

APPENDIX C

SELECTED SPECIFICATIONS FOR THE WWTF

NORTH READING PUBLIC SCHOOLS

NORTH READING MIDDLE AND HIGH SCHOOL

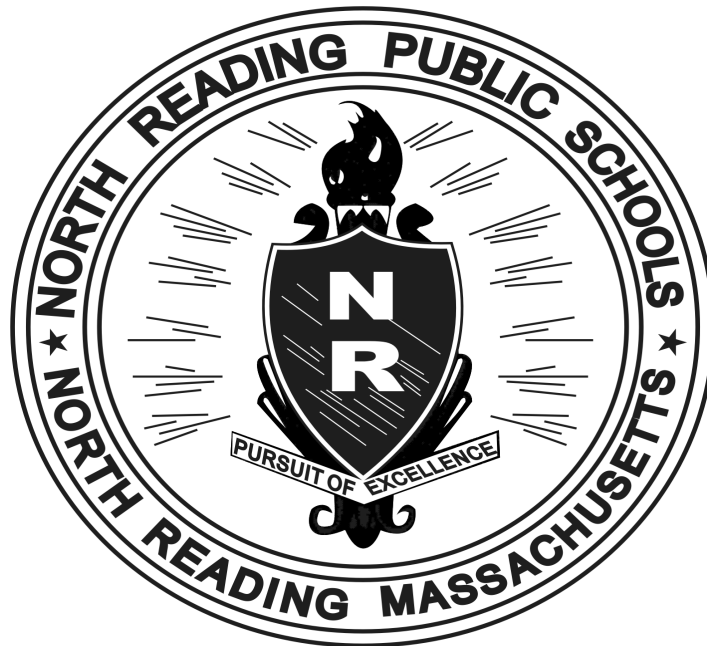
WASTEWATER TREATMENT FACILITY

CONTRACT OPERATION AND MAINTENANCE SERVICES

REQUEST FOR PROPOSAL

FEBRUARY 14, 2020

RFP No. 20 – 02



SANITARY SEWERAGE UTILITIES (WWTP)**PART 1 – GENERAL****1.01 CONDITIONS AND REQUIREMENTS**

- A. The GENERAL DOCUMENTS, as listed on the Table of Contents, and applicable parts of Division 00 10 00, shall be included in and made part of this Section.
- B. Examine all conditions as they exist at the project prior to submitting a bid for the work of this SECTION.
- C. Examine all Drawings and all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.
- D. 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.
- E. Any manufacture's names and/or model numbers identified herein are intended to assist in establishing a general level of quality, configuration, functionality, and appearance required. This is not a proprietary specification and it should be noted that "or approved equivalent" applies to all products noted herein. It is understood that all manufacturers will have minor variations in configurations, appearance, and product specification to encourage open and competitive involvement from multiple manufacturers that are able to supply similar products.

1.02 SCOPE OF WORK

- A. Provide all equipment and materials, and do all work necessary to construct the exterior sanitary sewerage system, complete, including all underground piping, manholes, tanks and connections and installation of the final underground sewage disposal area (including force main), as indicated on Drawings and as specified.
- B. The work shall also include the complete demolition of all existing septic systems including removal of existing manholes, plugging of existing pipes, removal of existing pumps and controls, removal of existing wiring, pumping of existing manholes, septic tanks, siphon chambers, pump chambers and distribution boxes and proper disposal of the effluent, crushing and filling of the existing septic tanks and pump chambers and removal of distribution boxes and obtaining Board of Health approval of the abandonment of the existing septic system. This includes Septic Systems serving the existing High School and Middle School. Demolition schedule shall be as directed by the Architect and overall school phasing schedule.
- C. The Contractor shall pay for all costs and fees related to the construction of the new sewerage system, including all permit, connection and inspection fees and shall file all applications, details, and drawings required by the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control.

1.03 RELATED SECTIONS

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Alternates: Administrative requirements for alternates affecting work of this section.
 - 2. Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS
 - 3. Section 02 00 00, EXISTING CONDITIONS
 - 4. Section 03 10 00, SITE CLEARING
 - 5. Section 31 20 00, EARTH MOVING
 - 6. Section 32 10 00, BASES, BALLAST, PAVING
 - 7. Section 32 30 00, SITE IMPROVEMENTS
 - 8. Section 32 92 00, TURFS & GRASSES
 - 9. Section 03 30 00 CAST IN PLACE CONCRETE
 - 10. Division 05 00 00, MISCELLANEOUS METALS
 - 11. Division 22 00 00, PLUMBING
 - 12. Division 23 00 00: MECHANICAL
 - 13. Section 26 00 00, ELECTRICAL

14. Section 44 41 13, PACKAGE WATER TREATMENT PLANT

1.04 REFERENCES

- A. Codes and Standards: Materials and methods of installation, cleaning, and testing of water system shall comply with local requirements, except where more stringent requirements are indicated.
- B. Manufacturers: Firms regularly engaged in manufacture of materials of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- C. Massachusetts Plumbing Code: Comply with applicable portions of the current edition of the Commonwealth of Massachusetts Plumbing Code unless more stringent regulations apply.
- D. Massachusetts State Electrical Code: Comply with applicable portions of the current edition of the Commonwealth of Massachusetts Electrical Code unless more stringent regulations apply.
- E. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
 - 1. American Society for Testing and Materials (ASTM):
 - A 48 Gray Iron Castings
 - A 74 Cast Iron Soil Pipe and Fittings
 - A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - A 536 Ductile Iron Castings
 - C 32 Sewer and Manhole Brick (Made from Clay or Shale)
 - C 62 Building Brick (Solid Masonry Units Made from Clay or Shale)
 - C 270 Mortar for Unit Masonry
 - C 478 Precast Reinforced Concrete Manhole Sections
 - C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - C 891 Installation of Underground Precast Concrete Utility Structures
 - C 913 Precast Concrete Water and Waste Water Structures
 - D 2241 Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
 - D 2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipes and Fittings
 - D 2855 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
 - D 3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 - D 3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - F 758 Smooth-Wall Polyvinyl Chloride (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
 - 2. American National Standards Institute (ANSI)
 - B 16.5 Pipe Flanges and Flange Fittings
 - B31.1 Power Piping
 - 3. American Welding Society (AWS)
 - B3.0 Welding Procedure and Performance Qualifications
 - 4. American National Standards Institute/American Water Works Association (ANSI/AWWA):
 - C104/A21.4 Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water
 - C105/A21.5 Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
 - C110/A21.10 Ductile Iron and Gray Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.

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| C111/A21.11 | Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings |
| C115/A21.53 | Ductile Iron Compact Fittings 3 In., Through 16 In. for Water and Other Liquids |
| C150/A21.50 | Development of Standard Thickness Design of Ductile Iron Pipe |
| C151/A21.51 | Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids |
| C153/A21.53 | Ductile Iron Compact Fittings, 3 in. through 16 in., for Water and Other Liquids. |
| C500 | Gate Valves, 3 through 48 In. NPS, for Water and Sewage Systems |
| C600 | Installation of Ductile-Iron Water Mains and Their Appurtenances |
5. American Water Works Association (AWWA)
 - Manual M11 Steel Pipe - A Guide for Design and Installation
 6. Commonwealth of Massachusetts Highway Department (MHD):
 - Standard Specifications for Highways and Bridges
 7. Commonwealth of Massachusetts Department of Environmental Protection:
 - 310 CMR 15.00 et. seq. (Title V of the State Environmental Code), latest edition.

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 EQUALS AND SUBSTITUTIONS

- A. All bidders are reminded that the design plans and specifications for the project have been generally based on certain pumping and precast concrete items that have been selected by the Owner and Engineer as meeting their requirements for the project. Any pumping and precast concrete items from any manufacturer that meets all of the requirements of the project specifications and considered "or equal" will be accepted by the Owner.
- B. If the use of alternate equipment requiring significant relocation of certain items of equipment or the addition of equipment, accessories or other work, the Contractor shall include all such work necessary to accommodate his proposed substitution in his base bid.
- C. The Contractor shall include with his bid a listing of the intended suppliers and manufacturers of the precast concrete items. Each of these suppliers must certify that the material/equipment they intend to supply for the project meets the specifications and will function to provide the intended result.

1.06 SUBMITTALS

- A. The following shall be submitted:
 1. DIG SAFE ticket number with the time and date when the site is clear for work.
 2. Permit for transport and legal disposal of demolition debris.
- B. Contractor's qualifications to perform the work and evidence of a current, valid Town of North Reading Sewage System Installer's License.
- C. Manufacturer's product data shall be submitted for the following:
 1. Castings
 2. Access Hatchways
 3. Pipe and fittings
 4. Conduit
 5. Tubing
 6. Precast Concrete Manholes
 7. Precast Concrete Trash Traps #1 and #2
 8. Precast concrete Flow Equalization Tank
 9. Precast Concrete Pre Anoxic Tank and Aeration Tank
 10. Precast Concrete Post Anoxic Tank
 11. Precast Concrete Dosing Tank
 12. Plastic Flow Chamber

13. Precast Membrane Drain Sump
14. Transition Couplings - each type
15. Check Valves
16. Valves, Each Type
17. Valve Boxes
18. Filter Fabric
19. PVC Pipe and Fitting
20. Schedule 80 PVC Pipe and Fittings
21. Schedule 40 PVC Pipe and Fittings
22. Anoxic Tank Pump connections
23. Transition Couplings
24. Stainless Steel Pipe`

Submittals shall include material information, dimensions, pipe, fitting and valve class information, weights, coating and lining system data. The Contractor shall supply the Engineer with manufacturer Certificates of Compliance with these Specifications and certification that the pipe, fittings and valves have been manufactured and tested in accordance with AWWA/ANSI specifications.

D. Shop drawings shall be submitted for each of the following:

1. Precast Concrete manholes
2. Precast Concrete Trash Tanks #1 and #2
3. Precast Concrete Flow Equalization Tank
4. Precast Pre Anoxic & Aeration Tank
5. E. Precast Concrete Post Anoxic Tank
6. Precast Concrete Dosing Tank
7. Plastic Flow Chambers
8. Precast Membrane Drain Sump
9. Access Hatchways

Shop drawings, structural design calculations all of which are signed and sealed by a Massachusetts Registered Professional Structural Engineer shall be required for all precast concrete tanks. Structural calculations shall be based on the design cover conditions, H-20 loading and groundwater at the ground surface. Floatation calculations shall be based on groundwater at the ground surface.

1.07 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. All equipment manufacturers shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the installer and operator of the equipment to operate and maintain the equipment supplied. Said instructions may assume that the operator is familiar with pumps, motors, piping, and valves, but that he has not previously operated and/or maintained the exact equipment supplied.
- B. These instructions shall be prepared as a systems manual applicable solely to the equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
- C. The instructions shall include, but no be limited to, the following:
 1. Descriptions of, installation procedures for and operating instructions for, each major component of the equipment supplied.
 2. Instructions for operation of the equipment in all intended modes of operation.
 3. Instructions for all adjustments which must be performed at initial startup of the equipment, adjustments which must be performed after the replacement of components and adjustments which must be performed in the course of preventive maintenance as specified by the manufacturer.

4. Instructions for the adjustment, calibration, and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
 5. Service instructions for major components not manufactured by the equipment manufacturer but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.
- D. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall operational instructions related to this specific installation shall not be acceptable.
 - E. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and which require the operator to selectively read portions of the instructions shall not be acceptable.

1.08 QUALITY ASSURANCE

- A. The entire work provided in this section shall be constructed and finished in every respect in a workmanlike and substantial manner, in strict accordance with the Drawings and specifications. It is intended that the Drawings along with the manufacturer's shop drawings substantially show all pipe, fittings and appliances; however, the Contractor shall furnish and install such parts as may be necessary to complete the systems in accordance with the best trade practice and to the satisfaction of the Engineer.
- B. The Contractor shall refer to all the drawings for a full comprehension of the work to be done and coordinate the work with other trades to avoid interference. Should any discrepancy appear or any misunderstandings arise, the Contractor shall request clarification by the Engineer.
- C. The Contractor shall be responsible for fully coordinating all of the various parts of the work included under this section, and such other work of this contract as it may affect the work of this section throughout various phases of construction and before the ordering or fabrication of the various parts of the work, so as to insure compliance with the drawings and specifications, and as necessary to provide performance in conformity with design requirements and satisfactory operating condition and operating sequences. Cooperate with such trades to assure the steady progress of all work under the Contract.
- D. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- E. The Contractor shall provide manufacturer's certification that materials meet or exceed minimum requirements as specified. Reference to standards such as ASTM and ANSI shall apply to those versions in effect at the time of bid opening.
- F. Guarantees: In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain extended guarantees for materials furnished under this section where such guarantees are offered in the manufacturer's published data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.09 DELIVERY, STORAGE AND HANDLING

- A. All equipment and accessories shall be transported, unloaded, stored and handled in strict accordance with the manufacturer's instructions and recommendations. Protect from all possible damage.

1.10 TOWN OF NORTH READING AND STATE REQUIREMENTS

- A. The Contractor shall notify and make all necessary arrangements with the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control sufficiently in advance of the installation of the sewerage disposal system for any testing and inspection to occur.
- B. All work and materials for the sewerage disposal system installation shall be subject to approval of the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control.
- C. The Contractor shall be responsible for making all arrangements with the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control and for paying all fees associated with the sewerage disposal system installation, testing and inspection.

- D. Comply with the rules, regulations, laws and ordinances of the Town of North Reading, the Commonwealth of Massachusetts, appropriate agencies of the Commonwealth of Massachusetts, and all other authorities having jurisdiction. Coordinate all work done within Town of North Reading rights of way with the appropriate agencies. Provide all required traffic control and safety measures, including uniformed police officers per Town of North Reading requirements. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.
- E. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration (OSHA), United States Department of Labor.
- F. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.
- G. The Contractor shall not close or obstruct any street, driveway, sidewalk, or passageway unless authorized in writing by the Engineer. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of roads, driveways, sidewalks or other facilities near enough to the work to be affected hereby. The Contractor shall comply with the time limits established by the terms for trucking onto and off of the site.
- H. Any apparent conflict between the Drawings and Specifications and the applicable codes and regulations shall be referred to the Engineer in writing, for resolution before the work is started.
- I. The Contractor shall notify "Dig Safe" and all local utility companies prior to the start of construction. The "Dig Safe" number shall be submitted by the Contractor in writing to the Engineer and Owner prior to construction along with copies of written notification to the local utility companies.
- J. The contractor shall conform to all of the requirements of all of the permits in performing the work including the MGL Ch. 131, s40 Order of Conditions and Determination of Applicability.

1.11 INSPECTION AND TESTING

- A. Pipe, precast structures and castings shall be inspected and tested at the manufacturer for the standard specifications to which the material is manufactured.
- B. The Owner reserves the right to have any or all pipe, precast structures and castings inspected and/or tested by an independent testing agency at manufacturer's plant or elsewhere. Such inspection and tests shall be at the Owner's expense.
- C. Pipe, precast structures and castings shall be subjected to a careful inspection by the Contractor just before being installed.
- D. The Contractor shall be responsible for performing all tests required by the Town of North Reading Board of Health, the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control and the Engineer.

1.12 CONTRACTOR QUALIFICATIONS AND LICENSE

- A. Contractor installing the sewerage system shall have a minimum of five (5) years experience in work of the type required by this section and shall have installed at least 5 systems with a design flow equal to or greater than the design flow for this project.
- B. All work on the sewer system shall be performed by a contractor who is licensed and bonded with the Town of North Reading Board of Health and is a licensed installer of sewage disposal systems, with a valid current license issued by the Town of North Reading Board of Health.

