Northeast Water Solutions, Inc.

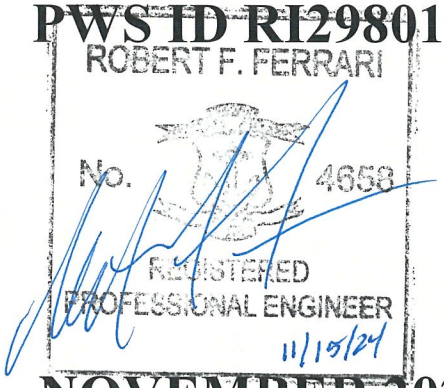
PROJECT SPECIFICATION MANUAL

ROUTE I-95 REST AREA TOURIST INFORMATION CENTER PUBLIC WATER SYSTEM UPGRADE

FOR

RHODE ISLAND DEPARTMENT OF TRANSPORTATION
2 CAPITOL HILL
PROVIDENCE, RHODE ISLAND
02903

PWS ID RI2980178



NOVEMBER 2024

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PUBLIC WATER SYSTEM UPGRADE

PROJECT SPECIFICATION MANUAL
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DIVISION 13 – SPECIAL CONSTRUCTION
Not Applicable

DIVISION 14 – CONVEYING SYSTEMS
Not Applicable

DIVISION 15 – MECHANICAL
Not Applicable

DIVISION 16 – ELECTRICAL

EQUIPMENT PROCUREMENT SPECIFICATION

SECTION 00002
PROJECT DIRECTORY

Owner:	Rhode Island Department of Transportation Two Capitol Hill Providence, RI 02903 Tel: 401-222-2450 E-mail: kerrie.vizzacco@dot.ri.gov
Process Engineer:	Northeast Water Solutions, Inc. 567 South County Trail Suite 116 Exeter, RI 02822 Attn: Robert F. Ferrari, PE Tel: 401- 667-7463 X-114 E-mail: rferrari@nwsi.net
Electrical Engineer:	Associated Engineers 640 George Washington Hgwy. Lincoln, RI 02865 Attn: Alan M. Salk, PE Tel: 401-524-3614 E-mail: alan@associatedengineers.net
Architect:	Laura Krekorian, Architect 40 Main Street, Wakefield, RI 02879 Tel: 401-789-0039 E-mail: laurakrekorian@cox.net
Surveyor	Alfred W. DiOrio, RLS, Inc. Professional Land Surveyors and Land Use Consultants P.O. Box 999 Ashaway, Rhode Island 02804-0009 Tel: 401-377-8124 E-mail: al@awdrls.com

END OF SECTION 00002

SECTION 01000
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 Scope of Work

A. Proposed improvements include but are not limited to: decommissioning of three (3) existing underground vaults, extend existing well casing, upgraded equipment and systems installed in a new above ground Pump House building accessible from grade. The project also includes and optional scope item for replacement of the existing 4-inch DI water main along with a 2-inch hydrant, pavement replacement, and various appurtenances. Contractors shall include this cost in their base bid amount and provide an itemized cost for this scope. If upon water line inspection the engineer of records determines replacement is not warranted, a credit can be given to the state.

B. Work Included: The Contractor's attention is directed to the following general requirements for completing the work.

1. Maintenance of Site and Public Access.
2. Project Schedule and Sequence.
3. Handling of Construction Debris, Excess Soil and water.
4. Identification and Protection of Existing Utility Services
5. Hours of Construction Work
6. Permits and Fees

C. Related Work: Documents related to, or affecting the work of this Section include, but are not necessarily limited to, the following:

1. Section 01010 – Summary of Work
2. Section 01030 – Special Requirements
3. Section 01200 – Project Meetings
4. Section 02070 – Selective Demolition

1.02 Site and Community Access

A. Free access to the public is of utmost importance and must be maintained by the Contractor at all times during the course of completing the work. The Contractor shall maintain continuous service of the existing water supply to the public excepting short-term shut-offs to complete tie-in and connections. All short-term disruptions in service must be scheduled and approved in writing by the Owner. Further the access to the truck parking in the rear of the welcome center must not be blocked.

1.03 Construction Sequence

A. Prior to the start of any mobilization, construction or ordering of materials the Contractor shall schedule a Pre-Construction Meeting and Site Walk with the Engineer and Owner. During the site walk the Engineer will clarify where erosion controls were anticipated to

be necessary and clarify the location of any drainage work items in the contract.

B. Erosion control measures shall be installed by the Contractor as indicated on the plans and as directed by the Engineer during the Site Walk prior to commencing any work. Additional erosion controls must be installed around stockpiled materials and as required to control erosion and sedimentation from the work area(s). Such measures shall be maintained throughout the contract period.

C. The Contractor shall ensure that no excavation be left open, unguarded, or water filled during any period of time when work is not in progress. All subsurface work shall be completed with temporary surfacing in a particular area before proceeding to other work areas.

D. Prior to the start of construction, the Contractor shall submit a schedule for the work to be completed under this contract for approval by the Owner.

1.04 Change in Amount of Work

A. The Owner reserves the right to increase or decrease the amount of any item of work included in the Bid Form, as may be desirable or necessary during the course of this contract.

1.05 Existing Utilities

A. Determining the location and depth of existing utilities will be the responsibility of the Contractor. The drawings do not show the exact location and depth of all utilities, nor do they show all utilities that may be encountered. If needed to perform the work, the Contractor shall locate all utilities in the area of the work by experimental excavations (if necessary) prior to and as the work progresses.

B. The Contractor shall notify the proper utility companies and Owner to obtain the location of all utilities prior to beginning work. The marked locations shall be preserved by the Contractor during the course of the work, until such time as they are no longer needed.

C. All utilities interfered with or damaged by the Contractor shall be immediately and properly restored by the Contractor. The Contractor shall fully compact all backfill material around and under all existing utilities encountered or crossed.

1.06 Temporary Facilities

A. If needed, the Contractor shall obtain the prior approval of the Owner and electrical utility provider for the temporary use of unmetered electrical power.

B. The use of any utility, including storm drainage and water supply systems, shall be coordinated with the Owner prior to such use.

1.07 Stockpile of Materials

A. The Contractor shall stockpile materials and equipment to be used in construction in approved location(s) as directed by the Engineer. Erosion control measures shall be maintained by the Contractor around all stockpiles. All storage locations shall be restored to their original condition by the Contractor at his/her expense.

B. Materials shall be stored to preserve their quality and fitness for the work. Stockpiled materials approved before storage may be re-inspected prior to their use in the work.

1.08 Disposal of Surplus Material and Debris

A. The Contractor shall not dispose of any construction/demolition debris, scrap materials, excess soil or wastewater without prior approval by the Owner and all materials shall be handled as described herein.

1. Construction Waste Materials and Debris: All construction materials, waste materials, pipe, concrete, building materials, wire, soil, etc. shall be inspected by the Owner prior to shipment off site for disposal in accordance with all applicable regulations. If the Owner determines that the means or methods of disposal are not appropriate, the Contractor shall stockpile the waste material on-site, in a secure condition, until an alternative disposal plan and methodology is approved by the Owner.

2. Materials and components identified for salvage shall be removed from the existing installation and provided secure temporary storage by the contractor, prior to turning over to the Owner.

B. During the progress of work the Contractor shall maintain the work site and adjoining areas in a neat and orderly manner and shall not allow the accumulation of construction debris. The Contractor shall use a suitable rubbish container at the site if so, directed by the Owner or Engineer. Should the Contractor neglect to maintain the site free of accumulated debris, the Owner reserves the right to have the service performed by others at the Contractor's expense.

C. Before acceptance and payment for the work at the substantial completion and final completion states of construction, all temporary structures, surplus materials including equipment, abandoned units, and debris with the Contractor may have accumulated during the work on the site or any adjoining property shall be removed of and properly disposed of at the Contractor's expense.

1.09 Permits and Fees

A. The Contractor shall obtain and comply with all required permits to complete the work, including all fees and bonds at his/her expense. The Contractor shall be solely responsible for performing all acts and providing all materials required to comply with all terms and conditions of required permits and licenses. Including any RIDOT permits required.

1.10 Notification of Construction

A. At least five (5) business days prior to beginning the work the Contractor shall notify the following agencies to provide information regarding proposed excavations:

1. DIG SAFE;
2. Police Department;
3. Fire Department;
4. Owner's Site Representative; and
5. Engineer (Northeast Water Solutions, Inc.)

1.11 Submittals

A. The Contractor shall submit to the Engineer for acceptance, shop drawings and other forms as required in Section 00700 General Conditions Article 36, for all items to be furnished under this contract.

B. The Contractor shall submit certificates of compliance for all backfill, bedding, pavement and other bulk materials from the source of supply demonstrating conformance with the contract specifications. If the Engineer so desires, materials may be approved at the source of supply before delivery is started.

1.12 Emergency Service

A. The Contractor shall maintain a full-time telephone service with access to his/her representative having the authority to respond to emergency situations such as settled trenches, weather damage, etc. The emergency telephone service number and list of contact personnel shall be submitted to the Owner prior to beginning work, and shall be maintained throughout the progress of work and the full contract period.

B. The Contractor shall be capable of placing response personnel at the work site within one (1) hour of emergency notification.

1.13 Hours of Operation

A. No outdoor activity by the Contractor shall be permitted on the site outside of the hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as required by the Contract Documents.

B. The Owner may approve other work hours for special considerations such as work to be completed during off-peak hours. The Contractor must receive written approval from the Owner prior to working during such hours.

1.14 Preconstruction Conference

A. Prior to the start of the construction there will be a preconstruction conference and site walk to discuss the phasing and scheduling of the construction project. The specific time and place of the conference will be arranged by the Owner after the Contract has been awarded.

1.15 Progress Meetings

A. During the course of the construction project, the Contractor shall attend status meetings as scheduled by the Engineer or Owner to be held at the Site. The attendance of subcontractors and suppliers may be required during the progress of the work. The Contractor's Project Manager shall attend the meeting and shall be prepared and authorized to discuss the following items:

1. Progress of Work in relation to Contract Schedule;
2. Proposed Work activities for forthcoming period;
3. Resources committed to Contract;
4. Coordination of Work with others;
5. Status of procurement of equipment and materials;
6. Status of Submittals;
7. Outstanding actions, decisions, or approvals that affect Work activities;
8. Security issues;
9. Quality Issues;
10. Potential Claims;
11. Contract Changes;
12. Costs & Budget;
13. Labor; and
14. Insurance;

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01000

SECTION 01010
SUMMARY OF WORK

PART I GENERAL

1.01 Description

A. This project involves the decommissioning of three (3) existing underground vaults, extend existing well casing, upgraded equipment and systems installed in a new above ground Pump House building accessible from grade. The project also includes and optional scope item for replacement of the existing 4-inch DI water main along with a 2-inch hydrant, pavement replacement, and various appurtenances. Contractors shall include this cost in their base bid amount and provide an itemized cost for this scope. If upon water line inspection the engineer of records determines replacement is not warranted, a credit can be given to the state.

