis, voltage waveform deviation and telephone influence factor.
  - 7. Generator short circuit capacity.
  - 8. Cooling system capacity.
- H. Provide manufacturer's load analysis calculation confirming that the generating set submitted is compatible with loads to be applied.
  - 1. Generator-Set Performance: Steady-State Voltage Operational Bandwidth: 3% of rated output voltage from no load to full load.
  - 2. Transient Voltage Performance: Not more than 20% variation for 50% step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three (3) seconds.
  - 3. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
  - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  - 5. Transient Frequency Performance: Less than 5% variation for 50% step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five (5) seconds.
  - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5% total and 3% for single harmonics. Telephone influence factor, determined according to NEMA MG1, shall not exceed 50%.
  - 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250% of rated full-load current for not less than ten (10) seconds and then clear the fault automatically, without damage to generator system components.
  - 8. Below requires ten (10) second maximum start time under specific conditions and includes startup only, not load assumption.
  - 9. Start Time: Comply with NFPA 110, Type 10, system requirements. The proposed generator set shall be factory EPA Certified <u>for stationary</u> <u>emergency use</u> and <u>be in compliance with the Commonwealth of Massachusetts</u> <u>Emission regulations at the time of installation (commissioning Actual engine</u>
    - Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier emissions standards per ISO 8178 – D2 Emissions Cycle at specified EKW/BHP rating. Utilization of the "Transition Program for Equipment Manufacturers" also known at "Flex Credits" to achieve Tier certification is not in compliance with MA Regulation "310 CMR 7.02 U Plan Approval and Emission Limitations" and will not be accepted.
- I. The manufacturer's warrantee shall be for a minimum period of five (5) years from the date of initial system start-up and acceptance or 1,500 operating hours, whichever occurs first. The warrantee shall include repair parts, expendables (lubricating oil, filters,

antifreeze, etc.), labor and travel expenses necessary for repairs at the job site. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

## 2.2 ENGINE

- A. The engine shall be diesel fueled, four (4) cycle, water-cooled, either vertical in-line or Vtype, with dry exhaust manifolds, operating with nominal speed not exceeding 1800 RPM. It shall have **6** cylinders with a minimum cubic inch displacement of **428**.
- B. Frequency regulation shall be lsochronous, regulated to within +/- 0.25% from no load to full load.
- C. All fuel piping shall be black iron or flexible fuel hose rated for this service. Flexible fuel lines rated 300°F and 100 PSI.
- D. The engine shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions, 110°F ambient air entering the room or enclosure (where an enclosure is specified), and permanent anti-freeze solution of 5 ethylene-glycol-based antifreeze and water with anticorrosion additives as recommended by engine manufacturer to protect equipment to -15°F without derating the unit. Antifreeze shall have a service life of 3000 hours without maintenance. The generator set supplier is responsible for providing a properly sized cooling system based on the installed static pressure restriction.
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- I. Provide lubricating oil pressure gauge, water temperature gauge, battery charge rate ammeter and running time meter mounted in common panel with engine controls, alternator controls and alternator instruments.
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imposed on the engine. The muffler and all indoor exhaust piping shall be "lagged" by the Contractor to maintain a surface temperature not to exceed 150°F. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

## 2.3 ALTERNATOR

- A. The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling to ensure permanent alignment. The insulation material shall meet NEMA standards for Class H insulation and be impregnated in a polyester varnish or vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (130 °C rise by resistance over 40°C ambient). Stator windings shall be random wound two-thirds pitch. Subtransient resistance shall not exceed 12%.
- B. The excitation system shall be of brushless construction. The permanent magnet brushless exciter shall be independent of main stator windings, shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes. Generator shall have the ability to sustain short circuit current for ten (10) seconds of 300% of rated current to allow protective devices to operate.
- C. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/-0.5% for any constant load between no load and full load. The regulator shall be three phase sensing, totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, overexcitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed. System shall reduce voltage automatically if load demand exceeds engine capacity and remove excitation when generator is overloaded for more than ten (10) seconds. Voltage regulator shall be, volts-per-hertz and include over voltage and under voltage protection.
  - 1. Maintain voltage within 20% on one step, full load
  - 2. Maintain frequency within 10% and stabilize at rated frequency within two (2) seconds.
- D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
  - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110% of full-rated load for sixty (60) seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
  - 2. Under single or three-phase fault conditions, regulates generator to 300% of rated full-load current for up to ten (10) seconds.
  - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- E. The alternator output shall be wired via a generator mounted 3 pole molded case circuit
breaker, trip rating as indicated on the drawings. Breaker shall utilize an electronic LSI solid state trip. Unit breaker shall each be housed in a steel NEMA 1 enclosure mounted on a separate support stand vibration isolated from the engine / generator arrangement.. Refer to the one line diagram for breaker information. Bus bars, sized for the cable type shown on drawing, shall be supplied on the load side of breaker.

## 2.4 VIBRATION ISOLATION

A. Provide linear vibration mounts between engine generator set and structural sub-base as recommended by equipment manufacturer. Unit shall be suitable for installation on any level surface.

# 2.5 STARTING

- A. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
- B. Provide 12 V lead acid batteries as recommended by equipment manufacturer, sized to provide no less than three cranking cycles without recharging. Provide unit mounted battery rack fabricated of metal with acid-resistant finish and thermal insulation, hold down and battery cables.
- C. A current limiting automatic-equalizing and float battery charger shall be furnished to recharge batteries. Unit shall comply with UL 1236 and include the following features:
  - 1. Equalizing-charging rate of 10 amps shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - 2. Adjust float and equalize voltages for variations in ambient temperature from minus 40 °F to 140 °F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - 3. Maintain constant output voltage regardless of input voltage variations up to plus or minus 10%.
  - 4. Ammeter and Voltmeter shall be flush mounted in door. Meters shall indicate charging rates.
  - 5. Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - 6. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
- D. Provide battery blanket heater to maintain battery temperature between 50°F and 90°F.

### 2.6 CONTROL PANEL

A. Provide a generator set mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, cycle cranking, AC metering (0.5% true RMS accuracy) with phase selector switch, shutdown sensors and alarms with horn and reset, adjustable cool-down timer and emergency stop push-button and engine run time meter (non-resettable).

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- B. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged door.
- C. The panel itself shall be mounted on a separate support stand isolated from the engine / generator arrangement. Panel / breaker arrangements mounted on the generator set in such a way that access to the AC Generator terminal box is restricted in any way whatsoever are not acceptable.
- D. Provide the following readouts:
  - 1. Engine oil pressure
  - 2. Coolant temperature
  - 3. Engine RPM
  - 4. System DC Volts
  - 5. Engine running hours
  - 6. Generator AC volts
  - 7. Generator frequency
  - 8. Generator AC amps
- E. Provide the following indications for protection and diagnostics according to NFPA 110 Level 1:
  - 1. Low oil pressure
  - 2. High water temperature
  - 3. Low coolant level
  - 4. Overspeed
  - 5. Overcrank
  - 6. Emergency stop depressed
  - 7. Approaching high coolant temperature
  - 8. Approaching low oil pressure
  - 9. Low coolant temperature
  - 10. Low voltage in battery
  - 11. Control switch not in auto position
  - 12. Low fuel main tank
  - 13. Battery charger AC failure
  - 14. High battery voltage
  - 15. Fuel tank rupture
  - 16. Engine running
- F. Diagnostics capabilities shall identifying both system and component level issues. The diagnostic codes shall be maintained in a history log specifying the number of occurrences, and second/minute/hr at which they occur.
- G. Provide the following control functions:
  - 1. Terminals located inside the control panel for REMOTE EMERGENCY STOP
  - 2. ON / OFF / AUTO control switch
- H. Provide a minimum of four (4) programmable output dry contacts for connection to the Owner's security or ATC system. Three (3) of the four (4) outputs shall be programmed to alarm "Engine Running", "Summary Alarm" and "Generator not in Automatic".