1.13 INFORMATION

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.
- B. Plans, surveys, measurements and dimensions, under which the work is to be performed, are believed to be correct to the best of the Engineer's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found herein.
- C. Information on the Drawings and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

- D. Subsurface information is contained in the geotechnical report which has been prepared for the Owner by school project geotechnical firm.

1.14 EXISTING CONDITIONS

- A. The Contractor shall become thoroughly familiar with the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section.
- B. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.
- C. The Contractor may, at his own expense, conduct additional subsurface testing for his own information after approval by the Owner.

1.15 DISPOSITION OF EXISTING UTILITIES

- A. Active utilities existing on the site and work areas shall be carefully protected from damage and relocated, rerouted or removed by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings as described in this Section and Engineer, Owner and the Utility Owner notified in writing.
- B. Inactive or abandoned utilities encountered during construction operations shall be removed if within a building area or grouted, plugged or capped. The location of such utilities shall be noted on the record drawings and reported in writing to the Engineer and Owner.

1.16 PROTECTION

- A. Do not interfere with use of adjacent buildings. Maintain free and safe passage to and from all adjacent buildings and buildings on the site to remain.
- B. Cease operations and notify Engineer immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.
- C. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.
- D. Provide, erect, and maintain street boardings, sidewalk shed, barricades, lighting, and guardrails to protect general public, workers, and adjoining property.

1.17 MAINTAINING TRAFFIC

- A. Do not close or obstruct roadways without permits. Access to the existing school buildings on site and homes along the forcemain route must be maintained.
- B. Conduct operations with minimum interference to public or private roadways.
- C. Refer to the Massachusetts Highway Department Access and Utility Construction permits for special conditions regarding safety and the maintenance of traffic flow on state highways.

1.18 MAINTENANCE OF EXISTING FLOW

- A. The Contractor shall schedule his work so as to maintain sewage flow within the existing septic system until the new subsurface sewage disposal system is fully constructed, tested and approved for operation. This provision may require the use of temporary pumps, pipes or connections, all of which shall be provided by the Contractor.

PART 2 - PRODUCTS

2.01 PIPE STUB MARKER

- A. Pipe stub markers shall be 2 in. by 2 in. solid oak stakes with a 2 in. by 1/16 in. by 12 in. galvanized steel strap screwed to the top end.

2.02 WALKWAY, PAVING AND CURBING REPAIR FOR TEST PITS

- A. Any materials necessary to repair walkways, pavements or curbs damaged by the excavation of test pits shall match the existing material types and the specifications contained in Section 32 00 00 of these specifications.

2.03 LAWN REPAIR FOR TEST PITS

- A. Any materials necessary to repair lawns damaged by the excavation of test pits shall match the existing material types and the specifications contained in Section 32 12 16 of these specifications.

2.04 UTILITY REPAIRS

- A. Any materials necessary to repair underground utility lines damaged by the excavation of test pits shall match the existing material types and the relevant sections of these specifications or the specifications of the appropriate utility company.

2.05 PVC SEWER AND VENT PIPE

- A. Vent pipe shall be Poly (Vinyl Chloride) (PVC) non pressure pipe and conform to ASTM D3034, SDR 35 minimum wall thickness for solid wall pipe.

2.06 PVC PIPE AND FITTINGS

- A. Polyvinyl chloride (PVC) nonpressure pipe for gravity sewers shown on the MEA WWTP contract drawings shall conform to ASTM D 3034, SDR35 minimum wall thickness for solid wall pipe or approved equal.
- B. Pipe shall be bell-and-spigot in standard lengths of 12 feet 6 inches.
- C. Bell end shall be an integral wall section with solid cross section rubber ring, factory assembled.
- D. Spigot end shall be beveled to ensure proper insertion. Spigot end shall be imprinted with assembly stripe, to which the bell end of the mated pipe will extend upon proper jointing.
- E. Rubber rings shall conform to ASTM D 3212.
- F. Pipe ends shall permit checking of the rings with a feeler gage to ensure their proper location in the coupling grooves.
- G. PVC fittings shall be bell-and-spigot type, compatible with the pipe. PVC pipe and fittings as manufactured by Zhejiang Nanfeng Pipe Industry Co., Shanghai, Tomson Plastic Industry, Yuyao Jiachi Pipe Co. LTD, or approved equal.
- H. Pipe couplings shall be Fernco type with stainless steel bands. Fernco couplings provided by Fastenal Co., Bellflower & Lakewood Steel & Pipe Utilities Supply Corp., or approved equal.

2.07 SCHEDULE 80 PVC SOLID PIPE AND FITTINGS (PRESSURE PIPE FOR PIPING BETWEEN TANKS AND INSIDE TANKS OR WHERE SHOWN ON DRAWINGS)

- A. Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Cell Classification 12454-B, Polyvinyl Chloride as outlined in ASTM D 1784. PVC shall be white in color. Pipe and fitting materials shall be specifically formulated with sufficient UV screeners to provide for long term outdoor exposure with no deleterious effects. Pipe shall be pressure rated.
- B. Materials from which fittings and pipe are manufactured shall have been tested and listed for conveying potable water by the National Sanitation Foundation (NSF).
- C. Fitting components with socket type solvent cement connections shall have socket diameters, lengths, and wall thicknesses as prescribed by ASTM D 2146.
- D. Pipe shall have diameters and wall thicknesses as prescribed by ASTM D 1785 for pressure rated pipe.
- E. Solvent cemented pipe and fittings shall be pressure rated accordance with the requirements of ASTM D 1785 and ASTM D 2146, respectively.
- F. Pipe and fittings shall be clearly marked in accordance with the requirements of ASTM D 1785 and ASTM D 2146, respectively.
- G. Pipe shall meet all of the requirements of Title V of the State of Massachusetts Environmental Code.
- H. Schedule 80 PVC Pipe as manufactured by Zhejiang Liutong Plastic Co., LTD, Cangzhou Haoguan Manufacturing Pipe Fitting Co. LTD, Hangzhou Hotool Pipe Tool Factory, or approved equal.

2.08 DUCTILE IRON PIPE AND FITTINGS (WHERE SHOWN ON DRAWINGS)

- 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 type, restrained joint or mechanical joints.
- B. Ductile iron (DI) pipe for sewer force main and gravity sewer shall be designed in accordance with ANSI/AWWA C150/A21.50 and shall be manufactured in accordance with ANSI/AWWA C151/A21.51. Unless otherwise indicated or specified, ductile iron pipe shall be at least thickness Class 52 with a rated working pressure of 150 psi (surge pressure = 300 psi) and furnished in nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by

U.S. Pipe and Foundry Company, Clow Corporation, American Cast Iron Pipe, or approved equal with gaskets conforming to AWWA C111 ANSI A21.11 "Rubber Gasket Joints".

1. DI pipe for sewers and force mains may be either mechanical joint or push on joint.
 2. DI pipe inside the pump stations and all underground tanks and under the floor of the new wastewater treatment building shall be flanged joint only.
 3. Pipe shall be supplied in 20 foot lengths along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.
 4. Fittings 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 manufactured in the United States. Fittings shall be of the same material and have the same lining and coating as the pipe specified above. 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.
 5. DI fittings inside all tanks shall be flanged joint type and shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 and shall further conform to the applicable requirements of MHD Standard Specification M5.05.3. All fittings shall be minimum Class 350.
 6. Retainer glands shall be used at all mechanical joints and shall be of ductile iron construction conforming to ASTM A 536. All retainer glands shall be U.L. and F.M. approved. All retainer glands shall be furnished with ductile iron set screws. Set screws shall be torque to 70 ft-lbs. Restraints for mechanical joints shall be Megalug as manufactured by Ebaa Iron Co., Mechanical Joint Restraint (MJR) System as manufactured by Tyler Pipe or equal. Restraints for push-on joints shall be Series 800 Coverall as manufactured by Ebaa Iron Co., Star Pipe, Inc., Qingdao Voltech Manufacturing Co. LTD.
 7. Gaskets shall conform to ANSI/AWWA C111/A21.11.
 8. Inside of pipe and fittings shall be given a double thickness cement lining and bituminous seal coat in accordance with ANSI/AWWA C104/A21.4. The outside of pipe and fittings shall be coated with a standard bituminous coating conforming to ANSI/AWWA C151/A21.51 and C110/A21.10, respectively.
 9. Pipe for use with sleeve-type couplings shall be as specified above except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.
 10. The Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross-connections, whether or not specifically stated in the Contract Drawings and Specifications.
- C. Pipe and fittings shall meet all of the requirements of Title V of the State of Massachusetts Environmental Code as well as the requirements of 310 CMR 15.00 et. seq.

2.09 SCHEDULE 40 SOLID PRESSURE RATED PVC PIPE AND FITTINGS PRESSURE PIPE FOR FORCEMAN PIPING UNDER THE FINAL DISPOSAL AREA, AND VENT PIPING (WHERE SHOWN)

- A. Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Cell Classification 12454-B, Polyvinyl Chloride as outlined in ASTM D 1784. PVC shall be white in color. Pipe and fitting materials shall be specifically formulated with sufficient UV screeners to provide for long term outdoor exposure with no deleterious effects. Pipe shall be pressure rated.
- B. Materials from which fittings and pipe are manufactured shall have been tested and listed for conveying potable water by the National Sanitation Foundation (NSF).
- C. Fitting components with socket type solvent cement connections shall have socket diameters, lengths, and wall thicknesses as prescribed by ASTM D 2467.
- D. Pipe shall have diameters and wall thicknesses as prescribed by ASTM D 1785 for pressure rated pipe.
- E. Solvent cemented pipe and fittings shall be pressure rated accordance with the requirements of ASTM D 1785 and ASTM D 2467, respectively.
- F. Pipe and fittings shall be clearly marked in accordance with the requirements of ASTM D 1785 and ASTM D 2467, respectively.

- G. Pipe shall meet all of the requirements of Title V of the Commonwealth of Massachusetts Environmental Code.
- H. Schedule 40 pressure rated PVC pipe and fittings as provided by Charlotte Pipe & Foundry, U.S. Plastics, Aetna Plastics Corp., or approved equal.

2.10 PVC VALVES

A. Butterfly Valves PVC Body

Butterfly valves and operators for wastewater piping shall conform to AWWA Standard Specifications for rubber seated butterfly valves. Designation C504, except as herein specified. Valves shall have minimum 150 psi pressure rating and be equal to those manufactured by Colonial Engineering, Inc., Hayward Valves, L.D. Valve Co., U.S. Plastics, or approved equal. Valve body shall be Type 1, Grade 1 PVC.

B. Gate Valves

Gate valves for PVC pipe in plant influent, process water and effluent lines to Dosing Tank shall be PVC Type 1, Grade 1 as manufactured by Asatii/America, Hayward Valves, L.D. Valve Co., LTD, U.S. Plastics Corp., or approved equal. Valves shall have a non-rising stem with a visible position indicator. Valves shall be provided with an operating wheel. Valve bodies shall be flanged and type (unless otherwise approved). All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

C. Ball Valves

Ball valves for the PVC pipe in plant influent/effluent lines upstream of Dosing Tank shall be of PVC Type 1, Grade 1 as manufactured by Asatii/America, Hayward Valves, L.D. Valve Co., or approved equal. Valve bodies shall be double union type supplied with flange adapters, unless otherwise approved. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.11 BUTTERFLY VALVES (METAL BODY)

A. Butterfly Valves (Metal Body)

1. Butterfly valves and operators for low pressure air, piping shall conform to the AWWA Standard Specification for rubber seated butterfly valves, Designation C504, except as hereinafter specified. Valves shall have a minimum 150 psi pressure rating and be equal to those manufactured by Henry Pratt Company, Crispin Valves, Triad Process Equipment, or equal.
2. Butterfly valves shall be flanged end with face to face dimensions in accordance with Table 2 of above mentioned AWWA Specification for short-body valve, or wafer type.
3. Valve seats shall be full resilient seats retained in the body or on the disc edge in accordance with Section 8 of the above mentioned AWWA Specification. If the resilient seat is in the body, the disc shall be of cast ni-resist conforming to ASTM A436 Type 1 with the periphery machined to a smooth spherical surface. If the resilient seat is mounted on the disc edge it shall be held in place by a one-piece Type 304 stainless steel retaining ring and stainless Nylock screws, the disc shall be of ASTM A48, Class 40 cast iron and a mating Type 304 stainless steel ring shall be installed in the valve body. Resilient seats shall be Hycar or equal for water service and Nordel or equal for air service. Resilient seats in valves for air service shall be mounted in the body only.
4. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Permanently self-lubricating body bushings shall be provided and shall be sized to withstand bearing loads. Stuffing box of liberal dimensions shall be provided at the operator end of the vane shaft, arranged so that the packing can be replaced by removing the bronze follower without removing the operator. Packing shall be of the Chevron type as manufactured by Garlock Packing Company. A sealing element utilizing O-rings shall also be acceptable.
5. The valve shaft shall be of type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque.
6. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.
7. Gearing for the operators where required shall be totally enclosed in a gear case in accordance with Section 3.8.3 of the above mentioned AWWA Standard Specification.

8. The manual operators shall conform to Section 3.8.1 of the above mentioned AWWA Standard Specifications, insofar as applicable. Valves shall have hand wheel or lever operators and open left, or counterclockwise. Operators shall have indicators to show position of the valve disc. Operators shall be rigidly attached to the valve body.

2.12 POLYPROPYLENE TUBING

- A. Polypropylene tubing for alkalinity and carbon feed lines shall be Type 1 polypropylene conforming to ASTM D-2146 with a stress of 112 psi @ 70 degrees F. Tubing shall be installed without any joints or splices. Tubing shall be ½" diameter, US Plastic Corp. or approved equal. Polypropylene tubing to be installed inside long sweep curved PVC piping. Tubing as provided by Uline Corp., U.S. Plastics, Omega Co., or approved equal.

2.13 SLEEVE TYPE TRANSITION COUPLINGS

- A. Sleeve-type couplings shall be cast iron and shall be Dresser Style 53, manufactured by Dresser Mfg. Div., Bradford, PA; Smith-Blair Style 441, manufactured by Smith-Blair, Inc., San Francisco, CA; Clow Type F-1208, manufactured by Clow Corporation, Rochester, NY; or approved equal.
 1. To ensure correct fitting of pipe and couplings, sleeve-type couplings and accessories shall be furnished by the supplier of the pipe and shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.
 2. Couplings shall be provided with galvanized steel bolts and nuts.
 3. Couplings shall be furnished with the pipe stop removed.
- B. Penetration Seals: Between Flow Equalization Tank and Pump Chamber there shall be a link seal type rubber seal with adjustable links to expand to pipe size. Link seal type connector to be provided by Trubull Mgr. Co., Pipeline Seal, RPH Distributors LTD, Flex Craft Industries, or approved equal.

2.14 STAINLESS STEEL PIPE (AIR PROCESS SUPPLY)

- A. Stainless steel shall be seamless and 316 Grade Stainless Steel piping and shall be used for all process air lines below floor grades. Fittings shall be 316 Stainless Steel. Joint for fitting shall be threaded for standard screwed joints or welded joints. (Submittal required). Stainless Steel pipe manufactured/supplied by Quality Pipe Products Inc., American Piping Products, American Stainless Supply.