B. The work shall be executed in the following sequence of tasks. The Contractor shall obtain written approval from the Owner for any proposed changes or modifications of this sequence of construction work. The work of this Contract includes, but is not limited to:

1. Site preparation set up erosion control silt fence as shown on plans.

2. Pump house construction per plans.

3. Demolition as show on plans. Coordinate with water system operator and determine the equipment in underground vaults 2 and 3 which can be decommissioned while keeping the existing system running. Vault 1 decommissioning should be left until the connection from the new pump house can be made to the existing distribution system to minimize any lapse in service.

4. Equipment/Mechanical Installation.

5. New Electrical Service and generator connection.

6. Well house startup and validation testing

7. Well casing extension and connection to pump house system and existing distribution system.

8. Decommissioning of vault 1.

9. Final grading, driveway pavement, and loam and seed

C. The work performed under this contract shall be coordinated with the operating schedule of the community and also with the public water system certified operator.

PART II - PRODUCTS (NOT USED)

PART III – EXECUTION (NOT USED)

END OF SECTION

SECTION 01015
MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.01 Scope

A. The work shall consist of the mobilization and demobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

B. This work shall not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract.

C. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

1.02 General

A. Mobilization shall include all activities and associated costs for transportation of Contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the Contractor's operations at the site; premiums paid for performance and payment bonds, including coinsurance and reinsurance agreements as applicable; and other items specified in these specifications.

B. Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal and site cleanup of offices, buildings and other facilities assembled on the site specifically for this contract.

C. This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01010

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01.1 Summary

A. Section Includes

1. Measurement and payment criteria applicable to the Work performed under a unit price or lump sum payment method of items fisted in the Bid.

B. Related Sections

1. Bid Form
2. 00522 - Agreement

1.02 Unit Quantities Specified

A. Quantities and measurements indicated in Section 00300 are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Engineer shall determine payment.

B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit price contracted.

1.03 Measurement of Quantities

A. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

B. Measurement by Area: Measured by square dimension using mean length and width or radius.

C. Linear Measurement: Measured by linear dimension, along the horizontal projection of the centerline or mean chord.

D. At appropriate points in this text, specifications are given with respect to measuring or estimating certain quantities and the sums due for the same. Except as otherwise provided, the Engineer shall determine the appropriate method for measuring and computing each quantity, and for estimating the sums due for the various kinds of work and material, using such methods, tools and degrees of precision as are suitable for the particular measurement, item or computation. When so requested by the Engineer, assistance in measuring or determining quantities shall be provided by furnishing the help of unskilled laborers on the site, by furnishing copies of invoices, or by other means.

E. For estimating quantities in which the computations of areas by analytic and geometric methods would be laborious, as determined by the Engineer, it is stipulated and agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of such areas and may be used for this purpose.

1.04 Unit Prices

A. Payment may be computed on the basis of the unit price for each item and the quantity of units completed. Unit prices are to include cost of all necessary materials, labor, equipment, overhead, profit and other applicable costs to complete the work to the satisfaction of the Engineer. (See Paragraph 6, this Section.)

B. The Owner reserves the right to increase or decrease the scope of the Contract work.

1.05 Lump Sum Prices

A. Payment will be computed on the basis of the percentage of work completed on each item in the contract Bid as determined by the Engineer. Lump sum prices are to include the cost of all necessary materials, labor, equipment, overhead; profit and other applicable costs. (See Paragraph 6, this Section.)

1.06 Prices Include

A. General

1. Transportation of all materials and equipment to be included in bid prices.

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

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

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

B. Traffic Control

1. There will be no separate payment for Traffic Control. The costs associated with providing appropriate signing, barricades, conies, flagmen, and uniformed police officer, will be included in the cost of construction. All traffic setups must be in accordance with the latest edition of the Manual on Uniform Traffic Control Devises (MUTCD).

C. Bid Prices Which Involve Excavation

1. The prices for those items which involve excavation shall include compensation for disposal of surplus excavated material, including bituminous concrete, and handling water.

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

D. Bid Prices for Pipe Items

1. The prices for all pipe items (i.e. sewers, service connections, drains, water etc.) shall constitute full compensation for furnishing, laying, jointing and testing, pipe

connection to exiting structures (manholes and catchbasins); earth excavation, backfill and compaction; materials for bedding pipe as specified; and cleaning up.

2. The Bid price for all pipe items shall also include the removal and disposal of the existing pipe being replaced or repaired, unless otherwise specified in the Contract.

1.07 Payment

A. In general, payment will be made for all Contract work satisfactorily completed through the end of the previous month. The payment will include any additional work, which has been completed, and approved and change order work agreed upon by the Owner and Contractor which has been completed and approved.

B. Each application for payment will indicate the total of a minimum five percent (5%) retainage held by the Owner on the total of all work completed under the contract and approved for payment to-date.

C. Monthly applications for payment may also indicate reduction or increase of the total Contract price when an approved change order results in a net reduction or net increase in the cost and quantity of work to be performed under the Contract.

D. Special billings and charges against the Contract as credit or payment to the Owner, that are not for change order work, may be subtracted from monies due on any monthly application for payment but shall not serve to reduce the total Contract price.

E. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the. Engineer multiplied by the unit price for work which is incorporated in or made necessary by the Work.

1.08 Temporary Utilities

A. All costs associated with providing, maintaining, operating and removal of the work described in the section titled Temporary Utilities - 01510, shall be considered part of the total price bid for the Work. It being understood and agreed to by the Contractor that the Contract Price, as indicated in the bid, shall constitute full and complete compensation to the Contractor for providing all provisions necessary and/or required for maintaining any of these facilities, controls or utilities during construction.

END OF SECTION 01025

SECTION 01030
SPECIAL REQUIREMENTS

PART 1 GENERAL

1.01 Materials

A. Aggregate and soils, concrete utilized in construction of the Project shall be obtained from Rhode Island Department of Transportation approved sources and sampled and tested by personnel certified by either the Northeast Transportation Training and Certification Program, the National Institute for Certification of Engineering Technologies or American Concrete Institute, whichever may be applicable for the materials being sampled and tested. All steel used in permanent placements shall comply with the Buy America Requirements.

B. The Contractor must provide the Owner and Engineer with certificates of compliance and mill certifications for all materials in conformance with the Rhode Island Department of Transportation Master Materials Testing Schedule. Manufacturer certificates of compliance must accompany each shipment of product and must be received and accepted by the Owner or Engineer prior to incorporating the product into the work. The Contractor will not be compensated for items where a certificate of compliance is not received.

1.02 Testing and Inspection

A. All materials used in the construction of the project shall be new and of current manufacture. All materials and construction will be subject to inspection and testing by a firm hired by the Contractor. The firm will perform all testing and inspection in accordance with the Rhode Island Department of Transportation Master Materials Testing Schedule.

B. Test results performed by the Contractor will not be accepted.

C. All samples shall be random samples and all sampling and all testing shall meet the requirements of 23 CFR Part 637, Construction Inspection and Approval.

D. The project may be subject to inspections by the Rhode Island Department of Transportation in accordance with State-funded project procedures. All findings must be satisfactorily addressed by the Contractor before final payment.

1.03 Work Within Right-of-Ways

A. If construction of the project requires any work within a Rhode Island State Highway right-of-way, in accordance with 23 CFR 635.105, the Rhode Island Department of Transportation will assign an engineer to ensure that the Project receives adequate supervision and inspection to ensure the Project is completed in accordance with the

approved plans and specifications. The Contractor must notify the Owner, Engineer and Rhode Island Department of Transportation at least five (5) days in advance of any proposed activity in a State right-of -way.

1.04 Prevailing Wage Rate Certification

A. The Contractor must submit a certification that prevailing wage (Davis Bacon) rates have been paid during construction with each invoice. The certifications will be subject to review and approval by the Owner, Engineer and Rhode Island Department of Transportation.

1.05 Contractor Invoices

A. The Contractor must submit invoices with a cover letter signed by a duly authorized agent of the Contractor, containing the following language and provisions:

"I hereby certify that the materials and work for which payment is being requested meets the requirements of the contract documents and approved change orders in all respects, except as noted below. This certification is made in full cognizance of the federal false Statements provision under United States Code, title 18, section 1020, and I am duly authorized to certify on behalf of the insert Contractor's legal name."

1.06 Maintenance of Records

A. The Contractor must maintain all records pertaining to this project for a period of at least three (3) years from the date of final payment and closure of all pending matters.

1.07 Dimensions of Existing Structures

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

1.08 Occupying Private Property

A. The Contractor shall not enter upon nor occupy with men/women, equipment or materials any property outside of the public highways or Owner's easements, except with the written consent of the property owner or property owner's agent.

1.09 Existing Utility Locations – Contractor Responsibility

A. The Contractor shall be responsible for having the utility companies locate their respective utilities on the ground prior to construction.

B. The Contractor shall, at least 72 hours, exclusive of Saturdays, Sundays and holidays,

prior to construction in the proximity of telephone, gas, cable television and electric utilities, notify the utilities concerned by calling "DIG SAFE" at telephone number: 1-888-344-7233.

C. The Contractor shall coordinate all work involving utilities and shall satisfy himself as to the existing conditions of the areas in which he is to perform his work. He shall conduct and arrange his work so as not to impede or interfere with the work of other contractors working in the same or adjacent areas.

1.10 Coordination of Work

A. The Contractor shall be responsible for coordinating his own work as well as that of any subcontractors. He/she shall be responsible for notification of the Engineer when each phase of work is expected to begin and the approximate completion date.

1.11 Time for Completion of Contract

A. The time for completion of this contract is stipulated in the Bid Form. The Bidder shall base his bid on completing the proposed work by the completion date stipulated in Section 00500, AGREEMENT.

1.12 Water for Construction Purposes

A. If water is required and is not available from the existing community water distribution system, the Contractor shall supply water at no additional cost to the Owner.

1.13 Compliance With Permits

A. The Contractor shall perform all work in conformance with requirements of the Permits which appear in Section 01067, PERMITS.

1.14 Cutting, Fitting and Patching

A. The Contractor shall do all cutting, fitting, or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors, as shown upon or reasonably implied by the drawings and the specifications for the completed structure, including all existing work.

B. The Contractor shall not endanger any work by cutting, digging, or otherwise and shall not cut or alter the work of any other Contractor, without the consent of the Engineer.

C. All holes or openings required to be made in new or existing work, particularly at pipe, conduit, or other penetrations not covered by escutcheons or plates shall be neatly patched. All such holes shall be made completely watertight as approved by the Engineer.

D. Size and locations of holes required in steel, concrete, or other structural or finish materials

for piping, wiring, ducts, etc., which have not been located and detailed on the drawings shall be approved by the Engineer prior to layout and cutting thereof. All holes shall be suitably reinforced as required by the Engineer.

E. Workmanship and materials of patching and repair work shall match the adjacent similar work and shall conform to the applicable sections of the specification. Patches and joints with existing work shall provide, as applicable in each case, visual, structural, and waterproofing continuity.

1.15 Contractors Representative

A. The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time day and night and on weekends and holidays should such a situation arise.

1.16 Visual Recording

A. Before beginning construction, the Contractor shall make a color video (DVD format) recording along the entire work length. One (1) complete recording, for the entire project length, shall be furnished to the Engineer prior to the start of the work. The visual recording shall be identified by street name, as applicable, and station.

1.17 Hours of Construction Activity

A. The Contractor shall conduct all construction activity between 7:00 a.m. and 5:00 p.m., Monday through Friday. No construction work shall be allowed on Saturdays, Sundays or Holidays without written authorization from the Owner.