### 2.7 ANNUNCIATOR

A. Provide an annunciator to meet the requirements of NFPA 110, Level 1, installed in

enclosure suitable for surface mounting. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.

#### 2.8 I/O MODULE

A. Provide one (1) twelve-point remote I/O modules for redundant monitoring of NFPA110, Level 1 alarms by the Owner's security or ATC system. The remote I/O modules shall interconnect with the ECP on the remote annunciator network wiring and be located in the building adjacent to the Owner's data collection panel.

#### 2.9 SOUND ATTENUATED WEATHERPROOF ENCLOSURE.

- A. Engine generator set, generator control panel, engine starting batteries and internally mounted exhaust silencer shall be enclosed in factory-assembled, rainproof-weather-protective skid-base enclosure with full floor panel. The enclosure shall have a resulting sound level of 67 DBA at twenty-three (23) feet. The enclosure and generator shall be UL2200 labeled.
- B. Enclosure will consist of a roof, fuel tank and rupture basin base, two (2) side walls, and two (2) end walls, of highly corrosion resistant construction made from galvanized steel. Stainless steel flush fitting latches and hinges tested and proven to withstand extreme conditions of corrosion. The sheet steel components shall be pre-tested with zinc phosphate prior to polyester powder coating at 392 °F. Roof bows shall be cambered to aid in rain runoff.
- C. An integral fuel tank underframe and rupture basin shall be supplied, consisting of the following:
  - 1. A rupture basin utilizing minimum 7 gauge steel channel perimeter walls and bottom.
  - 2. A U.L. listed (per U.L. 142) above-ground **777** gallon capacity (48 hours @ 100% load) rectangular tank of minimum 12 gauge steel construction.)
  - 3. The tank shall have venting and emergency venting (to roof) per U.L. 142, lockable fill, low level and high level alarm contacts, and an electric analog level gauge.
  - 4. The fill valve shall have an overfill prevention type, equal to the "Stopper" OPW 61f stop.
  - 5. The rupture basin shall have a float contact to indicate tank rupture.
  - 6. The entire system shall be leak tested prior to installation.
- D. Intake openings shall be screened to prevent the entrance of rodents. The system shall include a cooling and combustion air inlet silencer system, an equipment enclosure section, and a cooling air discharge silencer section.
- E. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls. They shall be reinforced for rigidity and set is a welded frame to ensure proper operation. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if

necessary and/or top hung and supported by gas struts.

- F. Battery racks and batteries shall be factory-installed and wired. Exhaust silencer, flexible exhaust connector and condensate drain valve shall be factory-installed.
- G. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves and capped with pipe nipples on flanged connectors. Radiator access shall be through a hinged, lockable cover on enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.
- H. Owner shall select finish color of enclosure.
- I. Provide a remote manual stop break-glass station to allow emergency shutdown of the unit. The station shall be integrated into and located on the exterior of the enclosure. It shall be accessible from the exterior, no greater than 6'-0" AFG

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Placement of the generator shall be the responsibility of the electrical Contractor. Coordinate placement with the Owner's Representative and obtain all associated permits and permissions necessary for blockage of public way, interference with parking, etc.
- B. Fill all fluid levels (including fuel where applicable) to maximum recommended levels by the manufacturer prior to testing and after testing completed.

### 3.2 START-UP AND TESTING

- A. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following four (4) hour load test:
  - 1. Verify that the equipment has been properly installed.
  - 2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, all remote annunciator points, etc.
  - 3. Test all alarms and safety shutdown devices for proper operation and annunciation.
  - 4. Check all fluid levels.
  - 5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
  - 6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
  - 7. Connect the generator to building load and verify that the generator will start and run all designated loads. Testing shall be performed in accordance with NFPA 110 from a "cold start" condition. Each of the following shall be observed and recorded upon opening of the Normal supply circuit breaker to the ATS:
    - a. Time delay on start
    - b. Cranking time until the prime mover starts and runs
    - c. Time required to reach operating speed
    - d. Voltage and frequency overshoot
    - e. Time required to reach steady state conditions with all switches transferred to the emergency position
    - f. Voltage, frequency and current
  - 8. The system shall be tested under load for a period of two (2) hours. The following

GENERATOR DIESEL – ALT B – 833 STATE RD 16321 – 10 readings shall be taken at fifteen (15) minute intervals:

- a. Oil pressure
- b. Coolant temperature
- c. Battery charge rate
- d. AC volts
- e. AC Amperes- all phases
- f. Frequency
- g. Kilowatts
- h. Kilovolt-amperes
- i. Ambient Temperature
- 9. Allow system to cool for five (5) minutes.
- 10. The system shall be tested for a period of two (2) hours with the use of a portable resistive/reactive loadbank at 100% rated load. Load shall be applied upon reaching rated RPM in one step. All data specified above shall be recorded for this segment until completion of the two-hour test.
- 11. The Generator Distributor shall provide a written test report upon completion of testing. Report shall specifically indicate the successful completion of each item referenced above and submit all recordings in a format similar to NFPA 110 tables.
- B. All costs associated with the referenced testing, including fuel consumption, load bank rental, temporary cables from the generator to the load bank, etc. shall be included in the bid price.
- 3.3 TRAINING
  - A. Provide a one (1) day of on-site training to instruct the Owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

### END OF SECTION 26321

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# **SECTION 16321**

# **GENERATOR - DIESEL**

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 16000 shall apply to this section unless specifically noted otherwise.

### 1.2 SUMMARY

- A. Section includes packaged engine-generator sets for **standby** power supply with the following features:
  - 1. Outdoor enclosure
  - 2. Acceptance Testing
- B. Related Sections include the following:
  - 1. Division 16000 Electrical.
  - 2. Section 16360 Transfer Switches for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
- C. Engine driven electrical generating systems shall be as manufactured by
  - 1. Caterpillar
  - 2. Cummins
  - 3. Kohler
- D. Obtain packaged generator sets and all associated auxiliary components through one source from a single manufacturer.

### 1.3 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system

# 1.4 ACTION SUBMITTALS

- A. Product Data: For each required component provide manufacturer's standard cut sheet containing technical details, listings and general information illustrating compliance with these specification requirements.
- B. Provide the following detailed documentation for review and evaluation:

- 1. The manufacturer shall provide copies of following documents for review and evaluation in accordance with general requirements of Division 01 and Division 26:
  - a. Factory published specification sheet indicating standard and optional accessories, ratings, etc. Weights of all equipment shall be highlighted.
  - b. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, silencer, exhaust flex, main circuit breaker, etc.
  - c. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems shall be included.
  - d. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, etc. Air flow requirements shall be for cooling and combustion air in CFM at 0.8 power factor, with air supply temperature of 95, 80, 70, and 50 °F.
  - e. Fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  - f. Generator electrical data including resistances, reactances, time constants, temperature and insulation data, thermal damage curve, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
  - g. Certified trip curves for each circuit breaker.
  - h. Certified copies of all Type (Design) and Verification Test Reports for prototype units.
  - i. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, and remote alarm indications.
  - j. Control panel schematics.
  - k. Calculations indicating acceptable performance of the submitted unit starting and running the specified load.
- 2. Report of exhaust emissions showing compliance with applicable regulations.
- 3. Third party certified noise test data on an equal or similar enclosure design.
- 4. Manufacturers and dealers written warranty.
- 5. Seismic Qualification Certificates for engine-generator set, accessories, and components.