2.15 STEEL PIPE

- A. Steel pipe shall be seamless and standard weight Schedule 40 pipe shall conform to ASTM Designation A120 or otherwise noted above. Where indicated on the Drawings to be galvanized (such as pump guide rails or submerged supports), pipe shall be hot-dipped galvanized after fabrication.
- B. Joints for pipe 2-in or less shall be threaded for standard screwed joints. Threaded joints shall be made up with good quality thread compound and applied to the male thread only. After having been set up, a joint shall not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. All joints shall be air tight. A sufficient number of unions shall be provided to allow for convenient removal of piping. Unions shall be spaced no more than every 20 ft.
- C. Fittings for steel pipe 2-in or less shall be standard malleable iron, 150 lb. Fittings shall conform to ASTM Designation A-47, Grade 32510 service rating. For galvanized pipe, fittings shall also be hot dipped galvanized and shall conform to ASTM Designation A-153. Joints for fittings shall be threaded for standard screwed joints.
- D. Where flanged connections are indicated or otherwise required on pipe 2-in or less for connection to flanged valves, fittings, and appurtenances, they shall be made up using companion type flanges. Where flanged fittings are indicated or otherwise required, they shall be made up using threaded steel nipples and steel companion type flanges. Companion flanges shall be steel, 150 lb. ANSI Standard flat face flanges of the threaded type. Flanges shall be spot faced on the back around each bolt hole. For galvanized pipe, flanges shall also be hot-dipped galvanized.
- E. Pipe greater than 2-in size, shall have threaded or welded joints. Threaded joints, fittings, and flanges shall be as specified above. Pipe shall have beveled ends for welding. Fittings shall be steel, butt weld type. Standard wall, conforming to ANSI B16.9 and ASTM A234, Grade WPB. Flanges shall be steel slip on or welding neck type, raised face, Class 150, conforming to ASTM A-105 and ANSI B16.5. Gaskets shall be ring type, composition asbestos Sheet No. 3, 1/16-in thick, I.D. and O.D. by pipe size. Bolts and nuts for flanges shall be hex head cap screws conforming to ANSI B16.2, coarse threads, Class 2A fit, manufactured of ASTM A307, Grade B steel.
- F. Steel pipe to be supplied by Tubular USA, Bellmore Steel Products Corp, Tubenet, or approved equal.

2.16 CONCRETE THRUST BLOCKS

- A. Concrete thrust blocks strength shall be 3,000 psi and meet, as a minimum the dimensions shown on the Drawings.

2.17 CONCRETE ENCASEMENTS, TANK INFILL AND ANTI-FLOTATION SLABS

- A. Concrete strength for encasements, tank infill and anti-flotation slabs shall be 3,000 psi and meet, as a minimum the dimensions shown on the Drawings.

2.18 PLASTIC LINE MARKER TAPE

- A. Provide six inch wide by four mil. thick green plastic tape with continuous black printing "CAUTION SEWER LINE BELOW" on one side. Provide tape intended for direct-burial service from one of the following manufacturers or Engineer approved substitute; Allen Systems, Inc., Emed Co. Inc., or Seton Name Plate Corporation.

2.19 PRECAST MANHOLES

- A. All sewer manhole structures shall be precast concrete.
- B. All precast concrete structures shall conform to ASTM C 478 and shall be similar to those manufactured by Concrete Systems, Inc., Old Castle Precast, Chase Precast, Precast Concrete Sales, Co., Acme Precast, or approved equal. Precast manhole structures shall further conform to the following:
 - 1. Sections shall have tongue and groove joints.
 - 2. Joints between sections shall be made with preformed butyl rubber gaskets conforming to ASTM C 443.
 - 3. Each section shall have no more than two lifting holes or cast-in lifting devices.
 - 4. Precast base shall be manufactured with wall openings to receive the ends of pipes which are to be connected to structure.
 - 5. Pipe openings in base shall be minimum size required to receive pipe, and shall be accurately set to conform to the required line and grade.
 - 6. The minimum inside diameter of all precast manhole structures shall be four (4') feet.
- C. Pipe shall be joined to precast base using 4" wide stainless steel Korband and resilient rubber material conforming to ASTM C923 pipe connections. Products to be supplied by Trelleborg, Shaw Pipe, National Pollution Control Systems, or approved equal.
- D. Manholes shall have shaped brick inverts.
- E. All sewer manholes shall be provided with manhole steps. Manhole steps shall be extruded aluminum, conforming to Fed. Spec. QQ-A-200/8, or polypropylene plastic reinforced with 3/8 in. diameter steel rod.
 - 1. Steps shall be drop-front, anti-skid design, 12 in. wide. Projection of front edge of step shall be greater than or equal to 5 in. from manhole wall.
 - 2. Steps shall be embedded 4 in. into manhole wall. Those portions of aluminum steps to be embedded in manhole wall shall receive a heavy coat of heavy-bodied bituminous paint. Coating shall be thoroughly dry before steps are embedded in manhole.
 - 3. Steps in precast sections shall be embedded at time of casting.
- F. Manholes shall be designed to safely withstand an AASHTO H-20 loading, as specified in the AASHTO Specifications.
- G. The exterior surfaces of all precast structures shall be given one shop coat of bituminous waterproof coating as manufactured by Kopper Company, Isomat Building Products, Aqual Seal, or an approved equal.

2.20 PRECAST MEMBRANE DRAIN SUMP

- A. Precast concrete structure similar in specifications as 2.25 B, except to include a cast in place hatchway within top slab.

2.21 BRICK

- A. Brick for support of cast-iron cover and frame shall be one of the following types:
 - 1. Common brick meeting the physical requirements of ASTM C 62, Grade SW.
 - 2. Clay brick meeting the physical requirements of ASTM C 32, Grade MS.
- B. Brick for sewer manhole invert channel shall conform to ASTM C 32, Grade SS.

2.22 PORTLAND CEMENT MORTAR

- A. Mortar shall be a Portland cement mortar conforming to ASTM C 270, Type M.
- B. Mortar shall contain a waterproofing admixture. Waterproofing admixture shall be one of the following:

<u>Admixture</u>	<u>Manufacturer</u>
Hydratite Plus	W.R. Grace and Company
Medusa Waterproofing	Medusa Portland Cement Co.
Omicron Mortarproofing	Master Builders Company
Mortaron	The Aquabar Company
Hydrocide Powder	Sonneborn Bldg Prod., Inc.

2.23 NONSHRINK GROUT

- A. Grout shall be nonshrink cement-based type, such as Master Builders Company "Embeco" or U.S. Grout Corporation "5 Star Grout".

2.24 PRECAST CONCRETE TANKS

- A. The concrete tanks for the trash traps, flow equalization, dosing and reverse osmosis reject tank shall be as manufactured by Rotondo & Sons, Inc., Old Castle Precast, Chase Precast, Concrete Systems, Inc., Acme Precast, or approved equal.
- B. The precast tanks shall include the following:
 - 1. Precast Concrete Trash Tanks #1, #2, #3 and #4
 - 2. Precast Concrete Flow Equalization Tank
 - 3. Precast Concrete Pre Anoxic and Aeration Tanks
 - 4. Precast Concrete Anoxic Tank
 - 5. Precast Concrete Dosing Tank
 - 6. Precast Membrane Drain Sump
- C. Precast concrete structures shall further conform to the following:
 - 1. The tank structural design shall be based on groundwater being at the elevation of the ground surface. The structural design of each unit shall take full account of the load applied by the soil and structure(s) to be placed above the unit as well as H-20 vehicle loading.
 - 2. All sections shall have tongue and groove joints.
 - 3. Joints between sections shall be made with preformed rubber gaskets conforming to ASTM C 443.
 - 4. Each section shall have cast-in lifting devices (NO HOLES WILL BE ALLOWED).
 - 5. The tanks will be provided with copolymer manhole steps at intervals of not more than twelve (12") inches on the wall where the main access cover is located.
 - 6. The tanks shall be manufactured with wall openings to receive the ends of pipes, which are to be connected to structure.
 - 7. Pipe openings in the tanks shall be minimum size required to receive pipe, and shall be accurately set to conform to the required line and grade.
 - 8. Entrance and discharge pipes shall be joined to tanks using "KOR-N-SEAL" pipe connections.
 - 9. The exterior surfaces of all precast structures shall be given two shop coats of bituminous waterproof coating.
 - 10. The installed tanks must be leak tested by the tank supplier after installation as specified herein and the supplier shall provide a written certification that each Precast Concrete Tank specified is watertight.

2.25 LEACH FIELD CHAMBERS

THE FINAL FILTER AREA WILL REQUIRE LEACHING CHAMBERS AS FOLLOWS:

- A. PLASTIC CHAMBERS;
 - 1. Plastic flow diffusers shall consist of custom precast concrete units. Approved equal must meet the same dimensional requirements as Cultec to provide H-20 loading without revision to the leaching area geometry or

flow distribution pattern. Contractor will be responsible for all design changes including resubmittal to MA DEP for approval. Plastic Chambers shall be manufactured by Cultec, Infiltrator Quick 41S1, Storm Tech -5C-310 or ADS-36 ARC.

2. The plastic chambers shall further conform to the following chamber parameters:
 - a. The Chambers will be sized to be equivalent to Cultec, Inc. and must be designed for H-20 loading.
 - b. The Chamber will be vacuum thermoformed of black high molecular weight high density polyethylene (HMWHDPE).
 - c. The chamber will be arched in shape.
 - d. The chamber will be open-bottomed.
 - e. The chamber will be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate end walls.
 - f. The nominal chamber dimensions of the Cultec Contactor 100HD shall be 12.5 inches (318 MM) tall, 36 inches (914 MM) wide and 8 feet (2.44 M) long, the installed length of a joined contactor 100HD shall be 7.5 feet (2.29M).
 - g. Maximum inlet opening on the chamber end wall is 10 inches (250 MM).
 - h. The nominal storage volume of the contactor 100HD chamber will be 1,800 ft³/ft (0.173 M³/M) – without stone. The nominal storage volume of a joined contactor 100HD shall be 13,995 ft³/ft/unit (0.396 M³/unit) – without stone.
 - i. The contactor 100HD chamber will have fifty-six discharge holes bored into the sidewalls of the unit's core to promote lateral conveyance of water.
 - j. The contactor 100HD chamber shall have 16 corrugations.
 - k. The end wall of the chamber, when present, will be an integral part of the continuously formed unit, separate end plates cannot be used with this unit.

B. CONCRETE CHAMBERS

1. Concrete Chambers may be used in lieu of plastic chambers provided the leach field remains the same dimensional size and flow distribution pattern. Contractor will be responsible for all design changes including resubmittal to DEP for approval.

The final filter area will require precast concrete chambers as follows:

- a. Concrete flow diffusers shall consist of custom precast concrete units as manufactured by Rotondo & Sons, Inc., Old Castle Precast, Chase Precast, Shea Concrete, Acme Precast or approved equal.
- b. The precast concrete flow diffusers shall further conform to the following:
 - 1) All sections shall have tongue and groove joints.
 - 2) Each section shall have cast-in lifting devices (NO HOLES WILL BE ALLOWED).
 - 3) The units will be manufactured with wall openings to receive the ends of pipes, which are to be connected to structure.
 - 4) Pipe openings in the diffuser shall be minimum size required to receive the vent pipe, and shall be accurately set to conform to the required line and grade.
 - 5) Precast Concrete Chamber must be designed for H-20 loading.
 - 6) Chambers must have horizontal stiffening flex reduction steps between the ribs.
 - 7) The chamber will be designed to withstand AASHTO H-25 load rating when installed according to recommended installation instructions.
 - 8) Heavy duty units are designated by a colored stripe formed into the part along the length of the chamber.
 - 9) The chamber will have a raised integral cap at the top of the arch in the center of each unit to be used as an optional inspection port or clean-out.
 - 10) The units may be trimmed to custom lengths by cutting back to any corrugation.
 - 11) The chamber shall be manufactured in an ISO 9001:2000 certified facility.

2.26 SLEEVE TYPE TRANSITION COUPLINGS

- A. Sleeve-type couplings shall be cast iron and shall be Dresser Style 53, manufactured by Dresser Mfg. Div., Bradford, PA; Smith-Blair Style 441, manufactured by Smith-Blair, Inc., San Francisco, CA; Clow Type F-1208, manufactured by Clow Corporation, Rochester, NY.
 - 1. To ensure correct fitting of pipe and couplings, sleeve-type couplings and accessories shall be furnished by the supplier of the pipe and shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.
 - 2. Couplings shall be provided with galvanized steel bolts and nuts.
 - 3. Couplings shall be furnished with the pipe stop removed.
- B. Penetration Seals: Between Permeate Feed Tank and Pump Chamber there shall be a link seal type rubber seal with adjustable links to expand to pipe size. Link seal type connector to be provided by Trubull Mgr. Co., Pipeline Seal, RPH Distributors LTD, Flex Craft Industries.

2.27 CASTINGS

- A. Manhole frames and covers shall be cast iron conforming to ASTM A 48, Class 35, and Massachusetts Highway Department Standard Details. Frames and covers shall be suitable for AASHTO H-20 loading.
 - 1. All 24" manhole frames and covers shown on the drawings shall have a 24" diameter (clear opening) and shall be Catalog #LB268-3 as manufactured by Ease Jordan Iron Works, Neenah Foundry co., Mechanic Iron Foundry, or approved equal. The manhole frames and covers shall provide for a 24" clear opening.
 - 2. All sewer and tank/structure manhole covers shall read "SEWER".
 - 3. All approved equals for the castings specified shall be North American made, heavy-duty castings.
- B. Castings shall have shop-applied coal-tar-pitch varnish coating.

2.28 TANK ACCESS COVER/HATCHWAY

- A. The hatchway for the Flow Equalization Tank, Dosing Tank shall be a heavy-duty style, H-20 loading, aluminum hatchway (Model #ECD-13HD (36"x 60" size) as manufactured by Syracuse Casting, Bilco Hatchways, Halliday, Babcock Davis, or approved equal.
- B. The Hatchway for the precast pre Anoxic, Aeration and Post Anoxic Tanks located inside the WWTP building shall be sized as shown on drawings except they may be H-10 loading (safety grate required). Membrane drain sump shall be same manufacturer as A above except hatchway shall be 24" x 30" size and may be H-10 loading rating with safety gate.
- C. Hatchway material shall be 6061-T6 aluminum for bars, angles and extrusions. 1/4" diamond plate shall be 5086 aluminum. Hatchway design of each access hatch shall conform to OSHA standard 1910.23. The hatchway unit shall be designed heavy duty, for H-20 wheel loads, where not subject to high density traffic. Angle frame and bearing plate must be cast into and supported by concrete. Each hatch shall be designed using a maximum design stress of 17,300 psi as per the Aluminum Association, Inc. "Specifications for Aluminum Structures", with a safety factor of 2.2 applied to a minimum allowable tensile strength. Engineering calculations shall be supplied upon request.
- D. Each hatchway door shall be supplied with a heavy duty, stainless steel pneu-spring, for ease of operation when opening cover. Cover shall be counterbalanced, so one person can easily open the hatch door. Spring design shall accommodate ease of maintenance. Each door shall be equipped with a grade 316 stainless steel hold open arm. Door shall lock open in the 90 degree position. Each hold open arm shall have a red vinyl grip handle. Hold open arm shall be fastened to the frame with a 1/2" grade 316 stainless steel bolt.
- E. The hatchway angle frame shall be of extruded aluminum, with a continuous 1-1/2" anchor flange. Angle frame shall be a minimum of 1/4" thick. Hinges shall be of heavy duty design. Material shall be a brass alloy with a 65,000 psi tensile strength. Each hinge shall have a 3/8" grade 316 stainless steel pin. Hinges shall be bolted to the angle frame and diamond plate, with grade 316 stainless steel bolts and ny-lock nuts.
- F. Each hatch shall be supplied with a grade 316 stainless steel slam lock, with keyway protected by a threaded aluminum plug. Plug shall be flush with the top of the 1/4" diamond plate. Slam lock shall be fastened with four grade 316 stainless steel bolts and washers. Each hatch shall be equipped with an aluminum lift handle. The lift handle shall be flush with the top of the 1/4" diamond plate.
- G. The hatchway shall be provided with safety grates as manufactured for ITT Flygt Corp. Safety grates shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 psi and a minimum yield strength of 35,000 psi, as

per ASTM B221. Grate design shall use safety factors as defined in the "Specifications for Aluminum Structures", by the aluminum Association, Inc., 5th edition, Dec. 1986 for "Bridge Type Structures".