1.18 Construction Crews

A. The Contractor shall not increase the number of construction crews assigned to the work without providing one (1) week advance notice to the Owner and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01030

SECTION 01041
PROJECT COORDINATION

PART I GENERAL

1.01 Description

A. Work Included:

The Contractor shall assign a project manager that shall be responsible for the following:

1. Preparing, implementing and maintaining a project schedule. This schedule shall be submitted to the Owner for review prior to the preconstruction meeting.

2. Coordinating work of the Contractors employees and subcontractors.

3. Scheduling, conducting and documenting the preconstruction meeting and progress meetings.

4. Establishing procedures for intra-project communications.

    a. Submittals
    b. Reports
    c. Shop Drawings

5. Obtaining all necessary construction and building permits.

6. Overall management of the project.

7. Scheduling and coordinating project testing and closeout.

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART I GENERAL

1.01 Description

A. Work Included: The Contractor shall be responsible for all cutting, fitting and patching required to complete the Work or to:

1. Make its several parts fit together properly.

2. Uncover portions of the work to provide for installation of the work.

3. Remove and replace defective work.

4. Repair disturbed areas to their original condition.

5. Remove and replace work not conforming to requirements of Contract Documents.

6. Remove samples of installed work as specified for testing.

7. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.02 Submittals

A. Submit a written request to the Owner well in advance of executing any cutting or alteration that affects:

1. Work of the Owner or any separate Contractor.

2. Structural value or integrity of any structural element or system.

3. Access to other areas of the Owner's facility or the site.

4. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.

5. Efficiency, operational life, maintenance or safety of operational elements.

B. The written request shall include:

1. Identification of the Project.

2. Description of affected work.

3. The necessity for cutting, alteration or excavation.

4. Effect on work of Owner or any separate contractor, or on structural or weatherproof integrity of the work.

5. Description of Proposed Work

   a. Scope of cutting, patching, alteration, or excavation.
   b. Trades who will execute the work.
   c. Products proposed to be used.
   d. Extent of refinishing to be done.

6. Alternatives to cutting and patching.

7. Cost proposal, when applicable.

8. Written permission of any separate contractor whose work is affected.

PART II PRODUCTS

2.01 Materials

A. Comply with specifications and standards for each specific product involved.

B. After uncovering work, inspect conditions affecting installation of Products, or performance of work.

C. Report unsatisfactory or questionable conditions to the Owner in writing; do not proceed with work until the Owner has provided further instructions.

PART III EXECUTION

3.01 Preparation

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of the project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work, and maintain excavations free from water.

D. Inspection

1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavation, patching and backfilling.

2. After uncovering work, inspect conditions affecting installation of new work. If the uncovered conditions are not as anticipated, the contractor shall immediately contact the Owner and secure the necessary direction.

3. The contractor shall not proceed until unsatisfactory conditions are corrected.

3.02 Performance

A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Employ original installer or fabricator to perform cutting and patching for:

1. Weather-exposed or moisture-resistant elements.

2. Site-exposed finished surfaces.

D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

E. Restore work which has been cut or removed. Install new products to provide complete work in accord with requirements of Contract Documents.

F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.

2. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01050
FIELD ENGINEERING

PART I GENERAL

1.01 Description

A. Work Included:

Providing such field engineering services as are required for proper completion of the work including, but not necessarily limited to:

1. Establishing and maintaining lines and levels;

2. Structural design of shores, forms, and similar items provided by the Contractor as part of his means and methods of construction.

B. Related Work

1. Additional requirements for field engineering also may be described in other Sections of these Specifications.

2. The Owner will furnish information describing the physical characteristics, legal limitations, and general utility locations of the site.

1.02 Quality Assurance

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 Submittals

A. Comply with pertinent provisions of Section 01340.

B. Upon request of the Owner, submit:

1. Data demonstrating qualifications of persons proposed to be engaged for field engineering services.

2. Documentation verifying accuracy of field engineering work.

3. Certification, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance or nonconformance with requirements of the Contract Documents.

1.04 Procedures

A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities:

1. Locate and protect control points before starting work on the site.

2. Preserve permanent reference points during progress of the Work.

3. Do not change or relocate reference points or items of the Work without specific approval from the Owner.

4. Promptly advise the Owner when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.

    a. Upon direction of the Owner, require the field engineer to replace reference stakes or markers.
    b. Locate such replacements according to the original survey control.

END OF SECTION

SECTION 01067
CONSTRUCTION PERMITS

PART 1 GENERAL

1.01 GENERAL

A. The Contractor shall obtain and pay for all other permits required, as defined under the Permits subsection of Section 00700, GENERAL CONDITIONS. The Contractor shall obtain and pay for the permits listed below in Paragraph A.2, which are required for this project.

1. Permits by Contractor: Building Permit (if necessary)
   Plumbing Permit (if necessary)
   Electrical Permit (if necessary)
   RIDOT PAPA (if necessary)
   RIDEM Wetland Permit

B. The Contractor shall perform the work in accordance with the Contract Documents, including the aforementioned permits/order of conditions, and any applicable municipal requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01067

SECTION 01090
REFERENCE STANDARDS

PART 1 GENERAL

1.01 Section Includes

A. Quality assurance.

B. Schedule of references.

1.02 Quality Assurance

A. For products or workmanship specified by association, trade, or Federal Standards comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at job site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 Schedule of References

AA Aluminum Association
818 Connecticut Ave.,
N.W. Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capitol Street,
N.W. Washington, DC 20001

ACI American Concrete Institute Box 19150
Reford Station
Detroit, MI 48219

AGC	Associated General Contractors of America 1956 E Street N.W. Washington, DC 20006
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 400 North Michigan Avenue Eighth Floor Chicago, IL 60611
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ASCE	American Society of Civil Engineers 345 East 47th Street New York, NY 10017
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195

EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601
IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NASSCO	National Association of Sewer Service Companies 101 Wymore Road, Suite 521 Altamonte, FL 32714
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association P.O. Box 781 Herndon, VA 22070
NFPA	National Fire Protection Association Battery March Park Quincy, MA 022.69
NSF	NSF International (formerly National Sanitation Foundation) 789 N. Dixboro Road Ann Arbor, MI 48105

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PCI Prestressed Concrete Institute
201 North Wells Street
Chicago, IL 60606

PS Product Standard
U.S. Department of Commerce
Washington, DC 20203

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART II PRODUCTS

Not Used

PART III EXECUTION

Not Used

END OF SECTION 01090

SECTION 01153
CHANGE ORDER PROCEDURE

PART I GENERAL

1.01 Description

A. Work Included: Making such changes in the scope of Work, in the Contract Sum, in the Contract Time of Completion, or any combination thereof, as are described in written Change Orders signed by the Owner and issued after execution of the Contract, in accordance with the provisions of this Section.

B. Related Work

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 Quality Assurance

A. Include within the Contractor's quality assurance program such measures as are needed to assure familiarity of the Contractor's staff and employees with these procedures for processing Change Order data.

1.03 Submittals

A. Make submittals directly to the Owner and Engineer at the addresses presented in the Project Directory Section of this Specification.

B. Submit the number of copies called for under the various items listed in this Section.

1.04 Product Handling

A. Maintain a "Register of Bulletins and Change Orders" at the job site, accurately reflecting current status of all pertinent data.

B. Make the Register available to the Owner for review at his request.

1.05 Processing Changes Initiated by the Owner

A. Should the Owner contemplate making a change in the Work or a change in the Contract Time of Completion, a "Bulletin" will be issued to the Contractor.

1. Bulletins will be dated and will be numbered in sequence.

2. The Bulletin will describe the contemplated change, and will carry one of the following instructions to the Contractor:

    a. Make the described change in the Work at no change in the Contract Sum and no change in the Contract Time of Completion;
    b. Make the described change in the Work, credit or cost for which will be determined in accordance with the General Conditions;
    c. Promptly advise the Owner as to credit or cost proposed for the described change. This is not an authorization to proceed with the change.

B. If the Contractor has been directed by the Owner to make the described change in the Work at no change in the Contract Sum and no change in the Contract Time of Completion, but the Contractor wishes to make a claim for one or both of such changes, the Contractor shall proceed with the change and shall notify the Owner as provided for in the General Conditions.

C. If the Contractor has been directed by the Owner to make the described change subject to later determination of cost or credit in accordance with the General Conditions, the Contractor shall:

1. Take such measures as needed to make the change;

2. Consult with the Owner and reach agreement on the most appropriate method for determining credit or cost for the change.

D. If the Contractor has been directed by the Owner to promptly advise the Owner as to credit or cost proposed for the described change, the Contractor shall:

1. Analyze the described change and its impact on costs and time;

2. Secure the required information and forward it to the Owner for review;

3. Meet with the Owner as required to explain costs and, when appropriate, determine other acceptable ways to achieve the desired objective;

4. Alert pertinent personnel and subcontractors as to the impending change and, to the maximum extent possible, avoid such work as would increase the Owner's cost for making the change, advising the Owner in writing when such avoidance no longer is practical.

1.06 Processing Changes Initiated by the Contractor

A. Should the Contractor discover a discrepancy among the Contract Documents, a concealed condition as described in the General Conditions, or other cause for suggesting a change in the Work, a change in the Contract Sum, or a change in the Contract Time of Completion, he shall notify the Engineer as required by pertinent provisions of the Contract Documents.

B. Upon agreement by the Owner that there is reasonable cause to consider the Contractor's proposed change, the Owner will issue a Bulletin in accordance with the provisions described in Article 1.05 above.

1.07 Processing Bulletins

A. Make a written reply to the Owner in response to each Bulletin.

1. State the proposed change in the Contract Sum, if any.

2. State the proposed change in the Contract Time of Completion, if any.

3. Clearly describe any other changes in the Work required by the proposed change, or desirable therewith, if any.

4. Include full backup data such as the subcontractor's letter of proposal or similar information.

5. Submit this response in a single copy.

B. When cost or credit for the change has been agreed upon by the Owner and the Contractor, or the Owner has directed that cost or credit be determined in accordance with provisions of the General Conditions, the Owner will issue a "Change Order" to the Contractor.

1.08 Processing Change Orders

A. Change Orders will be dated and will be numbered in sequence.

B. The Change Order will describe the change or changes, will refer to the Bulletin or Bulletins involved, and will be signed by the Owner.

C. The Owner will issue four copies of each Change Order to the Contractor.

1. The Contractor promptly shall sign all four copies and return three copies to the Owner.

D. Should the Contractor disagree with the stipulated change in Contract Sum or change in Contract Time of Completion, or both:

1. The Contractor promptly shall return three copies of the Change Order, unsigned by him, to the Owner with a letter signed by the Contractor and stating the reason or reasons for the Contractor's disagreement.

2. The Contractor's disagreement with the Change Order shall not in any way relieve the Contractor of his responsibility to proceed with the change as ordered and to seek settlement of the dispute under pertinent provisions of the Contract Documents.

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART I GENERAL

1.01 Description

A. Work Included - To enable orderly review during progress of the Work, provide for systematic discussion of problems, and coordination of trades, personnel and schedule, the Owner will conduct project meetings throughout the construction period.

B. Related work documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Special Requirements, and Sections in Division 1 of these Specifications.

1. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content.

1.02 Quality Assurance

A. Those persons designated by the Contractor to attend and participate in project meetings, shall have the required authority to commit the Contractor to decisions or directives agreed upon in the project meetings.

1.03 Submittals

A. Agenda Items

To the maximum extent practicable, advise the Owner at least 24 hours in advance of project meetings regarding items to be added to the agenda.

B. Minutes

1. The Owner will compile minutes of each project meeting, and will furnish three copies to the Contractor.

2. Recipients of copies may make and distribute such other copies as they wish.

PART II PRODUCTS

(No products are required in this Section)

PART III EXECUTION

3.01 Meeting Schedule

A. Except as noted below for Preconstruction Meeting, project meetings will be held weekly.

B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.02 Meeting Location

A. The Owner will establish meeting location. To the maximum extent practicable, meetings will be held at the job site.

3.03 Preconstruction Meetings

A. The Preconstruction Meeting will be scheduled to be held within 5 working days after the Owner has issued the Notice to Proceed.

1. Provide attendance by authorized representatives of the Contractor and major subcontractors.

2. The Owner will advise other interested parties, and request their attendance.

B. Minimum Agenda

Data will be distributed and discussed on at least the following items.

1. Organizational arrangement of Contractor's forces and personnel, as well as those of subcontractors and materials suppliers.

2. Channels and procedures for communication.

3. Construction schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies of original Documents and revisions.

5. Processing of Shop Drawings and other data submitted.

6. Processing of Bulletins, field decisions, and change orders.

7. Rules and regulations governing performance of the work.

8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters.

3.04 Project Meetings

A. Attendance

1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the work.

2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the work is involved.

B. Minimum Agenda

1. Review, revisions as necessary, and approval of minutes of previous meetings.

2. Review of the progress of the Work since last meeting, including status of submittals for approval.

3. Identification of problems which impede planned progress.

4. Development of corrective measures and procedures to regain planned schedule.

5. Completion of other current business.

C. Revisions of Meeting Minutes

1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.

2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.

3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

END OF SECTION

SECTION 01340
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART I GENERAL

1.01 Description

A. Work Included

1. Preparing and submitting Shop Drawings, Product Data and Samples required by Contract Documents, and revising and resubmitting as necessary to establish compliance with the specified requirements.

2. All submittals shall be sequentially numbered.

3. Individual requirements for submittals also may be described in pertinent sections of these Specifications.

1.02 Quality Assurance

A. Coordination of Submittals

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.

2. Verify that each item and the submittal for it conform in all respects with the specified requirements.

3. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.

1.03 Substitutions

A. When three (3) or more products are specified, no substitutions therefore will be considered.

B. The Owner will consider a formal request for the substitution of a product specified, only under the following conditions:

1. Requests for substitutions when forwarded by the Contractor to the Owner, are understood to mean that the Contractor:

a. The Contractor has investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.

The burden of proof of equality or superiority of any proposed substitution is totally the responsibility of the Contractor;

b. Will provide the same guarantee for the substitution that he would for that specified;

c. Certifies that the cost data presented is complete and includes all related costs under this Contract, and that he waives all claims for additional costs related to the substitution which subsequently become apparent; and

d. Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects for all trades.

C. When the Submittal Register includes materials or equipment not acceptable to the Owner, the Contractor shall be limited to one (1) additional resubmission within 10 calendar days. If, in the second submission any product or products fails to equal or exceed the materials and equipment specified in the Contract Documents, and the Owner rejects said products and refuses to permit further re-submittals. In such event, the Contractor, in lieu of the rejected products shall provide the items exactly as specified in the Contract Documents to avoid further delay.

D. Products are generally specified by ASTM or other reference standard, and/or by manufacturer's name and model number or trade name.

E. The decision of the Owner relative to substitutions shall be final.

PART II PRODUCTS

2.01 Submittals

A. Submittals shall be accomplished with a Contractor Transmittal Form containing the following information:

1. Sequential Submittal Number;

2. Submittal date;

3. Project title and number;

4. Contractor's name and address;

5. Number of each drawing and a description of material submitted;

6. Notification of deviations from Contract Documents.

B. Submittals shall include:

1. Dimensions, clearly identified as such.

2. Applicable Specifications section numbers.

3. Applicable standards, such as ASTM or Federal Specification number.

4. Identification of known deviations from the Project Drawings and Specifications sections.

5. Manufacturers' installation instructions.

6. Contractor's stamp, initialed or signed, certifying:

   a. Verification of field measurements.
   b. Review of submittals for compliance with all Contract requirements except those specifically indicated.
   c. Compatibility of the Work shown thereon with that of all affected trades.

E. Changes in those products for which Shop Drawings have been accepted will not be permitted unless those changes have been accepted in writing by the Owner.

2.02 Shop Drawings

A. Scale and measurements used shall make Shop Drawings accurate to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work.

B. Types of Prints Required

1. Submit Shop Drawings in the form of five (5) blueline prints of each drawing.

2. Review comments of the Owner shall be shown on the Shop Drawings. The Contractor shall make and distribute such copies as are required for the Contractor's purposes.

2.03 Manufacturer Literature and Product Data

A. Where contents of the submittal literature from manufacturers includes data not pertinent to the submittal, clearly show which portion of the contents is being submitted for review.

B. Submit a minimum of five (5) copies of all literature and information.

2.04 Samples

A. Samples which can be conveniently mailed shall be sent directly to the Owner.

B. All other samples shall be delivered to the Engineers field office, if any, or directly to the Engineers principal office, with sample identification tag attached and properly filled in. Transmittal notice of sample so delivered shall be sent to the Owner by the Contractor.

C. Three specimens of each sample requested shall be submitted, unless otherwise specified in the individual Sections of the Specifications.

D. Provide samples identical to the precise article or item to be provided.

2.05 Supplementary Drawings

A. As work progresses, in addition to the shop drawings required, drawings shall be prepared by the Contractor at a suitable scale not less than 1:25 for changes in the work, where an approved substitution for equipment required such changes. The Contractor shall provide five (5) blueline or blackline prints of each drawing.

PART III EXECUTION

3.01 Identification of Submittals

A. All submittals shall be identified and submitted in accordance with Paragraph 2.01 of this Section of the Specifications.

B. Consecutively number all submittals.

C. Accompany each submittal with a letter of transmittal showing all information necessary for identification and checking.

D. On re-submittals, cite the original submittal number for reference. Each re-submittal shall have a new letter of transmittal with the original submission number plus a re-submittal suffix letter (ie: A, B, C etc.).

E. The Contractor shall maintain an accurate submittal log for the duration of Work. This log shall be available to the Owner upon request.

3.02 Re-submission Requirements

A. Re-submittals shall be submitted in a time which will avoid delaying the Project. Changes which are made, other than those suggested by the Owner, shall be indicated. If the Contractor considers any alteration to shop drawings suggested by

the Owner to constitute a change to the Contract Documents, the Contractor shall submit to the Owner notice as required in the GENERAL CONDITIONS.

1. Determine and verify all interface conditions, catalog numbers, and similar data.

2. Coordinate with other trades as required.

3. Clearly indicate all deviations from requirements of the Contract Documents.

3.03 Grouping of Submittals

A. Grouping of Submittals

Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

3.04 Timing of Submittals

A. General

Make all submittals far enough in advance of scheduled data for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.

B. Review Time

In scheduling, allow at least seven (7) calendar days for review by the Owner following the Owner's receipt of the submittal, except in the case of structural submittals.

The Contractor should allow fourteen (14) calendar days for review of structural submittals.

C. The Owner reserves the right to review submissions in a proper sequence reflecting the logical sequence and relative priority of the construction components, so as to ensure the preparation of a properly coordinated set of drawings. The Owner further reserves the right to keep related samples that have been submitted.

D. Delays

Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the Contract completion date.

3.05 Review Actions

A. The Owner will take one of the following actions on each submission:

1. "Action 1 - No Exceptions Taken"; this action means the fabrication, manufacture or construction may proceed providing the submittal complies with Contract Documents.

2. "Action 2 - Make Corrections Noted. Resubmission for Record Only"; this action means that the fabrication, manufacture or construction may proceed provided that the submittal complies with the notations made by the Owner and the Contract Documents. If, for any reason the Contractor cannot comply with the notations, the contractor shall resubmit as described for submittals stamped Action 3.

3. "Action 3 - Review and Resubmit"; this action means that the submittal does not comply with the Contract Documents and that the fabrication, manufacture or construction shall not proceed.

4. "Action 4 - Rejected"; this action means that the submittal is not in conformance with the Contract Documents, is incomplete, or inadequate.

B. The Contractor shall be limited to the original submittal plus one (1) re-submittal for each Shop Drawing, product data or sample required without incurring any cost or expenses. All subsequent re-submittals shall be reviewed by the Owner or Owner's representative at the expense of the Contractor.

3.06 Distribution of Submittals After Review

A. After review, Shop Drawings and product data bearing the review stamp and signature will be distributed to the Contractor, the Owner and record documents file.

B. The Contractor shall distribute to concerned subcontractors, suppliers, and fabricators.

END OF SECTION

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART I GENERAL

1.01 Description

A. Work Included

1. Employ competent photographer to take construction record photographs periodically during the course of the work.

1.02 Record Photographs Required

A. Provide photographs taken on cutoff date for each scheduled Application for Payment.

B. Provide color photographs taken at each major stage of construction:

1. Prior to initiation of demolition work, pavement removal or equipment removal.

2. Installation of each equipment item.

3. Installation of all other equipment items as they occur.

4. Installation of major mechanical piping and valves.

5. Substantial completion of work.

6. Completion of final site restoration work.

C. Views and Quantities Required

1. At each specified time, photograph the work from three different views, as approved by the Owner.

2. Provide one (1) print of each view plus one (1) final electronic file of all photographs.

D. The Contractor shall pay the cost for the specified photography and prints.

PART II PRODUCTS

2.01 Prints

A. Record photographs shall be digitally captured and embedded with descriptive text for PC compatible viewing and printing as Microsoft word documents. Each print shall be a full 8.5" X 11" format with a minimum picture dimension of 8" x 10".

B. Identify each print including the following, at a minimum:

1. Name of project.

2. Description of work.

3. Orientation of view.

4. Date and time of exposure.

5. Name and address of photographer.

PART III EXECUTION

3.01 Views Required

A. Photograph from locations to adequately illustrate condition of construction and state of progress.

1. At successive periods of photography, take at least one photograph from the same overall view as previously.

2. Consult with the Owner at each period of photography for instruction concerning views required.

3.02 Delivery of Prints and Electronic Print File

A. Deliver prints to the Owner to accompany each Application for Payment.

B. Deliver final set of prints as a condition of the final acceptance by the Owner, of the work.

END OF SECTION

SECTION 01405
CONTRACT QUALITY CONTROL

PART I GENERAL

1.01 Description

A. Quality control of products and workmanship.

B. Manufacturer's instructions.

C. Manufacturer's certificates and field services.

1.02 Related Requirements

A. Section 01340 - Shop Drawings, Product Data, and Samples: Field samples, Submittal of manufacturer's instructions.

1.03 Description

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, workmanship, and site conditions, to produce Work in accordance with Contract Documents.