# 1.5 CLOSEOUT SUBMITTALS

- A. Submit test report confirming acceptance of all Installation inspections and tests as outlined in Part 3 of this specification.
- B. Submit operation and maintenance data based on factory and field-testing, operation and maintenance of specified product.
- C. Submit maintenance manuals and recommended spare parts list required to conform to industry standard maintenance guidelines. Instructions shall include but not be limited to:
  - 1. Instructions for replacing any renewable components of the system.
  - 2. Instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.
  - 3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

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## 1.6 QUALITY ASSURANCE

- A. The system design and installation shall conform to the following standards
  - 1. All equipment shall be UL listed for its intended purpose, including UL 2200.
  - 2. All applicable NFPA standards, including but not limited to: 70 and 110.
  - 3. State Building Code.
  - 4. All requirements of the Authority Having Jurisdiction (AHJ)
- B. The equipment supplier and the Contractor shall demonstrate a minimum five (5) years' experience in the successful design and installation of standby generation systems similar in size and scope to that required for this project.

# 1.7 WARRANTY

- A. The installer and manufacturer's warranty shall be for a minimum period of five (5) years from the date of the final acceptance test approval.
- B. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

# 1.8 COORDINATION

A. Coordinate sizes and locations of actual equipment provided. Provide sketches to illustrate submitted equipment will fit within the allocated space where the dimensions of the submitted equipment exceed those illustrated on the drawings for the basis of design.

# PART 2 - PRODUCTS

# 2.1 GENERAL

- A. Provide factory assembled water cooled diesel engine-driven electric generating system rated for emergency standby service. The automatic transfer switch(es) specified in other sections of this specification shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination. Refer to the drawings for service ratings at 60 Hz.
- B. The system shall automatically start and accept full rated load within ten (10) seconds of being signaled to start.
- C. Engine generator and accessories including control panel, engine starting batteries and output circuit breaker(s) shall be mounted within a sound attenuated weatherproof enclosure. Refer to the enclosure specification section for additional details.
- D. Specified kW is for continuous service during utility source interruption, as established in ISO 8528-3 at 86°F. Rating shall be substantiated by manufacturer's standard published curves. Special and maximum ratings will not be accepted.
- E. Supplier shall have been engaged regularly in generator or engine manufacture, or both, for at least twenty-five (25) years. The generator manufacturer and local dealer shall be ISO 9001 certified.

- F. The supplier shall maintain a full time in-house parts and service organization so that parts and service are readily available, twenty-four (24) hours/day seven (7) days/week. Qualified, factory trained service personnel shall be available within four (4) hours of notification.
- G. Prototype testing shall certify the acceptable performance of the generating set series. The test shall prove acceptance, as a system, of the design and integration of all components. Proposed system shall be a current factory production model. Prototype testing shall confirm:
  - 1. Fuel consumption at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 2. Exhaust emissions.
  - 3. Mechanical and exhaust noise levels.
  - 4. Governor speed regulation at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
  - 5. Generator temperature rise in accordance with NEMA MG1-22.40
  - 6. Harmonic analysis, voltage waveform deviation and telephone influence factor.
  - 7. Generator short circuit capacity.
  - 8. Cooling system capacity.
- H. Provide manufacturer's load analysis calculation confirming that the generating set submitted is compatible with loads to be applied.
  - 1. Generator-Set Performance: Steady-State Voltage Operational Bandwidth: 3% of rated output voltage from no load to full load.
  - 2. Transient Voltage Performance: Not more than 20% variation for 50% step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three (3) seconds.
  - 3. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
  - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  - 5. Transient Frequency Performance: Less than 5% variation for 50% step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five (5) seconds.
  - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5% total and 3% for single harmonics. Telephone influence factor, determined according to NEMA MG1, shall not exceed 50%.
  - 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250% of rated full-load current for not less than ten (10) seconds and then clear the fault automatically, without damage to generator system components.
  - 8. Below requires ten (10) second maximum start time under specific conditions and includes startup only, not load assumption.
  - 9. Start Time: Comply with NFPA 110, Type 10, system requirements. The proposed generator set shall be factory EPA Certified <u>for stationary</u> <u>emergency use</u> and <u>be</u> in compliance with the Commonwealth of Massachusetts Emission regulations at the time of installation/commissioning. Actual engine
    - emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with EPA Tier emissions standards per ISO 8178 – D2 Emissions Cycle at specified EKW/BHP rating. Utilization of the "Transition Program for Equipment Manufacturers" also known at "Flex Credits" to achieve Tier certification is not in compliance with MA Regulation "310 CMR 7.02 U Plan Approval and Emission Limitations" and will not be accepted.
- I. The manufacturer's warrantee shall be for a minimum period of five (5) years from the date of initial system start-up and acceptance or 1,500 operating hours, whichever occurs first. The warrantee shall include repair parts, expendables (lubricating oil, filters,

antifreeze, etc.), labor and travel expenses necessary for repairs at the job site. The supplier shall provide a trailer mounted portable engine generator with accessories (including interconnection to the electrical distribution system) to provide backup power for any warrantee related system outages that exceed five (5) calendar days.

# 2.2 ENGINE

- A. The engine shall be diesel fueled, four (4) cycle, water-cooled, either vertical in-line or Vtype, with dry exhaust manifolds, operating with nominal speed not exceeding 1800 RPM. It shall have 4 cylinders with a minimum cubic inch displacement of **269**.
- B. Frequency regulation shall be lsochronous, regulated to within +/- 0.25% from no load to full load.
- C. All fuel piping shall be black iron or flexible fuel hose rated for this service. Flexible fuel lines rated 300°F and 100 PSI.
- D. The engine shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions, 110°F ambient air entering the room or enclosure (where an enclosure is specified), and permanent anti-freeze solution of 5 ethylene-glycol-based antifreeze and water with anticorrosion additives as recommended by engine manufacturer to protect equipment to -15°F without derating the unit. Antifreeze shall have a service life of 3000 hours without maintenance. The generator set supplier is responsible for providing a properly sized cooling system based on the installed static pressure restriction.
- E. Provide thermostatically-controlled electric-immersion type engine jacket water heater, be sized by the manufacturer to maintain jacket water temperature at 90°F, 208 V, single-phase, 60 HZ mounted, piped and prewired to terminal strip.
- F. Lube oil pump shall be mechanically driven positive displacement. Lube oil system shall be piped through an oil cooler and a full flow filter with replaceable cartridge. Filter and Strainer shall be rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
- G. Fuel oil pump shall be mechanically driven positive displacement with dual full flow filters and replaceable cartridge. One filter shall be isolated while the other is on-line. Fuel system shall have a manual-priming pump. Fuel piping shall be arranged to prohibit loss of prime with an anti-siphon check valve at the fuel pump suction piping. Filter and Strainer shall be rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
- H. Air intake shall be via a heavy duty replaceable dry element filter and "blocked filter" indicator.
- I. Provide lubricating oil pressure gauge, water temperature gauge, battery charge rate ammeter and running time meter mounted in common panel with engine controls, alternator controls and alternator instruments.
- J. A critical type silencer (25-34 DBA at 500Hz exhaust noise reduction), companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be

imposed on the engine. The muffler and all indoor exhaust piping shall be "lagged" by the Contractor to maintain a surface temperature not to exceed 150°F. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