- H. Grating for outside tankage shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span. Grate opening shall be 5" x 5", which will allow for visual inspection of the pit, once the access hatch is open. Each grate shall be provided with a permanent hinging system, which will lock the grate in the 90 degree position once opened. Each grate shall have an opening arm, with a red vinyl grip handle, which will allow opening of the grate, while providing the grate as a barrier between the operator and the pit.
- I. Grate shall be painted with OSHA type safety orange paint. Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

2.29 VALVES AND VALVE BOXES

- A. Gate valves shall be iron body, resilient seated, tight-closing type. The valves shall be designed for minimum of 200 psi working pressure and 400 psi test pressure meeting all requirements of the latest AWWA Specification C509. Valves shall have a 10-mil minimum thickness factory applied epoxy coating on the interior and exterior surfaces. Epoxy coating shall be suitable for potable water usage and certified to NSF 61 standards the latest AWWA Specification C550.
- B. Valves are to have O-ring seals and a non-rising bronze stem. Valves shall have a 2-inch operating nut. Valves shall open left.
- C. Resilient wedge valves shall meet or exceed the most recent version of the AWWA standard specification for gate valves C-509-87.
- D. Valves shall be AVK Resilient Seat Gate Valve, U.S. Pipe, Mueller, Watts, or approved equal. All valves shall be U. L. listed and approved by Factory Mutual for fire service.
- E. Valve boxes shall be cast iron, tar coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece (oval in shape and compatible to the valve size), a flanged top piece, and a cover with two (2) lifting holes. Valve boxes shall further conform to the following:
 - 1. Box shall be designed and constructed to prevent the direct transmission of traffic loads to the piping or valve.
 - 2. Upper section of box shall have a flange with sufficient bearing area to prevent undue settlement. Lower section of box shall be designed to enclose the valve operating nut and stuffing box, and rest on the backfill.
 - 3. Boxes shall be adjustable by 6 in. vertically without reduction of the lap between sections to less than 4 in.
 - 4. Inside diameter shall be 6" for all gate valves. The sliding top section shall be 26" long, extra heavy duty. The bottom section shall be 5-1/4" inside diameter by 60" long with bell.
 - 5. Box cover shall be close fitting and substantially dirt tight. Top of cover shall be flush with top of box rim. Cover shall have the word "SEWER" cast into the top. Valve boxes shall be supplied by Trumball Industries, D&L Supply, Sigma Co., or approved equal.

2.30 CHECK VALVES

- A. Provide VB Series ball check valves at all locations shown on drawings. Check valve to be manufactured by IPEX, Flomatic Corp, Crispin Multiplex Mfg., or approved equal.

2.31 BITUMINOUS PAINT

- A. Bituminous paint shall be Koppers Company, Inc., Isomat Building Products, Aqualseal or equivalent bituminous-base product.

2.32 ASPHALT MASTIC CEMENT

- A. Asphalt mastic cement shall be a pitch-base or asphalt-base compound fibrated with non-asbestos fibers conforming to Fed. Spec. SS-C-153, as supplied by FBC Chemical Corp., Hamilton Kent-Kern Seal, Stone Technologies, or approved equal.

2.33 EMBEDMENT MATERIALS

- A. All sewer pipe, forcemain pipe and precast concrete structures shall be installed on a bed of and surrounded by gravel fill as shown on the Drawings. Gravel fill and sand fill shall conform to the requirements of Section 3120000, EARTH MOVING.

2.34 PAVEMENT REPAIR AND PATCHING MATERIALS

- A. Materials for pavement patching and repair (temporary and permanent) shall conform to Section 32 10 00, BASIS, BALLAST, AND PAVING of these specifications.

PART 3 - EXECUTION

3.01 TEST PITS

- A. Prior to ordering any materials or utility structures for the project, the Contractor shall excavate test pits to determine the exact locations and elevations of all existing utilities at critical points such as at every location where a proposed utility line is to cross an existing utility line and at every point where a proposed utility line is to connect with an existing utility line.

NOTE: The Drawings indicate payline elevation for unsuitable material within the new filter bed areas to be removed and replaced with specified Title V sand.

- B. The Engineer shall be notified at least five days in advance of any test pit excavation. Such notice shall include a sketch of the proposed test pit locations.
- C. Work on the test pits shall proceed slowly, with the Engineer or the Owner's Representative present and a representative of the Town of North Reading Board of Health or the appropriate utility company. Hand excavation shall be required when the excavation nears the utility line.
- D. Test pit excavation and backfill shall conform fully with the relevant portions of these specifications.
- E. Test pit surface restoration shall conform fully with the relevant portions of these specifications for paving, walkways, curbing and all lawn areas.

3.02 RECORDING OF TEST PIT INFORMATION

- A. The Contractor shall keep a precise record of all information uncovered by test pit excavation including soil types encountered and the elevations of all changes in soil strata and the size, type, material, location and elevation of any utility lines encountered. The Contractor's surveyor shall locate all test pits and utility lines and obtain elevations on the ground surface, the bottom of the test pit and any utility lines encountered.
- B. All information uncovered by test pit excavation shall be incorporated into the Project Record Drawings and incorporated into the As-Built Plans.
- C. The Contractor shall immediately report any discrepancies in utility locations or elevations discovered as a result of his test pit operations, in writing, to the Engineer and the Owner.

3.03 PIPE STUB MARKERS

- A. The Contractor shall install pipe stub markers at the ends of all buried pipe ends uncovered by the test pit operations.

3.04 TIES

- A. The Contractor shall take ties and top of pipe elevations at all underground utility lines uncovered by the test pit excavation to permit the accurate location of the utility line after backfilling. Ties shall be to permanent physical points which may be accurately reproduced.
- B. The Contractor shall review the location of all tie points with the Engineer prior to backfilling the test pit.

3.05 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Existing structures and utilities shall be suitably protected from damage, including but not limited to existing stone walls, brick walls, pavements, walks, manholes, sewer lines, drain lines, water lines and utility lines.

3.06 GENERAL

- A. It is not intended that the Drawings shall show the exact locations of every utility, but the Contractor shall coordinate with all other utilities as necessary to complete the system in accordance with the best trade practice, to the satisfaction of the Engineer and all authorities having jurisdiction.
- B. Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting same.
- C. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plug during construction to prevent entry of obstructing material.

- D. All existing utilities shall be verified for service, size, invert elevations, and location prior to new connections to or relocation of same. Notify the Engineer in writing of any and all discrepancies prior to commencing any work. All existing utilities uncovered during excavations and construction, not indicated on the plans, shall be plugged, capped, rerouted or relocated as directed by the Engineer so as not to interrupt the operation of any of the existing systems. No claims for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and Contract Documents prior to executing the Contract would have revealed.
- E. All disruption of service required for execution of work within this section shall be coordinated with affected parties, on both the beginning time and the duration of the disruption of service. Existing operations may require "off hour" and minimum disruption period.

3.07 HANDLING AND CUTTING PIPE

- A. The Contractor's attention is directed to the fact that in cold weather PVC pipe and fittings are brittle. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces and abrasion of the pipe coating or lining. Joint ends of pipe shall 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. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at one from the work.
- F. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used will be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 in. from the visible limits of the crack.
- G. Except as otherwise approved, all cutting shall be done with a machine suitable for cutting PVC pipe. Hydraulic squeeze cutters are not acceptable for cutting pipe. Travel type cutters and guillotine or rotary type abrasive saws may be used. All cut ends shall be examined for possible cracks caused by cutting. The method of cutting used shall leave a smooth cut at right angles to the axis of the pipe.
- H. The Contractor's attention is directed to the fact that damage to the lining of pipe or fittings will render them unfit for use; he shall use the utmost care in handling and installing lined and coated pipe and fittings to prevent damage. Protective guards shall not be removed until the pipe is to be installed.
- I. Any damage to the exterior coating of pipe or fittings shall be repaired as directed by the Engineer.

3.08 PIPE INSTALLATION

- A. Piping shall be installed essentially as indicated on the Drawings. Where exact locating dimensions of piping are not given on the Drawings, the Engineer's approval shall be obtained for proposed locations before installation. Unless otherwise shown on the Drawings, all pressure pipes shall be buried with a minimum four foot cover. It may be necessary at utility crossings to install pressure lines deeper to avoid those utilities. The lower installation will not be considered as an extra cost to the project.
- B. All PVC pipe and fittings shall be installed in accordance with the manufacturer's recommendations and the following:
 - 1. Inspect pipe before installation to detect any apparent defects. Mark defective material with white paint and promptly remove from the site. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work and when laid shall conform to the lines and grades required. A firm bed, even bearing throughout the length of the pipe, shall be constructed by tamping selected material at the sides of the pipe up to mid-section. Blocking will not be permitted.
 - 2. All pipes shall be sound and clean before laying. Bottom of trench excavation shall be kept dry and free of water during pipe installation. Adequate measures shall be taken to prevent flotation of pipe in the trench. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plug or other approved means.
 - 3. Pipe shall be laid with the groove or bell end upstream. Bell shall rest over a shallow excavation in pipe bedding to prevent pipe weight from bearing on bell.

4. Each pipe length shall be installed in good alignment (both horizontally and vertically) to form a close joint with the next adjoining length and bring inverts to the required grade.
5. Joint deflection for all piping shall not exceed that recommended by the manufacturer. Additional fittings shall be supplied by the Contractor as necessary or to maintain the horizontal and vertical alignment or to cross existing or proposed utilities. All such fittings shall be considered incidental to the installation of the pipe and shall be installed at no additional cost to the Owner.
6. Each pipe length shall have a firm bearing along its entire length. Pipe bedding material shall be shaped to receive the pipe. No pipe or fitting shall be permanently supported on saddles, blocking, or stones.
7. Pipe shall be laid to proper grades, free from pockets.
8. Pipe shall be thoroughly cleaned before installation, and shall be maintained free from foreign matter during installation.
9. Tight-fitting temporary wood bulkheads or plugs shall be employed to close ends of pipeline immediately after installation.
10. Pipe shall not be backfilled until joints have been fully inspected, and approved.
11. Entire length of pipe shall be thoroughly flushed clean following completion of backfill.
12. Jointing of push-on 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 insure 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.
13. Pipe joints shall be made with rubber gaskets.
 - a. Rubber gasketed joint: Pipe gasket shall be installed using lubricants, cements, adhesives, and other accessories and methods recommended by the gasket manufacturer. Pipe and gasket surfaces shall be kept clean until pipe has been properly drawn up and the joint closed. Gaskets and other jointing material shall be placed on the pipe immediately before joint is made up. Jointing materials shall be inspected and defects repaired before joint is completed.
14. Any pipe which is found defective after having been laid shall be removed and replaced with a sound piece of pipe at no additional cost to the Owner.
15. Piping in the precast concrete tanks and pump chambers shall be installed under this section of the specifications but shall be supported in accordance with the pipe support requirements of the specifications.
16. All fittings shall be laid and jointed to assure a water tight connection and proper alignment. Fittings shall be lowered into the trench, inspected and cleaned of all dirt and debris. All plugs, caps, tees and bends shall be provided with a concrete thrust block to solid ground as shown on the Drawings.
- C. Pipe shall be thoroughly cleaned before installation, and shall be maintained free from foreign matter during installation.
 1. When pipe laying is stopped for any length of time, including short periods, the open ends of the pipe and fittings shall be closed with a watertight plug or cap.
 2. Entire length of pipe shall be thoroughly flushed clean following completion of backfill.
- D. The electrical conduits in the precast concrete pump station tank shall be vapor sealed at both ends to prevent vapors from the tank(s) from entering the conduit(s).
- E. Joint Restraints
 1. Changes in direction, both vertical and horizontal, tees, plugs, caps and tapping sleeves shall be restrained with concrete thrust blocks.
 2. Concrete for thrust blocks shall be of the minimum size specified on the Drawings and shall meet the requirements of the specifications. Felt roofing paper shall be placed to protect pipe joints before placing the concrete. Concrete shall not be placed over bolts or nuts, or in a manner which prevents the removal of the joints.
- F. Any pipe which is found defective after having been laid shall be removed and replaced with a sound piece of pipe at no additional cost to the Owner.

- G. Valves: Prior to lowering the valves into the trench, they shall be cleaned of dirt and debris and operate to the satisfaction of the Engineer. Gate valves shall be set on firm foundations of undisturbed earth or masonry in a horizontal and plumb position. Piping into and out of the valve shall not exceed a length of six feet before the next pipe joint. When backfilling about the valve, care shall be taken not to disturb its set position. Upon backfilling to a point two inches or more above the flanged joints of the valve cover, the back base shall be set. Valve boxes shall be set in a plumb position with the cover flush with the finished grades. When placing the backfill about the boxes, care shall be taken to assure the unit's plumbness.

3.09 ASSEMBLING SLEEVE-TYPE COUPLINGS

- A. Sleeve-type couplings shall be used only where approved by the Engineer.
- B. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8 in. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 in. from the end, and the middle ring shall be placed on the already laid pipe and until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.
- C. After the bolts have been inserted and all nuts have been made up fingertight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.
- D. The correct torque as indicated by a torque wrench shall not exceed 90 ft.-lb.

3.10 PRECAST MANHOLE INSTALLATION

- A. Manholes shall be set to the required elevation and shall be plumb and vertical, with each section in true alignment.
1. Lifting holes in precast sections shall be thoroughly plugged with mortar and finished smooth and flush with adjoining surfaces.
 2. Sewer pipe shall extend, around its entire circumference, to inside surface of wall of structure into which it is inserted. Pipe shall be joined to manhole wall using the attached resilient rubber connector boot. The boot shall be sealed to the pipe using the stainless steel bands supplied with the boot.
 3. The gap between the resilient rubber connector boot and the pipe on the inside of the manhole structure shall be filled using nonshrink grout.
- B. The Contractor shall provide brick to bring all new and existing manhole cast iron frames and covers to required finish elevation. In paved areas the rims shall not be finally adjusted until the binder course paving is placed. Completed brick installation shall be coated with at least a 3/4 in. thickness of mortar on outside to provide sealed watertight collar between top manhole or catch basin section and cover or grate frame.
1. Before installation of castings, touch up chipped and scraped areas with one coat of bituminous paint.
 2. Cast iron frame shall be set concentric with manhole opening in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast iron frame. Mortar surface shall be smooth and shall be sloped to shed water away from the frame.
 3. Waterproofing shall be added to the mortar for underground masonry in accordance with the waterproofing manufacturer's directions. Other additives will not be permitted in the mortar.
- C. Portland cement-based mixtures used on this work shall receive a minimum of three days of moist curing, which shall start immediately after the material has been placed. Suitable means shall be employed to protect cement-based mixtures from too rapid drying and damage from cold weather and frost.
- D. All rims in paved areas shall be encased in concrete collars as shown on the details on the Drawings.
- E. Where required, connect new piping to existing manholes and catch basins by cutting or breaking into existing structures. Patch and finish with nonshrink grout to Engineer's satisfaction.