1.04 Workmanship

A. Comply with national or local codes and standards and the Owner's standards and requirements except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Provide suitably qualified personnel to produce Work of specified quality and suitably experienced and qualified to work in a clean room work environment.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

D. Provide finishes to match approved samples.

1.05 Manufacturer's Instructions

A. Require compliance with instructions in full detail, including each step, in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Owner before proceeding.

1.06 Manufacturer's Certificates

A. When required in individual Specifications Sections, submit manufacturer's certificate, in duplicate, certifying that products meet or exceed specified requirements, executed by responsible officer.

1.07 Manufacturer's Field Services

A. When required in individual Specifications Sections, have manufacturer provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to make written report of observations and recommendations to the Owner, Project Manager and Engineer.

PART II PRODUCTS

Not used.

PART III EXECUTION

Not Used.

END OF SECTION

SECTION 01410
TESTING LABORATORY SERVICES

PART I GENERAL

1.01 Description

A. Section Includes

1. Qualification, duties and responsibilities of testing laboratories.

2. Coordination and scheduling responsibilities of the Contractor.

1.02 Payment Procedures

A. Initial Testing:

1. The Contractor will pay for initial testing services required by the Engineer.

B. Retesting:

1. When initial tests indicate non-compliance with the Contract Documents, subsequent re-testing occasioned by the non-compliance shall be performed by the same testing agency, and costs thereof will be deducted by the Owner from the Contract Sum.

C. Contractors Convenience Testing;

1. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.03 References

A. American Society for Testing and Materials (ASTM)

1. E-329-90, Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.04 Requirements

A. Work Included:

1. Cooperate with the Owner's selected testing agency and all others responsible for testing and inspecting the work.

2. Provide other testing and inspecting as specified to be furnished by the Contractor in this section and/or elsewhere in the Contract Documents.

3. Where no testing requirements are described, but the Owner directs testing, the Contractor shall provide testing under the requirements of this Specification.

B. Wort Not Included:

1. Selection of testing laboratory: The Owner will select a prequalified independent testing laboratory.

1.05 Quality Assurance

A. Qualifications:

1. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329-90.

B. Regulatory Requirements:

1. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

2. Regulatory Requirements: Inspections and tests required by codes or ordinances, or by a plan approved by a Regulatory Agency, and which are made by a legally, constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.06 Delivery, Storage and Handling

A. Comply with pertinent provisions of Section 01600 – Materials and Equipment.

B. Promptly process and distribute to the Engineer, required copies of test reports and instruction to assure necessary re-testing and replacement of materials with the least possible delay in progress of the Work.

1.07 Scheduling

A. Establishing Schedule:

1. By advance discussion with the testing lab oratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.

2. Provide all required time within the construction schedule.

3. Coordinate testing activity with the appropriate testing laboratory.

B. Revising Schedule:

1. When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to Schedule:

1. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

PART II PRODUCTS

Not used.

PART III EXECUTION

3.01 Field Quality Control

A. Site Tests:

1. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

2. All specimen and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimen and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

SECTION 01510
TEMPORARY UTILITIES

PART I GENERAL

1.01 Description

A. Work Included: Furnish, install and maintain temporary utilities services required for construction. Temporary utilities shall be removed upon completion of the Work.

1.02 Requirements of Regulatory Agencies

A. Comply with National Electric Code.

B. Comply with Federal, State and local codes and regulations and with utility company requirements.

PART II PRODUCTS

2.01 Materials - General

A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 Temporary Electricity and Lighting

A. Provide connections to existing facility utility services, which are of adequate capacity to provide service required for power and lighting; Owner will pay the costs of power used.

B. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.

C. Provide adequate artificial lighting for all areas of work when natural light or the existing lighting is not adequate for work.

2.03 Temporary Heat and Ventilation

A. Provide temporary heat and ventilation, as required, to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature, humidity or particulate contamination.

B. Provide adequate forced ventilation of enclosed work areas for curing of installed materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors or gases.

C. Portable heaters and ventilation units shall be standard approved units complete with controls.

D. Provide connections to existing facilities, extend and supplement with temporary units as required to comply with requirements. Pay all costs of installation, maintenance, operation and removal. Owner will pay costs of fuel used from the existing system.

E. Ventilation systems used to exhaust enclosed work areas shall be installed such that the external ventilation exhaust stream is not in proximity to other ventilation intakes or to personnel areas or public access ways.

PART III EXECUTION

3.01 General

A. Maintain and operate systems to assure continuous service.

B. Modify and extend systems as work progress requires.

3.02 Removal

A. Completely remove temporary materials and equipment when their use is no longer required.

B. Clean and repair damage caused by temporary installations or use of temporary facilities.

C. Restore existing facilities used for temporary service to specified, or to original, condition.

END OF SECTION

SECTION 01540
SECURITY

PART I GENERAL

1.01 Description

A. Work Included

1. Provide a project security program to:

a. Protect Work, stored products and construction equipment from theft and vandalism.
b. Protect premises and work area from entry by unauthorized persons.

B. Related Work

Protect Owner's operations at site from theft, vandalism or damage from Contractor's work or employees.

1.02 Maintenance of Security

A. Initiate security program in compliance with Owner's system, prior to job mobilization. Maintain the security program throughout construction period, until the Owner's acceptance of the work precludes the need for Contractor security.

B. Require that identification by displayed by all persons entering, and on, the premises.

1. Exclude from site personnel not properly identified.

1.03 Entrance Control

A. Provide control of all persons and vehicles entering and leaving project site.

1. Require display of proper identification by each person.

2. Allow no visitors except with issuance of temporary identification.

3. Maintain log of visitors.

B. Owner will control deliveries and vehicles related to his own operations.

PART II PRODUCTS

Not used.

PART III EXECUTION

Not Used.

END OF SECTION

SECTION 01560
TEMPORARY CONTROLS

PART 1 GENERAL

1.01 Description

A. Work Included

Provide and maintain methods, equipment, and temporary construction, as necessary, to provide controls over environmental conditions at the construction site and related areas under Contractor's control; remove physical evidence of temporary facilities at completion of Work.

1.02 Dust Control

A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent airborne dust from dispersing into the atmosphere and to adjacent manufacturing and personnel areas.

1.03 Construction Water Control

A. Provide methods to control spills, cleaning and flushing discharges and hydraulic testing discharges to prevent damage to the work, release to the site or adjoining properties or water bodies and to prevent overloading of the on-site wastewater collection, transfer and treatment systems.

1.04 Maintain Water and Wastewater Utility Services to Users

A. Provide methods, materials and controls to protect and maintain the existing water distribution service to the community during the construction of the Pump House modifications and the water distribution system. Interruptions of service for cut-in of new water service connections to individual residences, or modification of Pump House piping, equipment, controls or power supply shall be scheduled in advance, and shall be for maximum 4-hour duration, unless otherwise approved in writing, by the Owner.

B. The community sanitary wastewater collection and transfer systems, and the individual and community on-site wastewater treatment and disposal systems shall be protected from damage and loss of service. Operation of these systems shall be maintained continuously, throughout the duration of the construction Work.

1.05 Debris Control

A. Maintain all areas under Contractor's control free of extraneous debris.

B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.

1. Provide containers for deposit of debris.

2. Prohibit overloading of trucks to prevent spillage on access and haul routes.

C. Schedule periodic collection and disposal of debris.

PART II PRODUCTS

Not used.

PART III EXECUTION

Not Used.

END OF SECTION

SECTION 01620
TRANSPORT, STORAGE AND PROTECTION

PART I GENERAL

1.01 Description

A. Work Included:

1. Provide secure storage and protection for materials and equipment to be incorporated into the Work.

2. Provide maintenance and protection of the installed materials and equipment until completion of the Work.

1.02 Transportation and Handling

A. Transport and handle products in accordance with manufacturer's instructions. Deliver products in undamaged condition in manufacturers unopened containers or packaging, dry.

B. Transport products and materials by methods to avoid product damage.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

D. Promptly inspect shipments to assure that products and materials comply with requirements and specifications, that quantities are correct, and products are undamaged.

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

1.03 Storage

A. Store products immediately upon delivery and protect until installed in the Work.

1. Store in accordance with manufacturer's instructions, with seals and labels intact and legible.

2. Arrange storage of products and materials to provide assess for inspection. Periodically inspect to assure that products and materials are undamaged and are maintained under specified conditions.

3. The Owner shall designate storage areas for all materials and equipment.

B. Store products subject to damage by elements in weather tight enclosures.

1. Maintain temperatures within ranges required by manufacturer's instructions.

2. Provide humidity control for sensitive products, as required by manufacturer's instructions.

3. Store unpacked products on shelves, in bins or in neat piles, accessible for inspections.

C. Exterior Storage

1. Provide substantial platforms, blocking or skids to support fabricated products above ground, prevent soiling or staining. Arrange storage in manner to provide easy access and inspection.

2. Cover products subject to discoloration, corrosion or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

4. Granular media materials should be delivered to the site in clearly labeled, weathertight containers, and stored on pallets on solid, level surfaces.

5. Store loose, granular materials on solid surfaces in a well-drained area. Prevent mixing with foreign matter.

6. Provide surface drainage to prevent flooding of materials and equipment in temporary storage.

1.04 Maintenance of Storage

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. Storage facilities are adequate to maintain the original condition of the materials and equipment.

2. Required environmental conditions are maintained continuing basis.

3. Surfaces of products exposed to elements are not adversely affected.

1.05 Protection After Installation

A. Provide protection of installed products to prevent damage from subsequent operations. Remove upon completion of the work, immediately prior to initiation of system startup.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

1. In areas subject to foot traffic secure heavy paper, sheet goods, or other materials in place.

2. For movement of heavy products, lay planking or similar materials in place.

3. For storage of products, lay tight wood sheathing in place.

PART II PRODUCTS

Not Used

PART III EXECUTION

Not Used

END OF SECTION

SECTION 01650
START-UP OF SYSTEMS

PART I GENERAL

1.01 Description

A. Work Included

Execute the precise, sequential and orderly inspection, testing, cleaning, and start-up of the completed water distribution system.

B. Related Work

1. Division 15, Mechanical.

2. Division 16, Electrical.

3. Division 11, Equipment.

4. Section 01560 Temporary Controls.

5. Section 01700 Contract Closeout.

1.02 Quality Assurance

A. Use adequate numbers of trained, skilled workmen, experienced in the procedures and crafts required to execute the specified procedures and methods for proper performance of the work in this Section.

1.03 Submittals

A. The Contractor shall submit written notice and documentation of all procedures completed including:

1. Substantial completion.

2. Punch list inspection.

3. Final inspection.

4. Final pipeline flushing, pressure and hydrostatic testing of pipe, valves, fittings, pressure vessels and appurtenances.

5. Final electrical and instrument testing and evaluation.

6. Final sanitization of pipelines, filters, and wetted equipment.

7. Final analytical validation of water quality.

8. Final wet start-up of all process systems.

B. All submittals shall be typed, on 8-1/2" x 11" sheets or shall be on approved test documentation forms.

C. Submittals shall be made directly to the Owner.

1.04 Procedures

A. All procedures shall be in accordance with Section 15050 of this Specification, the Equipment Procurement Specifications and the specific manufacturer recommendations.

PART II PRODUCTS

Not used.