# 2.3 ALTERNATOR

- A. The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling to ensure permanent alignment. The insulation material shall meet NEMA standards for Class H insulation and be impregnated in a polyester varnish or vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed NEMA class F (130 °C rise by resistance over 40°C ambient). Stator windings shall be random wound two-thirds pitch. Subtransient resistance shall not exceed 12%.
- B. The excitation system shall be of brushless construction. The permanent magnet brushless exciter shall be independent of main stator windings, shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressors shall be included to protect the diodes from voltage spikes. Generator shall have the ability to sustain short circuit current for ten (10) seconds of 300% of rated current to allow protective devices to operate.
- C. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/-0.5% for any constant load between no load and full load. The regulator shall be three phase sensing, totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, overexcitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed. System shall reduce voltage automatically if load demand exceeds engine capacity and remove excitation when generator is overloaded for more than ten (10) seconds. Voltage regulator shall be, volts-per-hertz and include over voltage and under voltage protection.
  - 1. Maintain voltage within 20% on one step, full load
  - 2. Maintain frequency within 10% and stabilize at rated frequency within two (2) seconds.
- D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
  - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110% of full-rated load for sixty (60) seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
  - 2. Under single or three-phase fault conditions, regulates generator to 300% of rated full-load current for up to ten (10) seconds.
  - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- E. The alternator output shall be wired via a generator mounted 3 pole molded case circuit

breaker, trip rating as indicated on the drawings. Breaker shall utilize an electronic LSI solid state trip. Unit breaker shall each be housed in a steel NEMA 1 enclosure mounted on a separate support stand vibration isolated from the engine / generator arrangement.. Refer to the one line diagram for breaker information. Bus bars, sized for the cable type shown on drawing, shall be supplied on the load side of breaker.

## 2.4 VIBRATION ISOLATION

A. Provide linear vibration mounts between engine generator set and structural sub-base as recommended by equipment manufacturer. Unit shall be suitable for installation on any level surface.

# 2.5 STARTING

- A. A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
- B. Provide 12 V lead acid batteries as recommended by equipment manufacturer, sized to provide no less than three cranking cycles without recharging. Provide unit mounted battery rack fabricated of metal with acid-resistant finish and thermal insulation, hold down and battery cables.
- C. A current limiting automatic-equalizing and float battery charger shall be furnished to recharge batteries. Unit shall comply with UL 1236 and include the following features:
  - 1. Equalizing-charging rate of 10 amps shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - 2. Adjust float and equalize voltages for variations in ambient temperature from minus 40 °F to 140 °F to prevent overcharging at high temperatures and undercharging at low temperatures.
  - 3. Maintain constant output voltage regardless of input voltage variations up to plus or minus 10%.
  - 4. Ammeter and Voltmeter shall be flush mounted in door. Meters shall indicate charging rates.
  - 5. Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - 6. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
- D. Provide battery blanket heater to maintain battery temperature between 50°F and 90°F.

### 2.6 CONTROL PANEL

A. Provide a generator set mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation, cycle cranking, AC metering (0.5% true RMS accuracy) with phase selector switch, shutdown sensors and alarms with horn and reset, adjustable cool-down timer and emergency stop push-button and engine run time meter (non-resettable).

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- B. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged door.
- C. The panel itself shall be mounted on a separate support stand isolated from the engine / generator arrangement. Panel / breaker arrangements mounted on the generator set in such a way that access to the AC Generator terminal box is restricted in any way whatsoever are not acceptable.
- D. Provide the following readouts:
  - 1. Engine oil pressure
  - 2. Coolant temperature
  - 3. Engine RPM
  - 4. System DC Volts
  - 5. Engine running hours
  - 6. Generator AC volts
  - 7. Generator frequency
  - 8. Generator AC amps
- E. Provide the following indications for protection and diagnostics according to NFPA 110 Level 1:
  - 1. Low oil pressure
  - 2. High water temperature
  - 3. Low coolant level
  - 4. Overspeed
  - 5. Overcrank
  - 6. Emergency stop depressed
  - 7. Approaching high coolant temperature
  - 8. Approaching low oil pressure
  - 9. Low coolant temperature
  - 10. Low voltage in battery
  - 11. Control switch not in auto position
  - 12. Low fuel main tank
  - 13. Battery charger AC failure
  - 14. High battery voltage
  - 15. Fuel tank rupture
  - 16. Engine running
- F. Diagnostics capabilities shall identifying both system and component level issues. The diagnostic codes shall be maintained in a history log specifying the number of occurrences, and second/minute/hr at which they occur.
- G. Provide the following control functions:
  - 1. Terminals located inside the control panel for REMOTE EMERGENCY STOP
  - 2. ON / OFF / AUTO control switch
- H. Provide a minimum of four (4) programmable output dry contacts for connection to the Owner's security or ATC system. Three (3) of the four (4) outputs shall be programmed to alarm "Engine Running", "Summary Alarm" and "Generator not in Automatic".

### 2.7 ANNUNCIATOR

A. Provide an annunciator to meet the requirements of NFPA 110, Level 1, installed in

enclosure suitable for surface mounting. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.

#### 2.8 I/O MODULE

A. Provide one (1) twelve-point remote I/O modules for redundant monitoring of NFPA110, Level 1 alarms by the Owner's security or ATC system. The remote I/O modules shall interconnect with the ECP on the remote annunciator network wiring and be located in the building adjacent to the Owner's data collection panel.

#### 2.9 SOUND ATTENUATED WEATHERPROOF ENCLOSURE.

- A. Engine generator set, generator control panel, engine starting batteries and internally mounted exhaust silencer shall be enclosed in factory-assembled, rainproof-weather-protective skid-base enclosure with full floor panel. The enclosure shall have a resulting sound level of 67 DBA at twenty-three (23) feet. The enclosure and generator shall be UL2200 labeled.
- B. Enclosure will consist of a roof, fuel tank and rupture basin base, two (2) side walls, and two (2) end walls, of highly corrosion resistant construction made from galvanized steel. Stainless steel flush fitting latches and hinges tested and proven to withstand extreme conditions of corrosion. The sheet steel components shall be pre-tested with zinc phosphate prior to polyester powder coating at 392 °F. Roof bows shall be cambered to aid in rain runoff.
- C. An integral fuel tank underframe and rupture basin shall be supplied, consisting of the following:
  - 1. A rupture basin utilizing minimum 7 gauge steel channel perimeter walls and bottom.
  - 2. A U.L. listed (per U.L. 142) above-ground **255** gallon capacity (48 hours @ 100% load) rectangular tank of minimum 12 gauge steel construction.)
  - 3. The tank shall have venting and emergency venting (to roof) per U.L. 142, lockable fill, low level and high level alarm contacts, and an electric analog level gauge.
  - 4. The fill valve shall have an overfill prevention type, equal to the "Stopper" OPW 61f stop.
  - 5. The rupture basin shall have a float contact to indicate tank rupture.
  - 6. The entire system shall be leak tested prior to installation.
- D. Intake openings shall be screened to prevent the entrance of rodents. The system shall include a cooling and combustion air inlet silencer system, an equipment enclosure section, and a cooling air discharge silencer section.
- E. Number of doors on enclosure shall be as required so that all normal maintenance operations, such as lube oil change, filter change, belt adjustment and replacements, hose replacements, access to the control panels, etc., may be accomplished without disassembly of any enclosure components. Access doors shall be fabricated of the same material as the enclosure walls. They shall be reinforced for rigidity and set is a welded frame to ensure proper operation. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Fasteners shall be zinc plated or stainless steel. Doors shall be of a lift off design allowing one person to remove door if

necessary and/or top hung and supported by gas struts.

- F. Battery racks and batteries shall be factory-installed and wired. Exhaust silencer, flexible exhaust connector and condensate drain valve shall be factory-installed.
- G. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves and capped with pipe nipples on flanged connectors. Radiator access shall be through a hinged, lockable cover on enclosure. Cooling fan and charging alternator shall be fully guarded to prevent injury.
- H. Owner shall select finish color of enclosure.
- I. Provide a remote manual stop break-glass station to allow emergency shutdown of the unit. The station shall be integrated into and located on the exterior of the enclosure. It shall be accessible from the exterior, no greater than 6'-0" AFG

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Placement of the generator shall be the responsibility of the electrical Contractor. Coordinate placement with the Owner's Representative and obtain all associated permits and permissions necessary for blockage of public way, interference with parking, etc.
- B. Fill all fluid levels (including fuel where applicable) to maximum recommended levels by the manufacturer prior to testing and after testing completed.