3.11 PRECAST CONCRETE TANK INSTALLATION

- A. All precast concrete tanks and structures shall be installed in the locations shown on the Drawings, true to line and grade, level and plumb. Precast concrete tanks shall include supervised installation and provide written water tight certification.
- B. The contractor must meet the following requirements for the installation of the precast tanks and structures to be certified watertight:

1. The precast unit(s) must be placed on a base of 12 inches (minimum) of compacted gravel fill. The gravel base must be transit leveled and be suitably compacted to support the unit(s) without the chance of differential settlement.
 2. The excavation must be pumped dry during the installation.
 3. The unit(s) must be backfilled within 24 hours of the installation starting with the two ends in order to properly compress the joining gaskets, then working to the two long walls.
 4. The crane (provided by the Contractor) must be large enough to place the unit(s) without damaging them in any way.
 5. Suitable backfill material and placement methods must be used to avoid any damage or shifting of the units.
 6. The joints must be clean of any foreign material while the units are being drawn together.
 7. Tank must be backfilled prior to filling (water testing) to prevent potential joint separation.
 8. Tank manufacturer is responsible for supervision of the tank installation. It is the responsibility of the Contractor to provide the necessary manpower to do the work involved in setting the tank.
- C. All tank penetrations shall be sealed watertight inside and outside with non-shrink waterproof grout. Upon completion of the installation of the tank by the contractor under the supervision of the tank manufacturer, the tank manufacturer shall provide the Owner and the Contractor with signed, certified copies of the watertight guarantee for the tanks after the tanks have been tested. (CRITICAL)
- D. It shall be the responsibility of the contractor to take suitable measures to prevent flotation of the tank until all of the backfill has been placed on top of the tank and all anti-flotation slabs and/or concrete infill have been placed.
- E. All precast concrete tanks shall each be tested for leakage as specified. Leakage shall be less than 1% of tank volume over 24 hours. (CRITICAL)

3.12 FINAL SEWAGE DISPOSAL AREA INSTALLATION

- A. The new final disposal area shall be installed in accordance with the standard detail shown on the Drawings in the location and to the elevations shown on the Drawings.
- B. The general procedure for the construction of the disposal area shall be as follows.
1. Layout the final disposal area.
 2. Remove existing leach seepage pits in proposed area as shown on the drawings.
 3. Remove and/or stockpile the excavated material.
 4. The final disposal area is then excavated to the bottom of the excavation as shown on contract drawings.
 5. Install the Title V sand as shown on contract drawings.
 6. Install required double washed stone layer per contract drawings.
 7. Install all piping under the disposal area including tees, splash pads and effluent piping.
 8. Pressure test all piping and set the top elevation of all effluent pipes level.
 9. Install all of the plastic diffusers and inspection manholes.
 10. Fill around the plastic diffusers with double washed crushed stone to the top of chamber grade.
 11. Backfill the entire disposal area up to finish subgrade with on-site clean sands and gravel.
 12. Install base gravel and pavement per contract site civil drawings.

3.13 CONCRETE THRUST BLOCKS AND ENCASEMENTS

- A. Concrete Thrust Blocks: Install at all fittings and plugged ends on pressure pipelines and as indicated on the Drawings. Prior to pouring concrete, pipe and fittings shall be covered with polyethylene to prevent concrete from bonding to pipe and fittings. The concrete backing shall be poured directly against undisturbed earth and shall consist of concrete having strength at least 3,000 psi in 28 days.
- B. Concrete Encasements: Install where required due to utility clearance or cover conditions as indicated on the Drawings. Prior to pouring concrete, pipe and fittings shall be covered with polyethylene to prevent concrete from bonding to pipe and fittings. The concrete backing shall be poured directly against undisturbed earth and shall consist of concrete having strength at least 3,000 psi in 28 days.

- C. Concrete Tank Infill: Install where indicated on the Drawings. The concrete shall be poured using forms to control the placement and shall consist of concrete having strength at least 3,000 psi in 28 days.

3.14 PIPE INSPECTION

- A. Interior Inspection: Inspect pipe to determine whether line displacement or other damage has occurred.
 - 1. If the inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of the Engineer.

3.15 PIPE CLEANING

- A. Cleaning Pipe: Clean interior of pipe of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
 - 1. Flush lines to remove collected debris before connecting to other wastewater piping, treatment systems or tankage. Flush pipe at rates of flow recommended by the Engineer.

3.16 TESTING

- A. The entire sewer system, including piping, manholes, tanks and structures shall be tested for leakage. The gravity system may be tested by the use of either water or low-pressure air. Manholes and tight tanks shall be tested using a vacuum. Other tanks and precast concrete structures shall be tested by using water. Force main and other pressure piping shall be tested by the use of water.
- B. General test requirements.
 - 1. Piping shall be adequately restrained against movement before testing. All force main piping shall have thrust blocks installed and the concrete shall have attained full strength before test pressure is applied to the line.
 - 2. Piping system shall be flushed clean, and sediment, scale, dirt, and debris removed before piping is tested.
 - 3. Adequate provisions shall be made for carrying off flushing water without causing erosion or other damage.
 - 4. Manholes and piping shall be tested before joints are concealed or made inaccessible.
 - 5. Tests shall be made in the presence of the Engineer and an inspector from the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control.
- C. Notice of tests shall be made in writing to the Engineer and the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control. Such notices shall be mail sufficiently in advance of the testing so that all parties receive the notice not less than five (5) days before the date of test.
- D. Gravity flow system test.
 - 1. When the groundwater is more than 1 ft. above the crown of the pipe at the upper end of the section to be tested, an infiltration test shall be made. The upper end of the section to be tested shall be plugged and a V-notch weir of appropriate size shall be fitted into the lower end. There shall be no leakage around the weir plate. Commercially manufactured weirs, made and calibrated for the purpose, may be employed.
 - 2. When groundwater is less than 1 ft. above the crown of the pipe at the upper end of the section to be tested, an exfiltration test shall be made. The sewer shall be plugged at the inlet pipes of both the upper and lower manholes. The line shall then be filled with water to a level 2 ft. above the crown of the pipe in the upper manhole. Before any measurements are made, a period of about 2 hours shall be permitted to allow for absorption and escape of trapped air. Following this, a test period of at least 2 hours shall begin. At the end of the test period, loss of water shall be measured and leakage computed there from.
 - 3. Air testing shall be performed in accordance with the procedures described in ASTM C 828, except as otherwise noted. For low-pressure air tests use equipment specifically designed and manufactured to test sewer pipelines with low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig.
 - a. The leakage test using low-pressure air shall be made on each manhole-to-manhole section of pipeline after placement of the backfill.
 - b. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

- c. All air used for testing shall pass through a single control panel.
- d. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches a value 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the groundwater is greater than 4 psig, conduct infiltration test.
- e. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe diameter in 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

- f. When the sewer section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section, and shall be the time shown in the table reduced by 0.5 minutes.
- 4. Rate of infiltration and exfiltration shall not exceed 100 gal./in. of pipe diameter per mile of pipe per 24 hours. Each section of pipe tested shall meet the above criterion.
 - 5. If section shall fail to pass leakage test, locate, uncover, and repair or replace defective pipes, fittings, or joints, without extension of time for completion of work and at no additional cost to the Owner. Additional tests and repairs shall be made until section passes specified tests.
- E. Manhole, tank and structure testing.
- 1. Leakage testing of sewer manholes shall be included in the testing of the wastewater treatment system. Leakage for each manhole shall not exceed 1 gal./vertical ft. of manhole per 48 hours.
 - 2. Leakage testing of all precast concrete structures shall be done using water. Leakage for each precast tank shall not exceed 1% of the tank or structure volume in 24 hours.
 - 3. If any manhole, tank or precast concrete structure shall fail to pass leakage test, repair or replace defective sections or joints without extension of time for completion of work and at no additional cost to the Owner. Additional tests and repairs shall be made until the manhole, tank or precast structure passes the specified tests.
- F. Forcemain Testing:
- 1. All portions of sewer force main from the Dosing Tank shall be tested for leakage. System shall be tested by use of water.
 - 2. General test requirements.
 - a. Piping shall be adequately restrained against movement before testing. Pressure line shall have thrust blocks installed and concrete shall have attained full design strength before test pressure is applied to line.
 - b. Piping system shall be flushed clean, and sediment, scale, dirt, and debris removed before piping is tested.

- c. Adequate provision shall be made for carrying off flushing water without causing erosion or other damage.
 - d. Piping shall be tested before joints are concealed or made inaccessible. Piping shall have no visible leakage.
 - e. Tests shall be made in presence of the Owner, the Engineer and an inspector from the Town of North Reading Board of Health and MA DEP.
3. Notice of tests shall be made in writing to the Owner, the Engineer and Town of North Reading Board of Health and MA DEP and received by them at least five (5) days before date of test.
4. Forcemain Pressure and Leakage Tests:
- a. Pressure pipe shall be given combined pressure and leakage tests in sections of acceptable length.
 - b. Furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gages, and other necessary equipment; and all labor required.
 - c. Unless it has already been done, section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from pipe. Provide blow offs at high point (air release) to allow trapped air to escape.
 - d. Section under test shall be maintained full of water for a period of 1 hour prior to combined pressure and leakage test being applied.
 - e. Meter and gauge shall be installed and shall be kept in use during test so that water entering water main under test will be measured and pressure in water main indicated.
 - f. Pressure test shall consist of first raising water pressure (based on elevation of lowest point of section under test and corrected to gage location) to a pressure of 50 lb. per sq. in. If Contractor cannot achieve specified pressure and maintain it for a period of one hour with no additional pumping, section shall be considered as having failed to pass test.
 - g. If section shall fail to pass pressure test, leakage test, or both, locate, uncover, and repair or replace defective pipes, fittings, or joints, without extension of time for completion of work. Additional tests and repairs shall be made until section passes specified tests.
 - h. All joints within vaults shall have no visible leakage. Joints from which water continues to run or squirt in an active manner will not be accepted.
 - i. Upon successful completion of tests, plugs or caps installed for testing shall be removed.
 - j. If, in judgment of Engineer, it is impractical to follow foregoing procedure exactly for any reason, modifications in procedure shall be made and accepted, but in any event Contractor shall be responsible for tightness of line within above leakage and pressure requirements.
- G. Before submitting system for final approval of the authorities having jurisdiction, submit a written statement to Engineer that work has been completed in accordance with the Contract Documents.
- H. Any portion of the sanitary sewerage system which is found not to be in compliance with the Drawings and specifications shall be replaced by the Contractor in conformance with the Drawings and specifications at no cost to the Owner.
- I. Promptly following satisfactory completion of leakage testing, a report fully describing test procedures and listing test results shall be submitted to the Engineer and to governmental agencies that have jurisdiction. The report shall be signed by the Contractor's superintendent.

3.17 INSPECTIONS AND APPROVALS

- A. The Contractor shall notify and make all necessary arrangements with the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control sufficiently in advance of the installation of the sanitary sewerage system for any testing and inspection to occur.
- B. The Contractor shall be responsible for making all arrangements with the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control and for paying all fees associated with the sanitary sewerage system installation, testing and inspection.
- C. Any work installed without the proper inspections shall be removed and reinstalled with the proper inspections at no cost to the Owner.

- D. Any work failing to pass inspection shall be repaired or removed and replaced until it passes inspection at no additional cost to the Owner.
- E. The following is the minimum schedule of inspections:
 - 1. An inspection shall be scheduled after the tankage and piping between the tanks has been installed but prior to backfilling.
 - 2. An inspection shall be scheduled when the disposal area has been excavated to preparation grade but prior to the installation of any Title V fill.
 - 3. An inspection shall be scheduled when the final disposal area has been filled with Title V fill prior to installation of piping or chambers.
 - 4. An inspection shall be scheduled after all the disposal area piping has been installed and pressure tested.
 - 5. An inspection shall be scheduled after all the plastic chambers have been installed, but prior to placing backfilling.
 - 6. Final inspections (dry test and wet test) of the entire final leach area shall be requested when all work is complete and water and power is available to conduct the inspection. Dosing pumps must be operational with permanent electrical connection. (CRITICAL) The Contractor shall have his As-Built plans of the wastewater treatment system, pumps and controls available for review at the time of this inspection. The wet test shall coincide with the startup of the wastewater pumps and controls.
- F. Additional or repeat inspections may be necessary depending on the quality of the work and any necessary corrections to defective work.
- G. After all inspections of the final disposal area have been completed; the Contractor shall obtain and send to the Engineer and Owner written approval of the completed disposal area from the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control.

3.18 MAINTENANCE OF EXISTING FLOW

- A. The Contractor shall schedule his work so as to maintain sewage flow within the existing septic systems until the new sewer collection and treatment systems have been fully tested, accepted and approved for operation.

3.19 MANHOLE AND TANK/STRUCTURE RIM, HATCHWAY AND VALVE BOX ADJUSTMENTS

- A. The Contractor shall provide brick to bring all new and existing manhole cast iron frames, covers, and grates to required finish elevation. In paved areas the rims shall not be finally adjusted until the binder course paving is placed. Completed brick installation shall be coated with at least a 3/4 in. thickness of mortar on outside to provide sealed watertight collar between top manhole section and cover or grate frame.
 - 1. Before installation of castings, touch up chipped and scraped areas with one coat of bituminous paint.
 - 2. Frame shall be set concentric with manhole or catch basin opening in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast iron frame. Mortar surface shall be smooth and shall be sloped to shed water away from the frame.
 - 3. Waterproofing shall be added to the mortar for underground masonry in accordance with the waterproofing manufacturer's directions. Other additives will not be permitted in the mortar.
- B. Portland cement-based mixtures used on this work shall receive a minimum of three days of moist curing, which shall start immediately after the material has been placed. Suitable means shall be employed to protect cement-based mixtures from too rapid drying and damage from cold weather and frost.
- C. The Contractor shall adjust all new and existing sewer gate and curb boxes to required finish elevation. In paved areas the castings shall not be finally adjusted until the binder course paving is placed.
- D. All castings in paved areas shall be encased in concrete collars as shown on the details on the Drawings.

3.20 DEMOLITION OF EXISTING SEPTIC SYSTEMS

- A. Before beginning any Demolition work, disconnect or arrange for the disconnection of all utility service lines to any structures or tanks to be demolished. Notify the proper local authorities and utility companies, in writing before work commences. Remove all utility and service lines in accordance with the authorities and/or companies having jurisdiction over such work. Identify the location and size of all caps and plugs to the Engineer in writing.
- B. Take all possible precautions to avoid damaging those materials which are to remain.

- C. Demolition work shall be carried out in a careful and orderly manner. Provide adequate protection to persons and property inside and outside of the site. All existing Septic Tanks, Pump Chambers and Siphon Chambers shall be pumped of all sewage and filled completely with clean fill.
- D. Burn no material or debris on the site.
- E. Take all possible precautions to avoid damaging those materials which are to be salvaged or reused on the site.
- F. Remove and legally dispose of, at no cost to the Owner, all materials and debris resulting from Demolition work except those items scheduled for salvaging or stockpiling. Disposal shall be timely, performed as promptly as possible and not left until the final clean up.
- G. Leave the site in a safe and clean condition at the completion of the Demolition work.
- H. THE REUSE OF EXISTING MANHOLES OR FRAMES AND COVERS ON PORTIONS OF THE NEW WORK ON THE PROJECT WILL NOT BE ALLOWED.

3.21 SANITARY SEWERAGE SYSTEM TIES

- A. During the installation of the new sanitary treatment system, the Contractor shall take ties and top of pipe elevations at sufficient intervals along all pipelines to permit the accurate location of the pipe (particularly any buried ends or fittings) and shall take locations and elevations of all tanks and structures after backfilling. Ties shall be to permanent physical points which may be accurately reproduced. An accurate As Built Survey Plan in AutoCAD format shall be provided by the Contractor to the Owner at completion of construction. The As Built Survey Plan must be completed by a MA licensed surveyor or Professional Engineer or approved equal qualified skilled contractor staff.
- B. The Contractor shall review the location of all tie points with the Engineer prior to backfilling the sewer pipe and other components of the sewage treatment system.