PART III EXECUTION

Not Used.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART I GENERAL

1.01 Description

A. Work Included

Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 Substantial Completion

A. When Contractor considers the Work is substantially complete, he shall submit to Owner:

1. A written notice that the work, or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Owner shall make an inspection to determine the status of completion.

C. Should Owner determine that the work is not substantially complete:

1. Owner shall promptly notify the contractor in writing, giving the reasons therefore.

2. Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Owner.

3. Owner shall re-inspect the work.

1.03 Final Inspection

A. When Contractor considers the work is complete, he shall submit written certification that:

1. Contract Documents have been revised.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.

5. Work is completed and ready for final operation.

1.04 Contractor's Closeout Submittals

A. Certificates of Inspection.

B. Project Record Documents.

C. Operating and Maintenance Data, Instructions to Owner's Personnel.

D. Warranty Certificates.

E. Spare Parts and Maintenance Materials.

F. Certificate of Insurance for Products and Completed Operations.

G. Laboratory Certificates of Analysis for final water quality validation.

H. Conformance Inspection Approval by RI Department of Health.

PART II PRODUCTS

Not used.

PART III EXECUTION

Not Used.

END OF SECTION

SECTION 01710
CLEANING UP

PART 1 GENERAL

1.01 Scope

A. The Contractor must employ at all times during the progress of his work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon direction by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

PART 2 PRODUCTS

2.01 Materials Used for Restoration

A. All materials used for the restoration of damaged property shall be of equal or greater quality and shall be as approved by the Engineer, see Section 3.04.

PART 3 EXECUTION

3.01 Daily Cleanup

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Engineer, the Contractor shall within twenty-four (24) hours clean up those areas which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

D. Should the Contractor fail or neglect, after backfilling, to promptly remove all surplus materials, tools and other incidentals, or promptly do the required paving when ordered, the Owner may, after twenty-four (24) hours written notice, cause the work to be done and the cost thereof shall be deducted from any monies then or thereafter due the Contractor.

3.02 Material or Debris in Drainage Facilities

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

3.03 Removal of Temporary Buildings, Structures and Equipment

A. On or before completion of the work, the Contractor shall, unless otherwise specifically directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools and machinery or other construction equipment furnished by him; shall remove all rubbish from any grounds which he has occupied; shall remove silt fences and hay bales used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by his operations in a neat and satisfactory condition.

3.04 Restoration of Damaged Property

A. The Contractor shall restore or replace, when and as directed, any property damaged by his work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

3.05 Final Cleanup

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the condition of the site shall be approved by the Engineer.

END OF SECTION 01710

SECTION 02001
GENERAL SITE CONDITIONS

PART 1 GENERAL

1.01 Related Documents

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

1.02 Scope

A. Provide all labor, materials and equipment necessary to complete all GENERAL SITE CONDITIONS WORK indicated on the Drawings, herein specified or both. The work of this Section includes, but is not necessarily limited to, coordination and control of all site related work.

1.02 Related Work Specified Elsewhere

A. Division 1: For Sections on Project Meetings, Submittals, and Protection from inclement weather.

B. Division 2: For Sections on Clearing & Grubbing, Protection of Plants to remain, Earthwork, Concrete Paving, Site Utilities, Site Improvements, and Landscaping.

1.03 Quality Assurance:

A. Standards: See Section 01400, and below.

PART II PRODUCTS

Not Applicable

PART III EXECUTION

3.01 Excavations – All Classes, All Trades

A. Dig Safe:

1. Be aware of and comply with all laws governing work in areas of existing underground utilities on Federal, State, Municipal, and private land.

2. Before beginning any demolition, excavation or other Site related underground work, verify the locations of all underground utilities shown on the Drawings by any and all means necessary.

3. In addition, contact "Dig Safe" and individual utility companies to check for any additional utility lines not shown.

3.02 Protection of Existing Utilities

A. In addition to the Contractor's requirements in Division One and elsewhere, and in coordination with the Contractor, protect all existing utility lines and ways from all damage throughout the work of this Project, using only means and methods approved in advance by the applicable utility companies and the and/or Engineer.

B. Proceed only with utmost caution in areas of existing underground, above ground and aerial utilities, as prescribed by the pertinent utility companies and by applicable law. Immediately repair or replace any damaged utility lines and ways per the utility companies involved, at no additional cost to the Owner.

3.03 Awareness of Historical Artifacts

A. Prior to and during any excavation performed by the Contractor or his forces, the Contractor shall notify the Contractor and/or Owner immediately should any of the following be encountered:

1. Charcoal, bones, sea shells, rocks that appear to have been burned, and any obvious evidence of prior human habitation, such as arrowheads, pottery shards, hewed timber, etc.

2. No additional excavation work shall take place in the areas of such discoveries until the Contractor has been directed by the Engineer to proceed.

3.04 Maintenance of Existing Utilities

A. In addition to the requirements in Division 1 and elsewhere, and in coordination with the Contractor, take all necessary measures to ensure all existing utilities remain active and available to the community throughout the construction period.

1. When any utility must be temporarily disrupted for connection to the new building or for any other approved reason, provide 72 hours advance notice to the Owner and to the utility involved.

3.05 Protection of Open Excavations

A. In addition to the requirements of Division 1, provide - for the life of this Project protection of and from all open excavations, including but not limited to, trench excavations, open foundation excavations, excavations resulting from site clearing & demolition operations or from removal of ledge.

B. Using approved methods, protect all excavations to prevent cave-ins, erosion, and side slippage. Concurrently, using approved methods protect all excavations from being a hazardous condition to all workers and to the public.

3.06 Permits

A. Before beginning any work in any public highways, streets or ways, confirm through the Contractor that all necessary permits relating to such work have been obtained.

3.07 Access & Egress

A. In addition to the Contractor's requirements set forth in Division 1 and elsewhere, coordinate with the Contractor - who shall coordinate with the Owner and make whatever provisions are necessary to maintain unobstructed access to and egress from the site for both regular and emergency vehicular and pedestrian traffic.

B. Assure, through the Contractor, that all proper authorities and the Owner have been notified before beginning any work that might impede vehicular traffic adjacent to the site or to and from the site.

3.08 Licenses Required

A. Prior to beginning any site related work, ensure that operators of all equipment used in the sitework are properly and currently licensed to operate such equipment.

3.09 Clean Up

A. In addition to the General Contractor's requirements in Division One and elsewhere, insure at all times that debris, rubbish and excess materials from all Site work operations are removed from the site daily, and lawfully disposed of.
1. See Section 1710 — Cleaning Up.

3.10 Applicable Standards

A. Refer to Section 01090 — Reference Standards

3.11 Submittals

A. In addition to the requirements of Division 1, the following shall be the case:

1. Any Material, Labor or Equipment provided for this Project that has not first been approved by the Engineer shall be deemed to be provided solely at the provider's risk.

3.12 Storage of Materials

A. The on-site storage of all materials, whether new, excavated, deemed excess, salvage and any other type shall be coordinated through the Contractor, and approved by the Engineer, before such storage takes place.

END OF SECTION

SECTION 02010
SUBSURFACE CONDITIONS

PART 1 GENERAL

1.01 Related Documents

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

1.02 Site Soils Investigation

A. No site investigation of soils has been executed for this project. It is the responsibility of the Contractor to satisfy themselves regarding the subsurface conditions. No warranty, either expressed or implied, is provided by the Engineer as to the accuracy or completeness of this information of existing conditions presented on the Drawings.

B. The Contractors, however, will visit the site and acquaint himself with existing conditions, prior to beginning work.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not Applicable

END OF SECTION

SECTION 02070
SELECTIVE DEMOLITION

PART I GENERAL

1.01 Description

A. Work Included

1. The work to be performed under this Section includes the furnishing of all materials, equipment, transportation and labor and all operations for the dismantling and removal of all or portions of the existing interior and exterior water transfer pipeline and associated piping, fittings, valves and specialties.

B. Related Work Described Elsewhere

1. Division 15 - Mechanical
2. Division 16 - Electrical
3. Section 01045 - Cutting and Patching
4. Section 01510 - Temporary Utilities
5. Section 01540 - Security
6. Section 01560 - Temporary Controls

1.02 Quality Assurance

A. Only skilled workman regularly employed and engaged in performing work of this type, experienced in working within electronics manufacturing environments shall be employed.

B. The work in this Section shall conform to all applicable Federal, State and local codes as well as to codes, regulations and standards established and published by the Owner.

1.03 Protection

A. The Contractor shall accept the premises as they are prepared by the Owner, and carry out the work specified. The Owner assumes no responsibility for the conditions of the premises or a continuation in conditions existing after equipment demolition and removal is begun.

B. Do not interfere with use of adjacent work areas. Maintain free and safe access to and from other buildings areas.

C. Cease operations and notify the Owner immediately, if the safety of any structure appears to be endangered or contamination of the adjacent manufacturing or personnel areas occurs. Do not resume operations until safety and/or the integrity of the structural enclosure is restored.

D. The Contractor shall provide adequate protection to surrounding structures, equipment, piping and facilities to prevent damage or interference with operations.

1. The Contractor shall assume all liability for damage or contamination to adjacent surfaces, equipment or material resulting from site demolition work.

2. The Contractor shall notify the Owner in the event settlement or damage is apparent in materials or equipment or systems that are to remain or if such materials equipment or surfaces are endangered. Provide additional protection as required. Failure to notify the Owner of damage, settlement or impending danger or contamination to existing materials, equipment or surfaces to remain in no way relieves the Contractor of liability.

3. The Contractor shall repair, at his expense, any damage, settlement or contamination of materials, equipment and systems to remain that is caused by site demolition work.

4. The Contractor shall locate existing utilities or drains in the work area and protect same from damage in areas of work. Where drains or utilities are uncovered by the work and are not shown on plans, Contractor shall plainly mark said utilities and notify the Owner immediately. In no event shall said utilities be re-covered without concurrence of Owner.

5. During all demolition/dismantling work, the Contractor shall provide mechanical ventilation systems to control and capture particulate contaminants.

1.04 Existing Services

A. Place markers to indicate location of existing services. Identify service lines and capping locations on Project Record Documents.

PART II PRODUCTS

2.01 Materials

A. Except where equipment or materials are designated for salvage, the Contractor shall maintain possession of materials being demolished and immediately remove from site.

PART III EXECUTION

3.01 Preparation

A. Erect and maintain containment and control systems as required to prevent spread of dust, fumes and other airborne contaminants to other parts of the Owners site, operating and personnel areas. Upon completion of all work under this Contract, remove controls systems and repair damaged surfaces to match adjacent surfaces.

B. Carry out demolition work to cause as little inconvenience to adjacent occupied building areas as possible.

C. Prior to initiation of demolition, the Contractor shall inspect the existing equipment, structures, utilities and systems for the following purposes:

1. Familiarizing all Contractor personnel with the work to be executed.

2. Identify and tagging all equipment, structures, materials, etc., to be dismantled. Identification and tagging shall include the following designations.

    a. Equipment and materials to be dismantled and turned over the Owner for final disposition.

    b. Equipment and materials to be dismantled or demolished and removed from the site by the Contractor.

3. Locate and identify all utility services.

4. Identify all equipment and systems which must remain protected, undamaged and uncontaminated by the demolition process.