### 3.2 START-UP AND TESTING

- A. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following four (4) hour load test:
  - 1. Verify that the equipment has been properly installed.
  - 2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, all remote annunciator points, etc.
  - 3. Test all alarms and safety shutdown devices for proper operation and annunciation.
  - 4. Check all fluid levels.
  - 5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
  - 6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
  - 7. Connect the generator to building load and verify that the generator will start and run all designated loads. Testing shall be performed in accordance with NFPA 110 from a "cold start" condition. Each of the following shall be observed and recorded upon opening of the Normal supply circuit breaker to the ATS:
    - a. Time delay on start
    - b. Cranking time until the prime mover starts and runs
    - c. Time required to reach operating speed
    - d. Voltage and frequency overshoot
    - e. Time required to reach steady state conditions with all switches transferred to the emergency position
    - f. Voltage, frequency and current
  - 8. The system shall be tested under load for a period of two (2) hours. The following

GENERATOR DIESEL – ALT B – 1115 STATE RD 16321 – 10 readings shall be taken at fifteen (15) minute intervals:

- a. Oil pressure
- b. Coolant temperature
- c. Battery charge rate
- d. AC volts
- e. AC Amperes- all phases
- f. Frequency
- g. Kilowatts
- h. Kilovolt-amperes
- i. Ambient Temperature
- 9. Allow system to cool for five (5) minutes.
- 10. The system shall be tested for a period of two (2) hours with the use of a portable resistive/reactive loadbank at 100% rated load. Load shall be applied upon reaching rated RPM in one step. All data specified above shall be recorded for this segment until completion of the two-hour test.
- 11. The Generator Distributor shall provide a written test report upon completion of testing. Report shall specifically indicate the successful completion of each item referenced above and submit all recordings in a format similar to NFPA 110 tables.
- B. All costs associated with the referenced testing, including fuel consumption, load bank rental, temporary cables from the generator to the load bank, etc. shall be included in the bid price.
- 3.3 TRAINING
  - A. Provide a one (1) day of on-site training to instruct the Owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

### END OF SECTION 26321

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3.1	AUTOMATIC TRANSFER SWITCH

# SECTION 16360

## AUTOMATIC TRANSFER SWITCH

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 16000 shall apply to this section unless specifically noted otherwise.

### 1.2 SUMMARY

- A. Section Includes Automatic Transfer Switch (ATS) for standby power supply with the following features:
  - 1. Automatic transfer between the primary and secondary sources.
  - 2. Regularly scheduled control of the engine-generator for exercising.
  - 3. Acceptance Testing
- B. Related Sections include the following:
  - 1. Division 16000 Electrical
  - 2. Section 16231 Generator Diesel for automatic-starting and -stopping signals for the engine-generator set.
- C. The automatic transfer switch shall be 300 Series as manufactured by ASCO or approved equal from Russelectric or Eaton ATC-300.
- D. Obtain ATS from the engine-generator set supplier.

### 1.3 DEFINITIONS

- A. EPS: Emergency Power Supply.
- B. EPSS: Emergency Power Supply System
- C. ATS: Automatic Transfer Switch
- D. WCR: Withstand and Close Rating

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each required component provide manufacturer's standard cut sheet containing technical details, listings and general information illustrating compliance with these specification requirements.
- B. Provide the following detailed documentation for review and evaluation:

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- 1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
- 2. Dimensional elevation and layout drawings of automatic transfer switch and related accessories.
- 3. Certified copies of all Type (Design) and Verification Test Reports
- 4. Interconnect wiring diagram of complete system.
- 5. Control schematics.

## 1.5 CLOSEOUT SUBMITTALS

- A. Submit test report confirming acceptance of all Installation inspections and tests as outlined in Part 3 of this specification.
- B. Submit operation and maintenance data based on factory and field-testing, operation and maintenance of specified product.
- C. Submit maintenance manuals and recommended spare parts list required to conform to industry standard maintenance guidelines. Instructions shall include but not be limited to:
  - 1. Instructions for replacing any renewable components of the system.
  - 2. Instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.
  - 3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

### 1.6 QUALITY ASSURANCE

- A. The system design and installation shall conform to the following standards
  - 1. All equipment shall be UL listed for its intended purpose.
  - 2. All applicable NFPA standards, including but not limited to: 70 and 110.
  - 3. State Building Code.
  - 4. All requirements of the Authority Having Jurisdiction (AHJ)
- B. The equipment supplier and the Contractor shall demonstrate a minimum ten (10) years' experience in the successful design and installation of standby and emergency power systems similar in size and scope to that required for this project.

### 1.7 WARRANTY

A. The installer and manufacturer's warranty shall be for a minimum period of two (2) years from the date of the final acceptance test approval.

### 1.8 COORDINATION

A. Coordinate sizes and locations of actual equipment provided. Provide sketches to illustrate submitted equipment will fit within the allocated space where the dimensions of the submitted equipment exceed those illustrated on the drawings for the basis of design.

# PART 2 - PRODUCTS

# 2.1 GENERAL

- A. The ATS shall consist of power transfer unit and controller interconnected to provide complete automatic operation. The ATS shall be mechanically held and electrically operated by single-solenoid mechanism energized from the source to which load is to be transferred. Switch shall be rated for continuous duty and shall be inherently double throw. The ATS shall be mechanically interlocked to prohibit simultaneous closure of both normal and emergency contacts. The ATS shall be suitable for use with an engine driven emergency generator and utility sources. The entire assembly shall be contained in a NEMA 1 Enclosure.
- B. Main contacts shall be of silver composition. Contacts rated 600A and above shall have segmented blow-on construction and be protected by separate arcing contacts for withstand capability. Operating transfer time in either direction shall not exceed one-sixth of one second. An ATS with components of molded-case circuit breakers, contactors or components not designed for continuous duty or repetitive load transfer switching will not be accepted.
- C. The neutral contacts shall be fully rated overlapping where four-pole design is required by the Drawings.
- D. The ATS shall be rated to close on and withstand the available fault current at the transfer switch terminals. Where specific breaker or fused inputs are required to meet the stated WCR, these shall only be used where specifically indicated on the drawings.
- E. ATS ratings shall be as follows:
  - 1. 35 State Road ATS: 260A-4P (switched neutral) 50k WCR @ 208V (MCCB).
  - 2. 287 State Road ATS: 260A-4P (switched neutral) 50k WCR @ 208V (MCCB).
  - 3. <u>Bid Alternate A</u> 833 State Road ATS: 400A-4P (switched neutral) 50k WCR @ 480V (MCCB).
  - 4. <u>Bid Alternate B -</u> 1115 State Road ATS: 260A-4P (switched neutral) 50k WCR @ 208V (MCCB).
- F. Contacts, coils, springs and control elements shall be inspectable and removable from front of transfer switch without major disassembly or disconnection of power conductors. A manual operating handle shall be provided to permit full movement of contacts throughout their full travel for inspection and service.
- G. Automatic transfer switch controller shall be a single microprocessor with the ability to be networked through an optional serial communications port. An LCD display and keypad shall provide access to all available data and function for setting all operational parameters. Control module shall have protective cover and shall be mounted separately from transfer switch. Sensing and control logic shall be solid-mounted on plug-in printed circuit boards. Printed circuit boards shall be keyed to prevent incorrect installation. Provide industrial control grade plug-in interfacing relays with dust covers.
- H. Automatic transfer switch shall meet NEMA ICS 10-199, NFPA 110 and UL-1008 standards.
- I. Unless specifically illustrated on the drawings, the ATS shall be suitable for Front Access Only.
- 2.2 CONTROLLER