END OF SECTION

ISSUED WITH EARLY RELEASE PACKAGE #2 FOR REFERENCE ONLY
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PART 1 - GENERAL**1.01 SECTION INCLUDES**

- A. Provide all equipment and materials, and do all work necessary to construct the Dosing Tank installation complete, including, but not limited to the following:
 - 1. Furnish and install two new submersible wastewater pumps in the new Dosing Chamber including all pump fittings, stainless steel chain, stainless steel guide rails, accessories, controls, alarms, spare parts, inspection and testing;
 - 2. Coordinate and pay for inspection and testing observation of all of the work by the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control, including obtaining final approval of the completed system from the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control;
 - 3. Provide all necessary start up services (dry test, punch list, cleanup, initial startup and wet test, including supplying sufficient water for the wet test), support for one year, staff and operator training associated with the new wastewater treatment facility;
 - 4. All of the above work is as shown on the Drawings and as specified herein or as necessary to provide complete, operational sewage disposal system.

1.02 RELATED REQUIREMENTS

- A. The Conditions of the Contract and General Requirements of the Project Manual, including the Construction Manager's Scoping Documents apply to this Contractor, material suppliers, and all other persons furnishing labor and materials under this Section. General Conditions, Supplementary Conditions, the Construction Manager's Scoping Documents, and applicable parts of Division 01 are included as part of this Section.
- B. Work described in other sections which contain requirements that affect the work of this section, or with which this contractor must coordinate the work of this section, or accommodate the work of others include the following:
 - 1. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
 - 2. Section 05 50 00 - METAL FABRICATIONS
 - 3. Section 31 10 00 - SITE CLEARING.
 - 4. Section 31 20 00 - EARTH MOVING.
 - 5. Section 33 30 00 - SANITARY SEWERAGE UTILITIES.
 - 6. Section 33 30 01 - SANITARY SEWERAGE UTILITIES (WWTP)
 - 7. Division 22 - PLUMBING
 - 8. Division 26 - ELECTRICAL
 - 9. Section 44 41 13 - PACKAGED WATER TREATMENT PLANTS

1.03 PRICE AND PAYMENT PROCEDURES

- A. Alternates: See Section 01 23 00 - Alternates, for project alternates affecting this section.

1.04 REFERENCE STANDARDS

- A. Codes and Standards: Materials and methods of installation, cleaning, and testing of sewerage system shall comply with local requirements, except where more stringent requirements are indicated.
- B. Manufacturers: Firms regularly engaged in manufacture of materials of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- C. Massachusetts Plumbing Code: Comply with applicable portions of the current edition of the Commonwealth of Massachusetts Plumbing Code unless more stringent regulations apply.

- D. Massachusetts State Electrical Code: Comply with applicable portions of the current edition of the Commonwealth of Massachusetts Electrical Code unless more stringent regulations apply.
- E. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
 - 1. American Society for Testing and Materials (ASTM):
 - a. A 48 Gray Iron Castings
 - b. A 74 Cast Iron Soil Pipe and Fittings
 - c. A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - d. A 536 Ductile Iron Castings
 - e. C 32 Sewer and Manhole Brick (Made from Clay or Shale)
 - f. C 62 Building Brick (Solid Masonry Units Made from Clay or Shale)
 - g. C 270 Mortar for Unit Masonry
 - h. C 478 Precast Reinforced Concrete Manhole Sections
 - i. C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - j. C 828 Low-Pressure Air Test of Vitrified Clay Pipelines (4 to 12-in.)
 - k. C 891 Installation of Underground Precast Concrete Utility Structures
 - l. C 913 Precast Concrete Water and Waste Water Structures
 - m. D 2241 Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - n. D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
 - o. D 2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipes and Fittings
 - p. D 2855 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
 - q. D 3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - r. D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 - s. D 3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - t. F 758 Smooth-Wall Polyvinyl Chloride (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
 - 2. American National Standards Institute (ANSI)
 - a. B 16.5 Pipe Flanges and Flange Fittings
 - b. B31.1 Power Piping
 - 3. American Welding Society (AWS)
 - a. B3.0 Welding Procedure and Performance Qualifications
 - 4. American National Standards Institute/American Water Works Association (ANSI/AWWA):
 - a. C104/A21.4 Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water
 - b. C105/A21.5 Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
 - c. C110/A21.10 Ductile Iron and Gray Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
 - d. C111/A21.11 Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
 - e. C115/A21.53 Ductile Iron Compact Fittings 3 In., Through 16 In. for Water and Other Liquids
 - f. C150/A21.50 Development of Standard Thickness Design of Ductile Iron Pipe
 - g. C151/A21.51 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 - h. C153/A21.53 Ductile Iron Compact Fittings, 3 in. through 16 in., for Water and Other Liquids.
 - i. C500 Gate Valves, 3 through 48 In. NPS, for Water and Sewage Systems
 - j. C600 Installation of Ductile-Iron Water Mains and Their Appurtenances

5. American Water Works Association (AWWA)
 - a. Manual M11 Steel Pipe - A Guide for Design and Installation
6. Commonwealth of Massachusetts Highway Department (MHD):
 - a. Standard Specifications for Highways and Bridges
7. Commonwealth of Massachusetts Department of Environmental Protection:
 - a. 310 CMR 15.00 et. seq. (Title V of the State Environmental Code), latest edition.

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 EQUALS AND SUBSTITUTIONS

- A. All bidders are reminded that the design plans and specifications for the project have been generally based on certain pumping equipment that has been selected by the Owner and Architect as meeting his requirements for the project. Pumping equipment for the Dosing Pumps is part of the BioProcess treatment package and cannot be substituted. Flow Equalization Pumps are part of the BioProcess treatment plant package and cannot be substituted.
- B. The Contractor shall include with his bid a listing of the intended suppliers and manufacturers of the pumping equipment and controls and the precast concrete items. Each of these suppliers must certify that the material/equipment they intend to supply for the project meets the specifications and will function to provide the intended result.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. The Contractor shall submit the following data (as a minimum) for the wastewater pumps and controls:
 1. Pump data sheet stating the mechanical and electrical performance on the pumps and motors to be supplied along with complete calculations of all head losses involved in the pump station and force main system and shall certify that the equipment provided will be capable of functioning as intended, by pumping sanitary sewage from the bottom of the pump station wetwell, through the force main to the receiving sewer at the flow rate stated in the specifications.
 2. To scale shop drawings of the pumps and motors, including all accessories and control cabinet.
 3. Control data sheet clearly stating the alarmed conditions and with complete internal wiring diagrams. Cabinet layout of all controls and face plate diagram for the control cabinet.
 4. Manufacturer's installation guides.
- C. The Contractor shall submit the following data documenting his experience in installing gravity sewers, major pumping stations and forcemains and the installation of the proposed system:
 1. Statement of Qualifications of the equipment supplier and installing contractor. The installing contractor shall provide documentation that he has experience in installing pump stations, gravity sewers and forcemains similar in scope and nature to the proposed project and that he has installed at least five (5) similar systems of the type and size (17,500 GPD) to the proposed project within the last five (5) years.

1.07 CLOSEOUT SUBMITTALS

- A. See Section 01 78 00 - Closeout Submittals, for submittal procedures.
 1. Technical manuals for all equipment, including operation and maintenance instructions, as described below.
 2. Parts lists for all equipment, list of spare parts and fluids to be provided.
 3. Manufacturer's Warranty.
 4. Manufacturers Field Report of testing of the actual installation of his equipment on the project.
 5. Project Record Documents.
 6. Warranties.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. All equipment manufacturers shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator of the equipment to operate and maintain the equipment supplied. Said

instructions may assume that the operator is familiar with pumps, motors, piping, and valves, but that he has not previously operated and/or maintained the exact equipment supplied.

- B. These instructions shall be prepared as a systems manual applicable solely to the equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
- C. The instructions shall include, but not be limited to, the following:
 - 1. Descriptions of, and operating instructions for each major component of the equipment supplied.
 - 2. Instructions for operation of the equipment in all intended modes of operation.
 - 3. Instructions for all adjustments which must be performed at initial startup of the equipment, adjustments which must be performed after the replacement of components and adjustments which must be performed in the course of preventive maintenance as specified by the manufacturer.
 - 4. Instructions for the adjustment, calibration, and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
 - 5. Service instructions for major components not manufactured by the equipment manufacturer but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.
 - 6. Electrical schematic diagram of the completed actual installation as supplied, prepared in accordance with National Machine Tool Builders Association (NMTBA) and Joint Industrial Council (JIC) standards. Schematics shall show, to the extent of authorized repair, motor branch, control, and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for electronic equipment, the detail parts of which is not normally repairable by the station operator, need not be included, and shall not be substituted for an overall schematic diagram. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall schematic diagram.
- D. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall operational instructions related to this specific installation shall not be acceptable.
- E. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and which require the operator to selectively read portions of the instructions, shall not be acceptable.
- F. The operation and maintenance data, when assembled into a complete package, shall meet all of the requirements of the Commonwealth of Massachusetts Department of Environmental Protection for Operation and Maintenance Manuals and the Town of North Reading Board of Health.

1.09 CONDITIONS OF SERVICE, WORKMANSHIP AND DESIGN

- A. The wastewater pumps shall be capable of discharging treated wastewater from a precast concrete Dosing Tank into a force main as well as raw unscreened sewage from the Flow Equalization Tank to the waste treatment process. The pumps and controls shall all be new and shall be capable of operating properly, for an extended period of years, in a wet or humid environment.
- B. Equipment parts shall be amply proportioned for long, continuous, and uninterrupted service. Suitable provisions shall be made for easy access for service or replacement of parts. Corresponding parts of multiple units shall be interchangeable.
- C. Workmanship shall be first class in all respects.

1.10 QUALITY ASSURANCE

- A. The entire work provided in this section shall be constructed and finished in every respect in a workmanlike and substantial manner, in strict accordance with the Drawings and specifications. It is intended that the Drawings along with the manufacturer's shop drawings substantially show all pipe, fittings and appliances; however, the Contractor shall furnish and install such parts as may be necessary to complete the systems in accordance with the best trade practice and to the satisfaction of the Architect.
- B. The Contractor shall refer to all the drawings for a full comprehension of the work to be done and coordinate the work with other trades to avoid interference. Should any discrepancy appear or any misunderstandings arise, the Contractor shall request clarification by the Architect.
- C. The Contractor shall be responsible for fully coordinating all of the various parts of the work included under this section, and such other work of this contract as it may affect the work of this section throughout various phases of

construction and before the ordering or fabrication of the various parts of the work, so as to insure compliance with the drawings and specifications, and as necessary to provide performance in conformity with design requirements and satisfactory operating condition and operating sequences. Cooperate with such trades to assure the steady progress of all work under the Contract.

- D. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- E. The Contractor shall provide manufacturer's certification that materials meet or exceed minimum requirements as specified. Reference to standards such as ASTM and ANSI shall apply to those versions in effect at the time of bid opening.
- F. Guarantees: In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain extended guarantees for materials furnished under this section where such guarantees are offered in the manufacturer's published data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.11 DELIVERY, STORAGE AND HANDLING

- A. All equipment, pumps, motors, controls and accessories shall be transported, unloaded, stored and handled in strict accordance with the manufacturer's instructions and recommendations. Protect from all possible damage.

1.12 TOWN OF NORTH READING AND STATE REQUIREMENTS

- A. The Contractor shall notify and make all necessary arrangements with the Town of North Reading Board of Health and MA DEP sufficiently in advance of the installation of the Flow Equalization Pumps and Dosing Pumps systems for any testing and inspection to occur.
- B. All work and materials for the pump system installations shall be subject to approval of the Town of North Reading Board of Health and MA DEP.
- C. The Contractor shall be responsible for making all arrangements with the Town of North Reading Board of Health and for paying all fees associated with the Flow Equalization and Dosing Pumps system installations, testing and inspection.
- D. Comply with the rules, regulations, laws and ordinances of the Town of North Reading, the Commonwealth of Massachusetts, appropriate agencies of the Commonwealth of Massachusetts, and all other authorities having jurisdiction. Coordinate all work done within Town of North Reading rights of way with the appropriate agencies. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.
- E. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration (OSHA), United States Department of Labor.
- F. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.
- G. Any apparent conflict between the Drawings and Specifications and the applicable codes and regulations shall be referred to the Architect in writing, for resolution before the work is started.

1.13 INSPECTION AND TESTING

- A. The Contractor shall be responsible for performing all tests required by the Town of North Reading Board of Health, the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control and the Architect.

1.14 CONTRACTOR QUALIFICATIONS LICENSE

- A. The Contractor installing the sewerage system shall have a minimum of five (5) years experience in work of the type required by this section and shall have installed at least three (3) systems with a design flow equal to or greater than the design flow for this project.
- B. All work on the sewage disposal system shall be by a licensed installer of sewage disposal systems with a valid current license issued by North Reading Board of Health.

PART 2 - PRODUCTS

2.01 WASTEWATER PUMPS

- A. The Contractor shall furnish and install two (2) slide rail mounted, electrically driven, non-clog submersible sewage pump systems as follows:
 - 1. Flow Equalization Pumps (Part of Bid Process Treatment Plant Package Under Section 44 41 13)
 - 2. Provide (2) Transfer Pumps shall be Myers WG20-43 grinder pump 2 hp, 460 volt 3 phase, SRA-125-CV lift out rail package with top rail support and lifting chain, Pumps as manufactured by F.E. Myers Co. Pumps rated for 40gpm @ 50TDH.
 - 3. The FET transfer pumps by Myers are included as part of the proprietary waste treatment process package by Bio-Process H2O LLC of Portsmouth, RI, but do not include stainless steel rails and chain. To be provided by contractor. See Division 44 41 13.
 - 4. The control panel and VFD's controlling these pumps are included within the custom built PLC control Panel by Engineered Control Systems Inc. of Fall River, MA. The Control Panel is part of proprietary waste treatment process equipment to be provided by Bio Process.
 - 5. Dosing Pumps (Included in BioProcess Treatment Plant Package Under Section 44 41 13)
 - 6. Provide (2) Dosing Pumps as manufactured by ABS Pumps submersible sewage pumps 2.68 HP 3 phase 480 volts rated for 200 gpm @ 21 TDH
 - 7. Pump controls include VFD's to control two (2) submersible pumps in the Dosing Tank. Settings will allow operator to set variable discharge rates of flow to final Leach Area.
 - 8. Stainless steel rails and chains to be provided by Contractor. See Division 44 41 13.
 - 9. This pump system and controls are part of the proprietary wastewater treatment package by Bio-Process H2O. The Control Panel and VFD's controlling these pumps are included within the custom built PLC Control Panel by Control Systems, Inc. of Fall River, MA as part of the complete BioProcess Treatment Package. The Control Panel is part of the proprietary waste treatment process because of its complexity.

PART 3- EXECUTION

3.01 WASTEWATER PUMPS AND CONTROLS INSTALLATION - GENERAL

- A. Refer to Section 44 41 13 - PACKAGED WATER TREATMENT PLANTS.
- B. The Wastewater pumps and controls shall be installed in strict accordance with the manufacturer's recommendations and the Drawings. If the requirements of the manufacturer appear to conflict with the requirements of the Architect, the Contractor shall consult with the Architect for directions prior to proceeding.
- C. Anchor bolts for the pump base flange shall be drilled into the bottom of the pump chamber tank.
- D. All sewage pump discharge piping shall be flanged cement lined ductile iron pipe or flanged Schedule 80 PVC pipe installed as shown on the Drawings and in accordance with the applicable sections of Division 33 30 00 of the specifications.
- E. All electrical shall be installed as shown on the Drawings and in accordance with the applicable sections of Division 26 00 00 of the specifications.
- F. All electrical conduits to the precast concrete pump chamber shall be vapor sealed at the pump chamber and at the wastewater pump control panel.