3.02 Demolition

A. Demolish in an orderly and careful manner as required to accommodate new work, including that required for connection to the existing building. Protect existing foundations, equipment, control systems and supporting structural members.

B. The Contractor shall remove materials and equipment as shown on the Drawings and specified herein. Materials shall be removed or demolished in a manner that will cause the least disturbance to surrounding materials and equipment that are to remain.

C. Perform demolition in accordance with applicable authorities having jurisdiction.

D. Repair all demolition performed in excess of that required, at no cost to the Owner.

E. Removal of mechanical equipment and piping system components shall be done in a manner that will leave adjacent piping, supports, fittings, equipment, etc. undamaged. All bolted, riveted or welded joints shall be carefully removed by hand tools to leave remaining members undamaged.

F. The Contractor shall remove all rubble, debris, scrap and demolition materials, leaving the work area clear and ready for new work. See Drawings for areas and equipment to be cleared.

G. Removal of waste materials requires that said materials be completely removed from the Owner's property, unless otherwise directed by the Owner, and legally disposed. The Owner shall retain possession of all principle mechanical and electrical process and utility components, equipment and materials that have been previously designated for salvage.

END OF SECTION

SECTION 02076
REMOVAL AND DISPOSAL OF SURPLUS, UNSTABLE, AND UNSUITABLE MATERIALS

PART I GENERAL

1.01 Description

A. Work Included: The removal and disposal of surplus, unstable and unsuitable materials.

B. Related Work:

1. Section 01000: Special Requirements

2. Section 02220: Excavating, Backfilling and Compaction for Utilities and Structures

1.02 Quality Assurance

A. Requirements of regulatory agencies

1. The work in this Section shall conform to all applicable local, state and federal codes and regulations.

PART II PRODUCTS

2.01 Materials

A. Prior to starting excavation of soil material:

1. Existing bituminous surfaces shall be broken into pieces not to exceed 6" in largest dimension and, unless otherwise noted on the Drawings or directed by the Owner, disposed of off-site in an approved disposal site.

2. Existing reinforced concrete structures, concrete masonry units, concrete pavement, bituminous concrete pavement and sidewalks shall be broken into pieces having an area not to exceed two (2) square feet, and any protruding steel shall be cut to within 1" of the encasing concrete. The broken pieces shall be removed from the site of the work and disposed of in a suitable manner by the contractor.

B. Stones and boulders encountered in excavation shall be removed and disposed of as noted on the Drawings or directed by the Owner.

C. Unstable material is soil materials of such a nature that, in the opinion of the Owner, it cannot be properly consolidated in embankments or material that will not or cannot be made to function to satisfy the project conditions.

PART III EXECUTION

3.01 Disposal

A. Surplus excavated material shall be disposed of in a legal manner outside the limits of the job site at a location chosen by the Contractor and approved by the Owner at the Contractor's expense. No material shall be removed from the site without approval of the Owner.

END OF SECTION

SECTION 02100
SITE PREPARATION

PART I GENERAL

1.01 Work Included

A. Requirements for removal of vegetation, fences, walls, guardrails, poles, posts, signs, topsoil, and other items required to fully prepare the site for the proposed construction.

B. Work includes items not specifically covered by other sections of the specifications.

1.02 Definitions

A. Clearing: Removal of trash, vegetation, trees, or organic matter alive or dead.

B. Grubbing: Removal of vegetation including stumps, buried logs and roots.

C. Scalping: Removal of grass turf to a depth of 3 inches.

1.03 Quality Assurance

A. Obtain Engineer's approval of staked work limits prior to starting the clearing, grubbing, and stripping.

1.04 Project Site Conditions

A. Environmental Requirements

1. Install erosion and sediment controls prior to starting the work. Erosion and sediment controls shall be maintained in accordance with all state and local requirements.

B. Existing Conditions

1. Temporarily remove property improvements, to the minimum extent necessary, to complete the work and restore improvements to condition which existed prior to construction.

1.05 References

A. Standard Specification for Road and Bridge Construction of the Rhode Island Department of Transportation amended December 2010, together with all erratic, addenda, additional revisions and supplemental specifications.

PART II PRODUCTS - Not Used

PART III EXECUTION

3.01 Protection

A. Do not cut or injure any trees or other vegetation outside the limits of disturbance and/or permanent easements, as indicated on the Drawings.

B. Trees, shrubbery, or plantings along the traveled highways or roads, shall not be removed except with the written approval of the Engineer.

C. Preserve certain vegetation such as trees, shrubs, hedges and plants within the construction area, as indicated on the Drawings to be protected or as directed by the Engineer.

D. Work In Improved Property

1. Protect trees, cultivated hedges, lawns, shrubs, and plants that might be damaged by the Contractor's operations.

2. Temporarily replant and care for trees under 4 inches in diameter which would be damaged by the construction operation. After the construction operations have been substantially completed, replant in their original positions and care for until growth is reestablished. If trees, cultivated hedges, lawns, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced at the Contractor's expense by items of kind and quality existing at the start of the work.

3. Do such handwork as may be required to prevent damage to buildings and improvements.

4. Protect fences and stone walls and if needed to be removed to facilitate construction or if damaged, upon completion of the work, properly restore or repair to at least as good a condition as existed prior to start of the work.

3.02 Clearing

A. Cut or remove all trees, saplings, brush, and vines, windfalls, logs, and trees lying on the ground, dead trees and stubs more than 1 foot high above the ground surface.

B. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and the stubs to be cleared shall be cut as close to the ground surface as practicable, but no more than 6

inches above the ground surface in the case of small trees, and 12 inches in the case of larger trees. Saplings, brush, and vines shall be cut off close to the ground.

C. Selective Trimming

1. Cut back limbs and branches of trees to be preserved only to the extent necessary for construction.

2. Trim neatly, and cleanly so that the remaining tree will not be damaged and healing will be facilitated. Where limbs and branches over 1 inch in diameter have been cut, the newly cut area of the tree shall be given a thorough application of approved tree-healing paint.

3.03 Grubbing

A. Remove completely all stumps.

B. Remove to a depth of 12 inches all roots 3 inches and larger in diameter.

C. Remove to a depth of 6 inches all roots less than 3 inches in diameter.

D. Measure depths from the existing ground surface, or the proposed finished grade, or the proposed grade of the gravel borrow subbase, whichever is the lower.

3.04 Disposal of Cleared and Grubbed Materials

A. Dispose of cleared and grubbed materials off site at authorized disposal location.

B. Such disposal shall be carried on as promptly as possible after removal of material in the clearing and grubbing operations and shall not be left until the final period of cleaning up.

C. Elm bark whether stripped from the wood or intact with the wood shall be either buried at least 1 foot below grade in approved dumping areas or burned in a suitable incinerator off-site with satisfactory anti-pollution and fire prevention controls to prevent the spread of Dutch Elm Disease.

3.05 Removal and Disposal of Miscellaneous Objects

A. Remove and legally dispose of miscellaneous items such as fences, posts and railings, guardrail, mail boxes and posts, private signs, highway bounds and any other object not specifically covered by another section of the Specifications, specifically indicated on the plans to be removed or required to be removed for the construction of the new work**.**

END OF SECTION.

SECTION 02101
PROJECT SURVEYING AND STAKING

PART I GENERAL

1.0 Work Included

A. This section includes the field surveying, staking, and maintenance of the same as necessary to properly complete the construction as proposed. The Contractor shall furnish all labor, materials, equipment, etc. necessary to properly do the work.

PART II PRODUCTS

NOT APPLICABLE

PART III EXECUTION

3.01 Control

A. Horizontal and vertical dimensions and exterior elevation contours are identified on the Drawings. The Contractor shall use these control points with the Drawings to construct the system accurately. The contractor shall be responsible for all necessary surveying and construction stake out work and shall use a Rhode Island Registered Land Surveyor to do this work. When requested, the Registered Land Surveyor shall certify to the Contractor, the Engineer, and the Owner that the project has been properly surveyed and staked out. When requested, during construction, the surveyor shall check and certify the accuracy of the construction.

3.02 Alignment and Elevation Checks

A. Alignment and elevations shall be checked frequently and stakes shall be maintained throughout the project as needed to complete the construction accurately. The Contractor has the responsibility to check and maintain construction accuracy throughout the project. All mistakes and errors greater than allowable shall be corrected at the Contractor's expense to the satisfaction of the Owner and Engineer before any related construction can continue.

1. Vertical elevations shall be constructed within ±0.03 feet of proposed elevations.

2. Horizontal dimensions of critical items shall be within ±0.1 feet of those proposed.

3. Locations of noncritical structures shall items shall be within ±0.5 feet of those proposed, unless otherwise allowed by the Owner of the Engineer.

B. The Contractor shall submit copies of his actual field measurements to the Owner's representative on a daily basis.

C. The Contractor shall make checks on the elevation and location of each anchor bolt, equipment pad, pipe joint, pipe connection, etc., to verify that the systems are being constructed according to the Drawings.

3.03 Record Drawings

A. The Contractor shall maintain a master set of record drawings that show all changes and deviations from the original drawings. The markups shall be made as the changes occur. At the conclusion of the project, these master record drawings shall be completed as "As-Built" Drawings and submitted to the Owner.

END OF SECTION

SECTION 02110
CLEARING OF SITE

PART I GENERAL

1.01 Work Included

A. This section includes furnishing all labor, material, equipment and services necessary for clearing the site within the area of work, as indicated on the drawings and specified herein.

B. Clearing and grubbing of trees, shrubs, and other vegetative matter from the site within the limits specified and shown. Clearing outside the specified limits shall contractually obligate the Contractor to furnishing, installing and maintaining nursery trees, shrubs, plants, grass, etc., as desired by the Owner.

PART II PRODUCTS

NOT APPLICABLE

PART III EXECUTION

3.01 Demolition

A. All demolition shall be done with care to prevent damage to persons and property.

B. Provide temporary shoring and bracing necessary for safe removal of existing work.

C. All debris shall be removed and disposed of and the site shall be left clean and neat.

D. Title to salvaged materials shall be vested in the Owner. Such materials shall be stored on the site, or disposed of as directed by the Owner.

3.02 Clearing and Grubbing

A. On all areas including borrow areas, where grading, excavation and filling is to be done; all timber, brush, stumps, roots, rubbish, large stone and boulders, and unsuitable material shall be removed to a depth of not less than one (1) foot below the surface. The surface shall be plowed to a depth of not less than six (6) inches and all stumps, roots, and other perishable matter thus exposed shall be removed to a depth of not less than one (1) foot. Material thus removed shall be piled and burned or otherwise disposed off-site in accordance with local laws and regulations.

END OF SECTION

SECTION 02122
TREE PROTECTION AND TRIMMING

PART 1 GENERAL

1.01 Related Documents

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-I Specification Sections, apply to work of this section.

1.02 Description of Work

A. Trees, which are to remain and must be protected, are indicated on the drawings.

B. Work includes trimming and protection of trees that are will remain, but interfere with or are in close proximity to new construction, as herein specified. All tree work to be performed with the approval of the Engineer and under the direction of a qualified Arborist (see below).

C. Refer to Section "Site Clearing", which limits removal of trees, shrubs and other vegetation to plants interfering with new construction, unless otherwise shown.