- A. Voltage sensing shall be close differential three phase line-to-line. Pickup shall be adjustable from 85% to 100% of nominal; dropout voltage shall be adjustable from 78% to 98% of pickup value. Transfer to emergency shall be initiated upon reduction of normal source to 85% of nominal voltage and retransfer to normal shall occur when normal source reaches 95% of nominal.
- B. Time delay to override momentary normal source outages shall delay transfer switch signals and engine starting signals. Time delay shall be field-adjustable from 0.5 to six (6) seconds and factory set at one (1) second.
- C. Time delay on retransfer to normal source shall be bypassed automatically if emergency source fails and normal source is available. Time delay shall be field-adjustable from zero (0) to sixty (60) minutes.
- D. Unloaded running time delay for emergency generator cooldown shall be field-adjustable from zero (0) to sixty (60) minutes.
- E. Time delay on transfer to emergency shall be field-adjustable from zero (0) to five (5) minutes for controlled timing of load transfer to emergency, where indicated.
- F. A time delay activated output signal shall be provided to drive external relays for selective load shedding. The controller shall be adjustable from zero (0) to five (5) minutes in any of the following modes:
  - 1. Prior to transfer only.
  - 2. Prior to and after transfer.
  - 3. Normal to emergency only.
  - 4. Emergency to normal only.
  - 5. Normal to emergency and emergency to normal.
  - 6. All transfer conditions or only when both sources are available.
  - 7. The controller shall include capabilities for optional Closed Transition and Delayed Transition operation where specifically called out on the drawings:

### 2.3 AUXILIARIES

- A. Provide a contact that closes when normal source fails for initiating engine start, rated 10 A, 32 V DC. The start circuit shall be supervised and cause a local and remote alarm and start the generator in the event that the connection integrity is lost.
- B. Provide push to test LED indicators, green to indicate when the ATS is connected to the normal source and red to indicate when automatic transfer switch is connected to emergency source.
- C. Provide two auxiliary contacts that are closed when the automatic transfer switch is connected to normal and two auxiliary contacts that are closed when automatic transfer switch is connected to emergency. Contacts shall be rated 10 A, 480 V AC, 60 Hz.
- D. Provide transfer inhibit input function to prohibit transfer of the ATS from normal to emergency upon a dry contact signal (open on inhibit) input. Install a labeled jumper across terminals from the factory.
- E. Provide load shed input function to shed load if powered via the emergency source upon a dry contact signal (open to shed) input. Install a labeled jumper across the terminals from the factory.

- F. Provide engine generator exerciser, which shall allow up to seven different exercise routines. The user shall be able to do the following to each routine:
  - 1. Enable or disable the routine.
  - 2. Enable or disable transfer of the load during the routine.
  - 3. Set the start time, day, week and period.
  - 4. Set the duration of the run.
  - 5. Where multiple ATSs are specified, engine exerciser option is required in one ATS only.

### 2.4 IN-PHASE MOTOR TRANSFER

- A. Provide in-phase monitor to inhibit transfer of loads from emergency to normal sources and vice versa until sources are in phase.
- B. Transfer shall be initiated only when power sources are approaching synchrony and when relative phase angle crosses set point towards 0°.
- C. In-phase monitor shall operate accurately regardless of which source is at highest frequency. In-phase monitor shall be solid state, with gated silicon transistor circuitry to ensure positive and crisp operation independent of variations in voltage input of 70% to 110% of nominal, with temperature between 0 and 45°C.
  - Repetitive accuracy throughout temperature and voltage ranges shall not exceed +/-30° (electrical) of setting. Monitor shall be capable of operating within frequency range of +/-3 Hz of nominal. Provide manual bypass circuit.
- D. Where an in-phase monitor is not manufactured for the submitted transfer switch, the following changes shall be incorporated into the design:
  - 1. Transfer switch shall be double-throw activated by dual electrical operators energized momentarily and connected to transfer mechanism with over-center linkage. Minimum transfer time shall be 400 milliseconds.
  - 2. Provide for time delay between opening closed contacts and closing open contacts sufficient to demagnetize loads.
  - 3. Motor and transformer loads shall be re-energized with normal in-rush current after transfer.
  - 4. Switch shall transfer in either direction with 70% rated voltage applied to terminals.

### PART 3 - EXECUTION

# 3.1 AUTOMATIC TRANSFER SWITCH

- A. Storage
  - 1. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.
  - 2. Automatic transfer switches shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between -30 °C and +25 °C. Indoor locations shall be protected to prevent moisture from entering enclosure.

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- B. Installation
  - 1. Provide ½ inch spacers for automatic transfer switches mounted at exterior walls below grade to establish ½ inch air space behind enclosure.
  - 2. Inspect installed automatic transfer switches for anchoring, alignment, grounding and physical damage. Clean interiors to remove construction debris, dirt and shipping materials.
  - 3. Check tightness of all electrical connections with calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.
  - 4. Each automatic transfer switch shall have laminated plastic nameplates with white cut letters identifying power source, voltage and circuit identified for both inputs and the output.
- C. Start-Up and Testing
  - 1. After installation is complete and normal and emergency power is available, the manufacturer's local dealer shall perform the following:
    - a. Verify that the equipment has been properly installed.
    - b. Check all transfer switch functions for proper operation.
    - c. Check all auxiliary device functions for proper operation. Perform integrated testing as outlined in the generator specification
  - 2. Provide on-site training to instruct the Owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

END OF SECTION 16360

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# **SECTION 16543**

## UNDERGROUND DUCT HANDHOLES AND MANHOLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 16000 shall apply to this section unless specifically noted otherwise.

#### 1.2 SUMMARY

- A. Section includes details and materials associated with underground ducts and raceways. The system shall include but not be limited to:
  - 1. Concrete encased Schedule 40 PVC.
  - 2. Handholes
  - 3. Manholes
- B. Related Sections include the following:
  - 1. Division 16000 Electrical

#### 1.3 DEFINITIONS

A. Refer to 16000.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each required component provide manufacturer's standard cut sheet containing technical details, listings and general information illustrating compliance with these specification requirements.
- B. Provide the following detailed documentation for review and evaluation:
  - 1. Product Data for each:
    - a. Raceway type and size.
    - b. Handhole.
    - c. Handhole and manhole cover and associated frame
  - 2. Shop drawing detailing and inside and outside dimension, material of construction and all miscellaneous components associated with each precast manhole.

#### 1.5 CLOSEOUT SUBMITTALS

A. None.

## 1.6 QUALITY ASSURANCE

- A. The system design and installation shall conform to the following standards
  - 1. Where applicable, equipment shall be UL listed for its intended purpose.

#### 1.7 WARRANTY

A. The installer and manufacturer's warranty shall be for a minimum period of three (3) years from the date of the final acceptance test approval.

### 1.8 COORDINATION

- A. Excavation and backfill shall be provided by Division 02200. Coordinate duct routing, excavation and backfilling.
- B. Concrete shall be provided by Division 03300. Coordinate exact dimensions associated with duct banks and pads as detailed on the drawings.
- C. Installation of handholes and manholes provided under this section shall be by Division 31200. Coordinate delivery for installation in accordance with the project schedule and excavation

## PART 2 - PRODUCTS

### 2.1 UNDERGROUND DUCT

- A. Raceways shall comply with Section 2.02 and 3.02 of Specification 16000 unless specifically modified in this section of the specification.
- B. Spacers shall accommodate a minimum of two (2) inch conduit separation and three (3) inches from the top, bottom and side edges of the duct bank. Spacers shall accommodate the specified conduit sizes and interlock horizontally. Spacers shall be equal to Carlon or Underground Devices Incorporated.
- C. PVC bell ends shall be utilized for all conduit transitions into manholes, handholes and building foundations where sealing fittings are not otherwise specified.
- D. Bends in excess of thirty (30) degrees over a ten (10) foot length shall be factory fabricated galvanized rigid steel conduit. Where required for pole risers and to turn up at pads, factory fabricated long radius 90° galvanized rigid steel sweeps shall be used.