3.02 WASTEWATER PUMP TESTING

- A. The pumps and controls shall be started up and tested in the presence of the manufacturer's representative, the Architect and the Town of North Reading Board of Health and DEP. The Contractor shall have pump supplier representative on site to record the voltage, current and all other significant parameters at the startup. The manufacturer shall provide a written formal procedure to be followed to ensure that the pumps and controls have been properly installed and are functioning within their specifications.
- B. The Contractor shall supply a sufficient amount of clean water for the complete startup and testing of the wastewater pumps and controls.
- C. The manufacturer's representative shall submit to the Architect and the Town of North Reading Board of Health and DEP written copies of the startup procedures and results with a statement from the manufacturer's representative that the pumps and controls have been properly installed and are functioning within their specifications.

- D. All clear water used for the testing shall be pumped out of the tanks and removed from the site upon completion of the testing only if required by the North Reading Board of Health and DEP or the Architect.

3.03 INSPECTIONS AND APPROVALS

- A. The Contractor shall notify and make all necessary arrangements with the Town of North Reading Board of Health and DEP sufficiently in advance of the installation of the sanitary sewerage system for any testing and inspection to occur.
- B. The Contractor shall be responsible for making all arrangements with the Town of North Reading Board of Health and DEP, and for paying all fees associated with the sanitary sewerage system installation, testing and inspection.
- C. Any work installed without the proper inspections shall be removed and reinstalled with the proper inspections at no cost to the Owner.
- D. Any work failing to pass inspection shall be repaired or removed and replaced until it passes inspection at no additional cost to the Owner.
- E. Additional or repeat inspections may be necessary depending on the quality of the work and any necessary corrections to defective work.
- F. After all inspections of the sewer system have been completed the Contractor shall obtain and send to the Architect and Owner written approval of the completed sewer system from the Town of North Reading Board of Health and DEP.

END OF SECTION

PACKAGED WATER TREATMENT PLANTS**PART 1 - GENERAL****1.01 CONDITIONS AND REQUIREMENTS**

- A. Examine all conditions as they exist at the project prior to submitting a bid for the work of this SECTION.
- B. Examine all Drawings and all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in 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.
- D. Acceptable Substitutions: The Membrane Batch Reactor process (MBR) as provided by BioProcess specified within this section has been determined to be in the public interest based on sound reasoning and voted as proprietary by the Owner. Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) and Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Engineer and Owner upon submission of complete product information as described in Section 01 25 13 – Product Substitution Procedures. Further additional information may be requested by the Owner or Engineer for determination that the proposed product substitution is fully equal to the specified product(s). The system specified herein has been approved by the Massachusetts Department of Environmental Protection for the North Reading High/Middle School and there is no guarantee that proposed substitutions will be approved, and the Contractor shall not order any materials until approval(s) are received in writing from the Owner and the Engineer.
 - 1. Requesting substitutions shall be at the Contractor's own risk, with regard to uncompensated delays of the Project. Time will be required for sufficient review and additional requests for information by the Engineer and Owner. Delays which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.

1.02 RELATED SECTIONS

- A. ALTERNATES: Administrative requirements for alternates affecting work of this Section.
- B. Section 01 50 00 – Temporary Facilities
- C. Section 03 10 00 – Site Clearing
- D. Section 31 20 00 – Earth Moving
- E. Section 33 30 00 – Sanitary Sewage Utilities
- F. Division 05 00 00 – Miscellaneous Metals
- G. Division 22 00 00 – Plumbing
- H. Division 26 00 00 – Electrical
- I. Section 43 21 00 – Liquid Pumps

1.03 SCOPE OF WORK

- A. The work under this section includes furnishing, installing and testing a Bio-Process H₂O process system as a proprietary product. The Bio-Process H₂O treatment system is capable of treating wastewater with a maximum hydraulic flow of 17,500 gallons/day and a maximum organic load of 65.7 pounds of BOD₅ per day. The system shall be proprietary and be supplied by one manufacturer who shall be responsible to the installing contractor for providing the selected equipment for satisfactory operation of the system. The contractor shall install the system as shown on the plans and described herein. The system will include the following reactor internals provided by Bio-Process H₂O:
 - 1. (2) flow equalization pumps and controls (Contractor to provide stainless steel rails and lifting chains, and fabricate standoff bracket)
 - 2. (1) mechanical bar screen
 - 3. (1) ultra filtration membrane skid assembly with three (3) membrane modules
 - 4. (2) ultraviolet (UV) disinfection units
 - 5. Chemical feed assembly for alkalinity, carbon, and membrane cleaning

6. 2 process blowers
 7. Odor control system
 8. Ultrasonic level controllers
 9. Metering pumps and accessories for process control
 10. Magnetic flow meters (6)
 11. Float switch
 12. pH transmitter
 13. aeration system for aeration tank
 14. Dissolved Oxygen (DO) analyzer
 15. Membrane Circulation pumps
 16. Turbidity Meter
 17. Membrane Permeate pump
 18. Denitrification pump
 19. Membrane Drain Sump Pump (Contractor to provide stainless steel rails and lifting chains, and fabricate standoff bracket)
- B. All of the above described equipment is included within the Bio-Process H2O Equipment package. Refer to Liquid Pumps Section 43 21 00 for required Dosing Pumps.

1.04 SHOP DRAWINGS, INSTALLATION INSTRUCTIONS AND O&M MANUALS

- A. The Contractor shall submit the following data (as a minimum) for the advanced wastewater treatment system:
1. Design data prepared by the equipment supplier detailing all pertinent calculations for the Architect to verify that the proposed system will meet the discharge limits stated in Title V of the State Environmental Code and the DEP Wastewater Treatment Plant Design Guidelines.
 2. Such supplemental calculations as may be requested by the Architect to verify that the proposed system will meet the discharge limits stated in Title V of the State Environmental Code and the DEP Wastewater Treatment Plant Design Guidelines as well as the approved engineer's report.
 3. Blower, carbon vent fan, and motor data sheets stating the mechanical and electrical performance of all equipment proposed to be supplied along with complete calculations relating to each piece of equipment or motor.
 4. Shop drawings of each individual component of and the completely assembled advanced wastewater treatment system.
 5. Submittals for carbon odor control system.
 6. Control data sheet clearly stating the alarmed conditions and with complete internal wiring diagrams.
 7. Manufacturer's installation guides.
 8. Technical manuals for all equipment.
 9. Parts lists for all equipment, list of spare parts and fluids to be provided.
 10. Manufacturer's Warranty.
 11. Statement of Qualifications of the installing contractor. The installing contractor shall provide documentation that he has experience in installing the selected advanced treatment system and that he has installed at least three (3) similar treatment systems of the type and size (larger than 15,000 GPD) selected for use on the project within the last five (5) years.
 12. Project Record Documents.
 13. Operation and Maintenance Data.
 14. Warranties including the process warranty.
- B. The Installing Contractor shall submit his qualifications for doing the work for approval.

1.05 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. All equipment manufacturers shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator of the equipment to operate and maintain the equipment supplied. Said instructions may assume that the operator is familiar with pumps, motors, piping, and valves, but that he has not previously operated and/or maintained the exact equipment supplied.
- B. These instructions shall be prepared as a systems manual applicable solely to the equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
- C. The instructions shall include, but not be limited to, the following:
 - 1. Descriptions of and operating instructions for, each major component of the equipment supplied.
 - 2. Instructions for operation of the equipment in all intended modes of operation.
 - 3. Instructions for all adjustments which must be performed at initial startup of the equipment, adjustments which must be performed after the replacement of components and adjustments which must be performed in the course of preventive maintenance as specified by the manufacturer.
 - 4. Instructions for the adjustment, calibration, and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
 - 5. Service instructions for major components not manufactured by the equipment manufacturer but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.
 - 6. Electrical schematic diagram of the completed actual installation as supplied, prepared in accordance with National Machine Tool Builders Association (NMTBA) and Joint Industrial Council (JIC) standards. Schematics shall show, to the extent of authorized repair, motor branch, control, and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for electronic equipment, the detail parts of which is not normally repairable by the station operator, need not be included, and shall not be substituted for an overall schematic diagram. Partial schematics block diagrams, and simplified schematics shall not be provided in lieu of an overall schematic diagram.
- D. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall operational instructions related to this specific installation shall not be acceptable.
- E. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and which require the operator to selectively read portions of the instructions shall not be acceptable.
- F. The operation and maintenance data, when assembled into a complete package, shall meet all of the requirements of the Commonwealth of Massachusetts Department of Environmental Protection for Operation and Maintenance Manuals for advanced wastewater treatment systems.

1.06 CONDITIONS OF SERVICE, WORKMANSHIP AND DESIGN

- A. The advanced wastewater treatment system shall be capable of treating raw, unscreened sewage from the new school and discharging the effluent to the new final leaching fields. All equipment shall be new and shall be capable of operating properly, for an extended period of years, in a wet or humid environment.
- B. Equipment parts shall be amply proportioned for long, continuous, and uninterrupted service. Suitable provisions shall be made for easy access for service or replacement of parts. Corresponding parts of multiple units shall be interchangeable.
- C. Workmanship shall be first class in all respects.

1.07 QUALITY ASSURANCE

- A. The entire work provided in this section shall be constructed and finished in every respect in a workmanlike and substantial manner, in strict accordance with the Drawings and specifications. It is intended that the Drawings along with the manufacturer's shop drawings substantially show all pipe, fittings and appliances; however, the Contractor shall furnish and install such parts as may be necessary to complete the systems in accordance with the best trade practice and to the satisfaction of the Architect.
- B. The Contractor shall refer to all the drawings for a full comprehension of the work to be done and coordinate the work with other trades to avoid interference. Should any discrepancy appear or any misunderstandings arise, the Contractor shall request clarification by the Architect.

- C. The Contractor shall be responsible for fully coordinating all of the various parts of the work included under this section, and such other work of this contract as it may affect the work of this section throughout various phases of construction and before the ordering or fabrication of the various parts of the work, so as to insure compliance with the drawings and specifications, and as necessary to provide performance in conformity with design requirements and satisfactory operating condition and operating sequences. Cooperate with such trades to assure the steady progress of all work under the Contract.
- D. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- E. The Contractor shall provide manufacturer's certification that materials meet or exceed minimum requirements as specified. Reference to standards such as ASTM and ANSI shall apply to those versions in effect at the time of bid opening.
- F. Guarantees: In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain extended guarantees for materials furnished under this section where such guarantees are offered in the manufacturer's published data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
- G. In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the manufacturer shall repair or replace, at the discretion of the engineer, upon return of such defective part to the systems supplier. The repair or replacement of those items normally consumed in service, such as seals, grease, shall be considered as part of routine maintenance and upkeep.
- H. The manufacturer shall guarantee for twelve (12) months from date of start-up, but not less than one full school year that the equipment furnished will be free from defects in design, material and workmanship. Warranties and guarantees of the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be acceptable.
- I. Process Guarantee: The manufacturer supplying the advanced wastewater treatment equipment and controls shall provide the Owner with a process warranty stating that the equipment provided will function as intended to produce treated effluent which meets the discharge limitations stated in these specifications and that if the system does not meet the discharge limitations stated in these specifications, the equipment supplier will provide and install additional units or equipment, AT NO ADDITIONAL COST TO THE OWNER, to meet the stated effluent limitations. The term of this warranty shall be for a minimum period of one full school year.

1.08 DELIVERY, STORAGE AND HANDLING

- A. All treatment equipment, pumps, motors, controls and accessories shall be transported, unloaded, stored and handled in strict accordance with the manufacturer's instructions and recommendations. Protect from all possible damage.
- B. During unloading of any Contractor purchased materials, the contractor shall take care to prevent damage to materials and coatings. The contractor shall carefully load and unload each piece of equipment using suitable equipment and labor so that the materials being unloaded are under control at all times. Place skids or blocks under each piece of equipment or materials and securely wedge pieces of equipment and materials during transportation to ensure no injury or damage to the material or equipment.

1.09 INSPECTION AND TESTING

- A. The Contractor shall be responsible for performing all tests required by the Town of North Reading Board of Health, the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control, and the Architect.
- B. The Bio-Process H₂O process system manufacturer shall furnish the services of a competent and experienced factory-trained representative, for a period not less than one full school year, who has complete knowledge of proper operation and maintenance of the equipment. The representative shall be in attendance, for a period of not less than five (5) full working days, (eight 8 hours per day) on-site in a minimum of five (5) separate trips to inspect the installation of the media, and the mechanical equipment, to provide instructions to the plant operating personnel, to assist in plant start-up, to be present during the clear water test with the Commonwealth of Massachusetts Department of Environmental Protection, and to be present during the process performance test. Additional days and trips, excluding those required to satisfy the process performance test, shall be reimbursed by the purchasing contractor to the manufacturer on a per diem basis.

- C. A mechanical performance test shall be performed prior to the plant being placed into service. Present shall be the engineer and the system suppliers designated representative. The installing contractor shall furnish all labor, materials and equipment required for such tests and shall correct any deficiencies noted by repairing or replacing the defective equipment and completing the testing.

1.10 PROCESS PERFORMANCE

- A. The performance of the Bio-Process H2O process system shall be guaranteed to produce an effluent which meets the design basis as indicated in Design Criteria and Data for a period of at least one full school year.

1.11 TOWN OF NORTH READING AND STATE REQUIREMENTS

- A. The Contractor shall notify and make all necessary arrangements with the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control sufficiently in advance of the installation of the wastewater treatment system for any testing and inspection to occur.
- B. All work and materials for the wastewater treatment system installation shall be subject to approval of the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control.
- C. The Contractor shall be responsible for making all arrangements with the Town of North Reading Board of Health and the Commonwealth of Massachusetts, Department of Environmental Protection, Division of Water Pollution Control and for paying all fees associated with the wastewater treatment system installation, testing and inspection.
- D. Comply with the rules, regulations, laws and ordinances of the Town of North Reading, the Commonwealth of Massachusetts, appropriate agencies of the Commonwealth of Massachusetts, and all other authorities having jurisdiction.
- E. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration (OSHA), United States Department of Labor.
- F. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.
- G. Any apparent conflict between the Drawings and Specifications and the applicable codes and regulations shall be referred to the Architect in writing, for resolution before the work is started.

1.12 DESIGN CRITERIA AND DATA

- A. The Contractor shall provide and install one new advanced wastewater treatment system on the project, complete with all necessary components, by Title V of the State of Massachusetts Environmental Code to treat 17,500 gallons of domestic wastewater from the new school each day. The system shall be capable of treating the peak flow from the school with Flow Equalization Tank and shall be capable of operating for extended periods (weekends and vacations) with little or no flow.
- B. The system provided shall be designed by the manufacturer to treat influent wastewater with the following characteristics which were obtained from a similar school and should be used in determining the minimum treatment requirements for the advanced treatment system.

Average daily flow = 17,500 gals/day

Influent Strength

BOD(5)-----up to 450 mg/l

TSS -----up to 350 mg/l

TKN -----up to 160 mg/l

Ammonia-N -----up to 140 mg/l

Ph (S.U.) -----6.5 to 8.5

Min. Temp, degrees C -----10

- C. The effluent discharge concentrations from the system shall not exceed 30 mg/l BOD5 and 30 mg/l Total Suspended Solids at any time and a minimum of 85% of the influent BOD5 and Total Suspended Solids shall be removed from the wastewater. The effluent pH shall not vary more than 0.5 standard units from the influent water supply pH. The

total nitrogen concentration in the effluent shall not exceed 10 mg/l at any time and a minimum of 90% of the influent total nitrogen concentration shall be removed from the wastewater. Fecal Coliform shall meet 200 colonies/100ml.