### 2.2 MANHOLES

A. The complete manholes shall be rated for AASHTO HS20-20 wheel loading per AASHTO HB14. Covers shall fit frames without excessive play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have smooth finish

and sharp lines and rises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Floor surfaces shall have a steel trowel finish.

- B. Precast units shall be the products of a manufacturer regularly engaged in the supply of precast concrete manholes and handholes, including products by American Precast, Rotondo or Chase.
- C. Concrete shall have an ultimate twenty-eight (28) day compressive strength of not less than 4,000 PSI. Structures may be precast to the design and details indicated for cast-inplace construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.
- D. Horizontal concrete surfaces of floors shall have a smooth finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound shall conform to ASTM C 309.
- E. Structure top, bottom, and wall shall be of a uniform thickness of not less than six (6) inches. Thin-walled knock-out panels designed for future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as required per the drawings, and cast completely open. Size of windows shall exceed the nominal duct bank envelope dimensions by at least twelve (12) inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. The sides of windows shall be a minimum of six (6) inches from the inside surface of adjacent walls, floors, or ceilings. The perimeter of window openings shall be formed to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. The minimum concrete cover for reinforcing steel shall be two (2) inches. Provide drain sumps for structures a minimum of twelve (12) inches in diameter and four (4) inches deep.
- F. Provide tongue-and-groove or shiplap joints on mating edges of precast components. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures. Where access frame meets the top slab, provide continuous grout seal.
- G. Metal Frames and Covers
  - 1. Frames and Covers shall be made of cast iron OR steel.
  - 2. Cast-iron frames and covers shall meet FS RR-F-621.
  - 3. Covers shall be rated AASHTO H20-44 wheel loading.
  - 4. Brick for manhole collar shall be sewer and manhole brick conforming to ASTM C 32, Grade MS.
- H. Pulling-In Irons
  - 1. Provide bent steel bars or hooks, which project into the manhole approximately four (4) inches and shall be designed to withstand a minimum pulling-in load of 6,000 pounds, cast in the walls or floors.
  - 2. Iron shall be hot-dipped galvanized after fabrication.

- 3. Pulling-In Irons shall be located within six (6) inches of the projected center of the duct bank pattern or precast window in the opposite wall. Irons shall not be located within six (6) inches of an adjacent interior surface, duct or precast window located within the same wall. Where a pulling-in iron cannot be located directly opposite the duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the six (6) inch clearance. Pulling-In Irons shall be located on the floor where clearances cannot be met for wall mounting. Floor mounted irons shall be a minimum of six (6) inches from the edge of the sump. Irons shall be placed directly below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of six (6) inches from any edge of the manhole.
- I. Cable Racks
  - 1. Racks in power manholes shall be spaced not more than three (3) feet apart with a minimum of three (3) levels of rack on each interior elevation.
  - 2. Racks in signal manholes shall be spaced no more than 16 ½ inches apart with the end rack being no further than twelve (12) inches from the adjacent wall. A minimum of three (3) levels of rack on each interior elevation.
  - 3. Racks and stanchion shall be non-metallic UL listed glass reinforced nylon. The stanchion shall incorporate multiple arm mounting holes on four (4) inch centers.
  - 4. The cable rack arms shall be a minimum of ten (10) inches long and rated for a minimum of 400 pounds. Load rating shall be based upon a concentrated load one (1) inch from the arm end.
  - 5. Drop in anchors shall be rated for a minimum of 8,500 pounds pulls out capacity and 6,500 pounds sheer. Hardware shall be 303 stainless steel with 316 stainless steel bolts and washers. Anchors shall be provided above each rack arm and at the top and bottom of each stanchion.
  - 6. Cable racks shall be equal to Underground Devices Incorporated.

# 2.3 HANDHOLES

- A. The complete handhole shall be rated for AASHTO HS20-20 wheel loading per AASHTO HB14. Covers shall fit frames without excessive play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have smooth finish and sharp lines and rises. Provide necessary lugs, rabbets, and brackets. Floor surfaces shall have a steel trowel finish.
- B. Precast units shall be the products of a manufacturer regularly engaged in the supply of precast concrete manholes and handholes, including products by American Precast, Shea, Rotondo or Chase.
- C. Concrete shall have an ultimate twenty-eight (28) day compressive strength of not less than 4,000 PSI. Structures may be precast to the design and details indicated for cast-inplace construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.
- D. Horizontal concrete surfaces of floors shall have a smooth finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete

may be steam cured. Curing compound shall conform to ASTM C 309.

- E. Structure top, bottom, and wall shall be of a uniform thickness of not less than six (6) inches. Thin-walled knock-out panels designed for future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as required per the drawings, and cast completely open. Size of windows shall exceed the nominal duct bank envelope dimensions by at least twelve (12) inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. The sides of windows shall be a minimum of six (6) inches from the inside surface of adjacent walls, floors, or ceilings. The perimeter of window openings shall be formed to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. The minimum concrete cover for reinforcing steel shall be two (2) inches. Provide drain sumps for structures a minimum of twelve (12) inches in diameter and four (4) inches deep.
- F. Provide tongue-and-groove or shiplap joints on mating edges of precast components. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures. Where access frame meets the top slab, provide continuous grout seal.
- G. Metal Frames and Covers
  - 1. Frames and Covers shall be made of cast iron OR steel.
  - 2. Cast-iron frames and covers shall meet FS RR-F-621.
  - 3. Covers shall be rated AASHTO H20-44 wheel loading.
  - 4. Brick for manhole collar shall be sewer and manhole brick conforming to ASTM C 32, Grade MS.

# PART 3 - EXECUTION

### 3.1 UNDERGROUND DUCT

- A. Where nonmetallic underground conduit transitions from concrete encasement and continues exposed to pull box, cabinet, or other electric apparatus, portion through floor or wall and where exposed shall be rigid galvanized steel. Provide adapter below floor or outside wall to transition from PVC and metal conduit.
- B. Where underground conduit enters building through membrane-waterproofed wall or floor, provide malleable iron seal with gland assembly and adjustable pressure bushings secured to masonry construction with one or more integral flanges. Membrane waterproofing shall be secured to device in watertight manner.
- C. Where underground conduit without concrete envelope enters building through nonwaterproofed wall or floor, provide Schedule 40 galvanized pipe sleeve. Fill space between conduit and sleeve with suitable plastic expandable compound on each side of wall or floor.
- D. Run conduits straight between manholes and upturned elbows. Unavoidable bends in nonmetallic conduits shall be made with assembling couplings at slight angle if resulting radius is at least 100 feet. For radii less than 100 feet, use 5 degree angle couplings or

factory-made PVC coated galvanized rigid steel bend sections.

- E. Space separators to prevent sagging of conduits and breaking of couplings and watertight seals, to maintain deformation of conduit at separators to 0.10 inches or less. Separators spacing shall not exceed four (4) foot centers. Spacing between exterior surfaces of conduits shall be least two (2) inches between telephone conduits, two (2) inches between conduits containing cables operating at 600 V or less, six (6) inches between telephone conduit and power conduit and two (2) inches between conduits that contain cables operating at more than 600 V. Secure with cords where necessary. Do not use tie wires, reinforcing rods or metallic materials.
- F. Stagger conduit couplings, so that couplings on adjacent conduits do not lie in same transverse plane.
- G. Conduits shall terminate in end bells where lines enter manholes. Space end bells nine (9) inches center to center at manhole wall face for 4-inch conduits; space proportionately for other sizes. Flaring of duct bank to accommodate transition to end bell spacing shall start ten (10) feet from face of the manhole wall. Make new conduit entrances into existing manholes and building walls consistent with grading requirements and existing entrances; waterproof as required by Owner's Representative.
- H. After concrete envelopes have set, nonmetallic conduits shall be cleared with mandrel of same size as conduit.
- I. Seal active and spare conduit and duct that enters building with non-metallic blank seals until conductors pulled.
- J. Excavation
  - 1. Excavation, shoring, bracing, backfiring and grading will be provided under Division 2. Trenches shall be evenly graded so that conduit slopes uniformly at least three (3) inches per 100 feet, without horizontal or vertical waves. Unless specified otherwise, conduit shall slope uniformly from one manhole to next or from high point between manholes. Avoid low points between manholes, or upturned elbows.
  - 2. Trenches shall not be back filled until concrete envelopes have set sufficiently
- K. Concrete
  - 1. Conduit envelopes shall be 2,500 psi under Division 3, concrete and shall extend at least three (3) inches beyond exterior surface of each conduit in bank. Coordinate work of this section with that of Division 3.
  - 2. Envelopes may be poured directly against sides of trenches, if trench wall is clean, even and free of loose material. Remove loose dirt and extraneous material. Concrete shall be spaded during pouring to eliminate voids under and between conduits and honeycombing of exterior surfaces. Power-driven tampers or agitators shall not be used.
  - 3. Envelope between manholes shall be poured in single operation. Where more than one pour is necessary, provide <sup>3</sup>/<sub>4</sub> inch reinforcing rod dowels extending eighteen (18) inches into concrete on each side of joint.
  - 4. Envelopes that cross conduits, pipelines, roads and driveways shall be reinforced. Provide reinforcement where envelopes connect to manhole and building walls. Reinforcement shall be <sup>3</sup>/<sub>4</sub>" rods in single layer (2) inches above bottom and below top of envelope. Outside rods shall be two (2) inches from outside edges of envelope and intermediate rod shall be placed in center of each space between conduits. Reinforcement rods shall be tied with pairs of "C" shaped <sup>3</sup>/<sub>4</sub> inch rods on eighteen (18) inch centers.

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# 3.2 MANHOLES

- A. Do not set manholes until final conduit grading has been determined, including field changes required by underground interferences. Set frames and covers to final grade.
- B. Commercial precast assemblies shall be set on six (6) inches of level, 90% compacted granular fill, <sup>3</sup>/<sub>4</sub> inch to one (1) inch size, extending twelve (12) inches beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.
- C. Provide a 2/0 AWG bare copper cable, surface mounted six (6) inches above finished floor around the perimeter of the manhole. The cables shall be exothermically welded to the two (2) 10' x <sup>3</sup>/<sub>4</sub>" copper clad ground rods driven in opposing corners of the manhole. Connect all non-current carrying metal parts in manholes, including the cover collar, with 6 AWG bare copper to the 1/0 AWG ground. Seal hole where ground rod penetrates the manhole floor with mastic.
- D. Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other contaminants, and given a coat of bituminous paint. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surfaces shall be primed with a coat of primer and one coat of synthetic exterior gloss enamel.

### 3.3 HANDHOLES

- A. Do not construct or set manholes until final conduit grading has been determined, including field changes required by underground interferences. Set frames and covers to final grade.
- B. Commercial precast assemblies shall be set on six (6) inches of level, 90% compacted granular fill, <sup>3</sup>/<sub>4</sub> inch to one (1) inch size, extending twelve (12) inches beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.
- C. Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other contaminants, and given a coat of bituminous paint. Steel frames not buried in masonry and steel covers shall be cleaned of mortar, dirt and grease by an approved blasting process. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surfaces shall be primed with a coat of primer and one coat of synthetic exterior gloss enamel.

# END OF SECTION 16543

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# SECTION 16574

# SHORT CIRCUIT, COORDINATION AND ARC FLASH STUDY

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. All criteria establish within Specification 26000 shall apply to this section unless specifically noted otherwise.

### 1.2 SCOPE OF SERVICES

- A. Section includes a computer-based fault-current study to determine the minimum interrupting capacity of circuit protective devices, overcurrent protective device coordination study to determine overcurrent protective device settings and an arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.
- B. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating methods, alternate operation, and operations which could result in maximum-fault conditions shall be thoroughly covered in the study.

### 1.3 DEFINITIONS

- A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- C. SCCR: Short-circuit current rating.
- D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

### 1.4 ACTION SUBMITTALS

- A. The results of the power system studies shall be summarized in a final report.
- B. Submit the following submittals prior to or concurrently with the submittal of system protective devices included with panelboards, switchboards/switchgear, starters, VFDs, etc.
- C. The report shall include the following sections:

- 1. Description, purposes, basis, and scope of the study and a single-line diagram of the portion of the power system which is included within the scope of study.
- 2. Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties and commentary regarding same.
- 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
- 4. Fault-current tabulations including a definition of terms and a guide for interpretation.
- 5. Study report; signed, dated, and sealed by a qualified professional engineer.
- 6. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory. Failure to submit the study prior to release of associated equipment shall be at the sole risk of the Contractor, who will bear all costs associated with changes necessary to comply with the requirements of the Electrical Construction documents.

# 1.5 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
  - 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

### 1.6 COORDINATION

A. An independent testing firm shall be engaged for the purpose of inspecting, setting, testing, and calibrating the protective relays, circuit breakers and other applicable devices as recommended in the power-system study report.

### PART 2 - PRODUCTS

2.1 NOT USED

### PART 3 - EXECUTION

- 3.1 SHORT-CIRCUIT STUDY
  - A. The study shall be in accordance with applicable ANSI and IEEE standards.

- B. The study input data shall include the utility company's short-circuit single and three phase contribution with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
- C. Short-momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
- D. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the maximum short-circuit momentary and interrupting duties. Evaluation study should be submitted prior to final approval of equipment submittals.

# 3.2 PROTECTIVE-DEVICE COORDINATION STUDY

- A. A protective-device coordination study shall be performed to select or to verify the selection of power fuse ratings, protective-relay characteristics and settings, ratios, and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings.
- B. The coordination study shall include all voltage classes of equipment from the utility's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground overcurrent protection shall be included as well as settings for all other adjustable protective devices.
- C. Coordination shall be in accordance with requirements of the NEC and the recommendations of the IEEE Standard 399. TC curves shall be provided for each typical branch scenario from source to largest branch circuit device.
- D. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Owner's attention.

# 3.3 ARC FLASH STUDY

- A. Determine arc flash levels based upon minimum and maximum available utility fault and protective device settings as determined in the Protective Device Coordination Study.
- B. Label all switchboards, panelboards, disconnects, starters, VFD's and any other electrical equipment likely to require maintenance or adjustment while energized.
- C. Identify the current appropriate ratings of personal protective equipment (PPE).
- D. Establish the Flash Protection Boundary (approach limit distance) as required by NFPA 70E.
- E. Provide equipment specific environment and chemical arc-flash hazard warning labels per NEC® Section 110.16 requirements.
- F. Label shall identify the level of arc flash hazard and the required PPE level.
- G. Identify the risk of personal injury as a result of exposure to incident energy released during an arc flash event for each electrical distribution component (switchboard, switchgear, MCC, starter, panelboard, disconnect).

## END OF SECTION 26574