- D. All components of the advanced wastewater system shall be supplied by Bio Process H₂O, and all components shall be new. Where possible, all components shall be of the same manufacturer. All components shall conform to industry standards and all electrical components shall bear the UL label. The system provided shall have one central control panel to control all functions of the system and to display all operating conditions of the system. No other method of modular treatment will be approved as an equal. The DEP Discharge Permit is based on the equipment specified.

1.13 SUMMARY

- A. All reactor operations are controlled from the main control panel (MCP). The mode of operation is manual based on the Wastewater Treatment Plant operator equipment setting. The carbon feed is automatic feed pulsed through the MCP flow meter.
- B. Each motor shall be capable of being operated from the main control panel through automatic and manual modes. The automatic mode is for time control to provide even wear on the equipment.

1.14 CONTRACTOR QUALIFICATIONS LICENSE

- A. The Contractor installing the wastewater treatment system shall have a minimum of five (5) years experience in work of the type required by this section.
- B. All work on the wastewater treatment system shall be performed by a septic system installer licensed and bonded by the Town of North Reading Board of Health. All work shall comply with the latest federal, state and local requirements and specifications including the latest edition of Title V of the State of Massachusetts Environmental Code. All permit applications must be filed and permits obtained prior to any construction work and all fees must be paid.
- C. The installing contractor shall provide documentation that he has experience in installing the selected advanced treatment system and that he has installed at least three (3) similar treatment systems of the type and size (larger than 15,000 GPD) selected for use on the project within the last five (5) years.

1.15 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. All equipment manufacturers shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator of the equipment to operate and maintain the equipment supplied. Said instructions may assume that the operator is familiar with pumps, motors, piping, and valves, but that he has not previously operated and/or maintained similar equipment.
- B. These instructions shall be prepared as a systems manual applicable solely to the equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
- C. The instructions shall include, but no be limited to, the following:
 - 1. Descriptions of and operating instructions for each major component of the equipment supplied.
 - 2. Instructions for operation of the equipment in all intended modes of operation.
 - 3. Instructions for all adjustments which must be performed at initial startup of the equipment, adjustments which must be performed after the replacement of components and adjustments which must be performed in the course of preventive maintenance as specified by the manufacturer.
 - 4. Instructions for the adjustment, calibration, and testing of selected electronic components or assemblies, normally considered replaceable by the manufacturer, whose performance is not ascertainable by visual inspection.
 - 5. Service instructions for major components not manufactured by the equipment manufacturer but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.
 - 6. Electrical schematic diagram of the completed actual installation as supplied, prepared in accordance with National Machine Tool Builders Association (NMTBA) and Joint Industrial Council (JIC) standards. Schematics shall show, to the extent of authorized repair, motor branch, control, and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for electronic equipment, the detail parts of which is not normally repairable by the station operator, need not be included, and shall not be substituted for an overall schematic diagram. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall schematic diagram.

- D. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall operational instructions related to this specific installation shall not be acceptable.
- E. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and which require the operator to selectively read portions of the instructions shall not be acceptable.
- F. The operation and maintenance data, when assembled into a complete package, shall meet all of the requirements of the Commonwealth of Massachusetts Department of Environmental Protection for Operation and Maintenance Manuals and the Town of North Reading Board of Health.
- G. Guarantees: In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain extended guarantees for materials furnished under this section where such guarantees are offered in the manufacturer's published data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – PRODUCTS

2.01 BIO PROCESS H2O EQUIPMENT PACKAGE (PROPRIETARY PRODUCT)

- A. The equipment package from BioProcess will include the following:

Item	P&ID Ref #	Description	Comments
Permeate Tank	T-0841	Custom 2000 gallon Tank	Nothing Required
EQ Pump #1	P-0211	Myers Model WG20-2HP	480v, 3 ph, VFD-Moisture and Thermal
EQ Pump #2	P-0212	Myers Model WG20-2HP	480v, 3 ph, VFD-Moisture and Thermal
Denitrification Pump	P-0511	ABS Model XFP 80C VX.3 PE22/4 2.7 HP	480v, 3 ph, DOL-Moisture and Thermal
Membrane Recirc Pump	P-0711	ABS model XFP100C-4.7 HP	480v, 3 ph, VFD-Moisture and Thermal
Permeate Pump #1	P-0811	Goulds 2ST-.5 HP	480v, 3 phase VFD
Permeate Pump #2	P-0812	Goulds 2ST-.5 HP	480v, 3 phase VFD
Backwash Pump #1	P-0911	Goulds 25SH-5 HP	480v, 3 phase VFD
Backwash Pump #2	P-0912	Goulds 25SH-5 HP	480v, 3 phase VFD
UF System Sump Pump	P-1011	Goulds Model WE05H.5HP	480v, 3 phase DOL
Permeate Tank (T-0841)	P-0811	Goulds 1ST-.5 HP	480v, 3 phase DOL
UV Recirc Pump			
Final Effluent Pump #1	P-1111	ABS-XFP-80C-2.68 HP	480v, 3 ph, VFD-Moisture and Thermal
Final Effluent Pump #2	P-1112	ABS-XFP-80C-2.68 HP	480v, 3 ph, VFD-Moisture and Thermal
Pre-Anoxic Tank Carbon Metering Pump	P-0311	Walchem Model EWB31	120v, 1 phase, 1.2 amp
Post-Anoxic Tank Carbon Metering Pump	P-0712	Walchem Model EWB31	120v, 1 phase, 1.2 amp
Aeration Tank Caustic Metering Pump	P-0411	Walchem Model EWB31	120v, 1 phase, 1.2 amp
UF Membrane Acid CEB Metering Pump	P-0913	Walchem Model LKN57A	120v, 1 phase, 6.2 amp DOL
UF Membrane Hypochlorate CEB Metering Pump	P-0914	Walchem Model EHE56	120v, 1 phase, 1.2 amp
UF Membrane Caustic CEB Metering Pump	P-0915	Walchem Model EHE56	120v, 1 phase, 1.2 amp
Pre-Anoxic Mixer	MI-0351	ABS Model RW3021-2.7 HP	480v, 3 phase, DOL-Moisture and Thermal Protection

Post-Anoxic Mixer	MI-0651	ABS Model RW3021-2.7 HP	480v, 3 phase, DOL-Moisture and Thermal Protection
Aeration Tank Mixer	MI-0451	ABS Model RW3021-2.7 HP	480v, 3 phase, DOL-Moisture and Thermal Protection
Aeration Blower #1	BL-0451	Kaeser Model DB131C-10HP	480v, 3 phase VFD
Aeration Blower #2	BL-0452	Kaeser Model DB131C-10HP	480v, 3 phase VFD
Membrane Air Scour Blower	BL-0751	Becker Model DX 4.4K-2.9HP	480v, 3 phase DOL
Process Air Compressor	CMP-1251	Speedaire Model 4TW29C 9	(dedicated 15 amp/120v breaker from PP panel)
EQ Level Sensor	LS-0221	Flowline Model LU83-5101	24 VDC Loop Powered
Post Anoxic Tank Level Sensor	LS-0621	Flowline Model LU81-5101	24 VDC Loop Powered
Permeate Tank Level Sensor	LS-0825	Flowline Model LU81-5101	24 VDC Loop Powered
Final Effluent Tank Level Sensor	LS-1121	Flowline Model LU81-5101	24 VDC Loop Powered
Bar Screen Float (Included w/ Ovivo Screen)	LSL-0223		
Membrane Sump Floats	LSL-1021,LSH-1022,LSH- 1023	Connery	24 VDC
UF Vibration Switch (Level)	LS-0724	Vibex Model LSV1- 01-06-N-C	24 VDC
UF Membrane Feed Pressure Transmitter	PG-0722	Mercoïd Model 3200 with Diphragm	24 VDC Loop Powered
UF Membranepermate Pressure Transmitter	PG-0822	Mercoïd Model 3200	24 VDC Loop Powered
Compressed Air Pressure Switch	PS-1221	Omega Model PSW-108	24 VDC
Dissolved Oxygen Meter	DO-0422	Insite Model 1000-CE	120v with self powered 4-20 ma output
UF Temperature Transmitter	TE-0723	Dwyer TTE_106-W	24 VDC Loop Powered
EQ Flow Meter	FM-0222	Siemens mag 5000/5100W-2"	120v with self powered 4-20 ma output
Membrane Recirc Flow Meter	FM-0721	Siemens mag 5000/5100W-6"	120v with self powered 4-20 ma output
Membrane Permeate Flow Meter	FM-0823	Siemens mag 5000/5100W-2"	120v with self powered 4-20 ma output
Membrane Backwash Flow Meter	FM-0921	Siemens mag 5000/5100W-4"	120v with self powered 4-20 ma output
Dentrification Pump Flow Meter	FM-0521	Siemens mag 5000/5100W-3"	120v with self powered 4-20 ma output
Dosing Pump #1 Flow Meter	FM-1125	Siemens mag 5000/5100W-4"	120v with self powered 4-20 ma output
Dosing Pump #2 Flow Meter	FM-1127	Siemens mag 5000/5100W-4"	120v with self powered 4-20 ma output
UF Membrane Air Flow Switch	FS-0725	Kobold Model KAL-8115	24 VDC power with dry contact

Aeration pH Controller & UF Membrane pH Meter	AIC-0421	Walchem Model WDP420-5-2-N	120v with two self powered 4-20 ma outputs
Pre/Post Anoxic ORP Controller	AIC-0321	Walchem Model WDP420-5-2-5	120v with two self powered 4-20 ma outputs
Final Effluent pH Meter	AI-1126	Walchem Model WDP410-5-2-N	120v with two self powered 4-20 ma outputs
pH Probes (for aeration)	Incl with controller	Walchem WEL-MVR-2-1	Nothing Required
ORP Probes (for Pre and Post Anoxic and RO)	Incl with Controller	Walchem WEL-MVR-2-1	Nothing Required
pH Probes (for Final Effluent)	Insertion Type	Sensorex S675 PH	Nothing Required
Turbidity Meter	TM-0824	Hach SC100-1720E	120v with self powered 4-20 ma output
UF Membranes	UF-0701,0702,0703,0704	Pentair Xflow Model 38PRV-XLT	Nothing Required
Aeration Tank Aeration System	AE-0451	EDI Model Flexair 84P Magnum	Nothing Required
Influent Fine Screen	SC-0251	Ovivo Model FS600S-2MM	480v, 3 phase, DOL
UF System UV Unit	UV-0851	Aqua Azul Model AAGI-50	120v, 1 phase, 2.1 amp/4-20 ma output
Permeate Tank UV Unit	UV-0852	Aqua Azul Model AAGI-50	120v, 1 phase, 2.1 amp/4-20 ma output
Odor Control Skid	B-1251	General Carbon Model ES-42-1	2 HP, 480v, 3 phase, DOL
UF Membrane Feed Valve	AV-0733	6" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane Drain Valve	AV-0734	6" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane Bypass Valve	AV-0735	3" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane De-Aeration Valve	AV-0736	2" Ball Valve	24 VDC solenoid with open & close limit switches
UF Membrane Return Valve	AV-0737	8" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane Air Scour Valve	AV-0738	1" Ball Valve	24 VDC solenoid with open & close limit switches
UF Membrane permeate Valve	AV-0831	2" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane BW Bypass Valve	AV-0937	3" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane Backwash Valve	AV-0938	4" Butterfly Valve	24 VDC solenoid with open & close limit switches
UF Membrane Aeration BW Valve	AV-0939	1" Ball Valve	24 VDC solenoid with open & close limit switches
UF Membrane Turbidity Valve	SV-08312	1/4" solenoid Valve	24 VDC solenoid
Main Control Panel		Custom Panel	NEMA 12 with AB compact logix and Panelview 6

NOTES:

- A. VFD's to have HOA with Potentiometers
- B. DOL's to have HOA
- C. pH/ORP controllers to be fed by common breaker

- D. EHE & EWB metering pumps to be fed by common breaker
- E. Flow meters to be fed by common breaker
- F. D.O and Turbidity meter to be fed by common breaker
- G. Minimum 2 spare I/O for all inputs and outputs.
- H. UPS required
 - 1. The BioProcess pump package does not include stainless steel rails and chains where shown. To be provided by WWTP contractor.
 - 2. Actuated valves will be IPEX or equal. All actuators to be single acting with open/close limit switches and indicating beacon. Actuators to have open and close speed adjustment. All valves to be schedule 80 PVC true union except for AV-0738 which is schedule 80 Dura Plus. Butterfly valves to be cast iron body, EPDM seats with nylon coated discs.
 - 3. Equipment as noted or equal.

2.02 SPARE PARTS

- A. The following spare parts are included:
 - 1. Bar Screen Motor
 - 2. pH Probe
 - 3. ORP Probe
 - 4. UV Lamp (4)
 - 5. Membrane Recirc Pump Repair Kit (mechanical seal and gasket)
 - 6. RO Pump Repair Kit (mechanical seal and O-ring)
 - 7. Pre/Aeration/ Post Anoxic Mixer (quantity 1)
 - 8. Membrane Recirc pump Repair Kit (mechanical seal and gasket)
 - 9. UV Recirc Pump Motor
 - 10. Membrane Recirc Pump

2.03 PROTECTION AGAINST CORROSION AND ABRASION

- A. After welding, all steel surfaces shall be blasted to remove rust, mill scale, weld slag,. All weld spatter and surface roughness shall be removed by grinding. Following cleaning, a single heavy inert coating shall be applied to all surfaces. This coating shall be epoxy resin especially formulated for abrasion and corrosion resistance. The dry coating shall be a minimum of 6 mils thickness.
- B. All stainless steel, aluminum and other corrosion-resistant surfaces shall not be coated.
- C. A touch-up kit shall be provided for repair of all scratches or mars occurring during installation. This kit shall contain detailed instructions for use and shall be a material, which is compatible with the original coatings.

2.04 ELECTRICAL CONTROLS

- A. The electrical components shall be furnished by the manufacturer of the modules in a NEMA 4 rain-tight cabinet. The cabinet shall be mounted by the contractor inside the control building. A separate thermal magnetic circuit breaker and magnetic contactor shall be furnished for each blower motor. The blower starter shall be controlled by a selector switch. Starters for 3-phase circuits shall have overload and under voltage release protection on each conductor. Wiring in the control cabinet shall be color-coded and shall be in accordance with the National Electrical Code.
- B. All conduit and wiring between the electrical control panel enclosure and motors furnished with the treatment plant and between the panel and the power utility pole shall be furnished and installed by the contractor.

2.05 INSTALLATION AND OPERATING INSTRUCTIONS

- A. Installation of the BioProcess H-20 treatment system shall be done in accordance with the instructions provided by the Manufacturer and shown on the drawings.
- B. Operation and maintenance manuals shall be furnished which will include a description of operation and upkeep procedures.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor is referred to the Contract Drawings and specifications for all items whether or not specifically described herein. It is intended that all manufactured devices, systems, equipment and other items described and specified in this section shall be furnished by this section except as otherwise noted. Installation shall be by this section except as otherwise noted.

3.02 EQUIPMENT INSTALLATION

- A. Installation by the purchasing contractor shall be in strict accordance with the Bio-Process H2O process system manufacturer's instructions and recommendations.

3.03 MISCELLANEOUS

- A. The Contractor shall furnish and install the following materials as specified by this section and/or the contract drawings:
 - 1. In addition to the above-mentioned items, the Contractor shall furnish and install (if applicable) any and all appurtenant items necessary to make the treatment plant fully operable in accordance with the approved Drawings and Specifications.

END OF SECTION