1.03 Quality Assurance

A. Arborist: Engage a qualified Arborist to perform the following work:

1. Remove branches from trees, which are to remain, if required to clear new construction.

2. Recommend procedures to compensate for loss of roots (if any) and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.

3. Perform tree repair work for damage incurred by new construction.

1.04 Submittals

A. Certification: Submit written certification by qualified Arborist that trees indicated to remain have been protected during the course of construction in accordance with recognized standards of the industry. Also certify that where damage did occur trees were promptly and properly treated. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.

1.05 Job Conditions

A. Temporary Protections: Provide temporary fencing, barricades or guards to protect trees and other plants, which are to remain, from damage.

B. Protect Root Systems: Do not store construction materials, debris or excavated material within drip line (outer perimeter of branches). Do not permit vehicles within drip line. Restrict foot traffic to prevent excessive compaction of soil over root systems.

PART II PRODUCTS

2.01 Materials

A. Drainage Fill: Selected stone or gravel, graded to pass criteria established in Section 02200 - Earthwork.

B. New Topsoil: Fertile, friable, surface soil, containing natural loam. Obtain from local sources or from areas having similar characteristics to topsoil found at work site. Provide topsoil that is reasonably free of subsoil, clay lumps, and free of brush, weeds, roots, stones larger than 2" in any dimension and free of other extraneous or toxic matter harmful to plant Obtain topsoil only from well-drained sites where soil occurs in depth of 4" or more; do not obtain from bogs or marshes.

PART III EXECUTION

3.01 General

A. Protect tree root systems from damage due to noxious materials in solution caused by run-off or spillage during mixing and placement of construction materials, or drainage from stored materials. Protect root systems from flooding, erosion or excessive wetting resulting from dewatering operations.

B. Do not allow fires under or adjacent to trees or other plants which are to remain.

C. Remove branches from trees that are to remain, if required and authorized by the Architect to clear new construction.

1. Where directed by Engineer, extend pruning operation to restore natural shape of entire tree.

D. Cut branches and roots, if required, with sharp pruning instruments; do not break or chop.

3.2 Excavation Around Trees

A. Excavate within drip line of trees only where indicated.

B. Where trenching or utilities is required within the drip line, tunnel under or around roots by hand digging. Do not cut main lateral roots or tap roods, cut only smaller roots which interfere with installation of new work. Cut roots with sharp pruning instruments. Do no break or chop.

C. Where excavating for new construction is required within drip line of trees, hand excavate to minimize damage to root systems. Provide sheeting at excavations if required. Use narrow tine spading forks and comb soil to expose roots.

1. Relocate roots in backfill areas wherever possible. If large, main lateral roots are encountered, expose beyond excavation limits, as required, to bend and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3" back from new construction.

D. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover, or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.

E. Prune branches to balance loss to root system caused by damage or cutting of root system.

3.3 Grading and Filling Around Trees

A. Maintain existing grade within drip line of trees, unless otherwise indicated.

B. Lowering Grades: Where existing grade is above new finish grade shown around trees, carefully hand excavate within drip line to new finish grade. Cut roots exposed by excavation or provide permanent protections as recommended by Arborist.

1. Prune branches to stimulate root growth and to compensate for loss of roots. Provide subsequent maintenance during the contract period as recommended by Arborist. Provide Owner with typed instructions for recommended long-range maintenance procedures to be followed after completion of construction operations.

C. Raising Grades:

1. Minor Fills: Where existing grade is 6" or less below elevation of finish grade shown, use topsoil fill material specified. Place in single layer and do not compact; hand grade to required finish elevations.

2. Moderate Fills: Where existing grade is more than 6", but less than 12" below finish grade elevation, place a layer of drainage fill on existing grade prior to placing topsoil. Carefully place against trunk of tree approximately 2" above finish grade elevation and extend not less than 18" from tree trunk on all sides. For balance of

area within drip line perimeter, place drainage fill to an elevation 6" below grade and complete fill with a layer of topsoil to finish grade elevation. Do not compact drainage fill or topsoil layers; hand grade to required elevations.

3.4 Repair and Replacement of Trees

A. Repair trees damaged by construction operations. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.

B. Remove and replace dead and damaged trees that are determined by Arborist to be incapable of restoration to normal growth pattern.

1. Provide new trees of same size and species as those being replaced. Plant and maintain as specified under Section "Trees and Shrubs".

C. If trees over 6" in caliper measurement (taken 12" above grade) are required to be replaced, provide new trees of 6" caliper size, and of species selected by the Engineer.

3.5 Disposal

A. Burning on Owner's Property: Burning of removed trees and branches is not permitted on site.

B. Removal from Owner's Property: Remove excess excavation, displaced trees and trimmings, and legally dispose of off Owner's property.

END OF SECTION

SECTION 02140
DEWATERING

PART 1 GENERAL

1.01 Section Includes

A. Requirements for designing, furnishing, installing, maintaining, operating and removal of temporary dewatering systems required to lower and control water levels and hydrostatic pressures during construction.

B. Requirements for disposing of pumped water.

1.02 Definitions

A. Dewatering: Lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; improving the excavating and hauling characteristics of on-site soil; preventing rupture or heaving of the bottom of an excavation; and disposing of pumped water.

1.03 Design Requirements

A. The Contractor is responsible for the adequacy of the dewatering system.

B. Design dewatering systems to:

1. Effectively reduce the hydrostatic pressure and lower the groundwater levels below excavation in soil;

2. Develop a dry and stable subgrade for the protection of subsequent operations;

3. Result in no damage to adjacent buildings, structures, utilities and other work included in this Contract.

C. Methods may include sump pumping, single or multiple stage well point or jet eductor well point systems, deep wells, or combinations thereof.

D. Locate dewatering facilities where they will not interfere with existing utilities, facilities and/or construction work to be done under this Contract.

1.04 Submittals

A. Shop Drawings

1. Submittals submit the following prior to dewatering system installation:

    a. Proposed system components.
    b. Operational plan to include locations and depth of components.
    c. Method of disposal of pumped water.

B. Quality Assurance/Control Submittals

1. In accordance with Section 00700, Article 6 - Submittals submit the following:

    a. Dewatering systems to be designed under the direct supervision of a professional Engineer registered in the state that the work is to be done.
    b. Complete Certificate of Design at the end of this section.
    c. Provide documentation demonstrating ability and experience of installing contractor for the type of conditions under this Contract.
    d. Names, addresses and telephone numbers of supervisory personnel actively involved in at least five successful projects requiring dewatering.

1.05 Project/Site Conditions

A. Environmental Requirements

1. Dispose of all pumped water in accordance with local agencies having jurisdiction and methods as detailed in the Contract.

B. Existing Conditions

1. Groundwater measurements have been made previously and are noted in the boring logs.

2. Groundwater surface is subject to fluctuations during periods of heavy precipitation.

PART II PRODUCTS

Not Used

PART III EXECUTION

3.01 Site Preparation

A. Surface Drainage

1. Construct dikes, ditches, pipe lines, sumps or other means to intercept and divert precipitation and surface water away from excavations.

B. Drainage of Excavated Areas

1. Construct dikes, ditches, pipe lines, sumps or other means to collect surface and seepage water which may enter the excavation.

2. Discharge water through settling basins or method approved by Engineer when water is to be deposited into an existing watercourse.

3.02 Installation

A. Advise Engineer of changes made to operational plan as submitted under Article 1.04 of this section, made to accommodate field conditions.

3.03 Monitoring

A. Observe and record daily the elevation of the groundwater during the length of the dewatering operation and provide data to Engineer on daily basis.

3.04 Operation

A. Operate dewatering systems to lower the groundwater level in excavations allowing all subsequent work to be done on a stable dry subgrade.

B. Modify dewatering procedures that cause, or threaten to cause, damage to new or existing facilities, to prevent further damage. Modifications shall be made at no additional expense to the Owner.

C. Maintain the water level a minimum of 2 feet below subgrade or at lower elevation to eliminate hydrostatic pressure on structures.

D. Prevent disturbance of foundation soils and loss of ground as water is removed.

E. Notify the Engineer of disturbance to the foundation soils caused by an interruption or inadequacy of the dewatering system.

F. Maintain on site, auxiliary equipment to operate the dewatering system continuously while excavations are opened below elevation of final grade.

3.05 Disposal of Water

A. Discharge water into a silt separator to eliminate any deposition of fines and or silt onto existing roadways or into existing drains.

B. Discharge water in a manner that will not cause erosion, flooding, damage to existing facilities, completed Work or adjacent property, improved or otherwise.

3.6 Removal

A. Remove all material and equipment from the site upon completion of dewatering operations.

B. Seal all dewatering wells upon completion of the dewatering by pressure injecting a grout capable of sealing the wells and preventing leakage.

END OF SECTION

SECTION 02205
SOIL MATERIALS

PART I GENERAL

1.01 Summary

A. Section Includes

1. Subsoil and topsoil materials.

B. Related Sections

1. Section 01410 - Testing Laboratory Services
2. Section 02220 - Earth Excavation, Backfill, and Compaction.
3. Section 02215 - Aggregate Materials.

1.02 References

A. ANSI/ASTM DI 557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 1b (4.54 Kg) Rammer and 18" (457 mm) Drop.

B. ASTM D2487 - Classification of Soils for Engineering Purposes.

PART II PRODUCTS

2.01 Soil Materials

A. Borrow or Excavated Material

1. All material, whether from the excavations or from borrow, shall be of such nature that after it has been placed and properly compacted, it will make a dense, stable fill. It shall not contain vegetation, masses of roots, individual roots, stones over 6" in diameter, or porous matter. Organic matter shall not exceed minor quantities and shall be well distributed.

B. Impermeable Earth Fill

1. As indicated on the Drawings, earth fill shall be constructed of selected, natural, inorganic, impermeable, suitably fine material. The source of the supply shall be at the option of the Contractor with the acceptance of the Engineer. The material shall be an impervious soil principally of clay.

2. The soil shall have 100 percent of the material finer than a No. 4 sieve and at least 50% finer than a No. 200 mesh sieve. When classified according to the United Soil

Classification System (ASTM D2487, Classification of Soils for Engineering Purposes) the soil shall have a Designation of CL. Twenty-pound samples of the proposed fill shall be submitted to the Engineer at least three weeks prior to its intended use.

PART III EXECUTION

A. Borrow or Excavated Material

1. Approved materials available from the excavations and not required for backfill around pipes or against structures may be used for filling and building embankments, except as otherwise specified. Material needed in addition to that available from construction operations shall be obtained from suitable gravel banks or other suitable deposits.

B. Impermeable Earth Fill

1. Just prior to placing of a new layer of impermeable material, the surface of the preceding layer shall be scarified to a depth of 2" with suitable equipment so that an effective bond will be obtained between layers.

2. The material shall be evenly and uniformly spread in layers as nearly as practicable to 7 inches in uncompacted thickness. Joints and laps in or between layers shall be carefully made so as to ensure the continuity of each layer in all directions. Each layer shall be thoroughly compacted to the extent required before a new layer is placed.

3. All layers shall be compacted to at least 90%. The moisture content during compaction shall be within ± 2% of optimum moisture content.

4. The compaction shall be accomplished by tamping as specified in Section 02220 Excavation, Backfill and Compaction for Utilities and the method shall be acceptable to the Engineer. The Contractor may use a different method, provided it achieves the required compaction and provided also that it is acceptable to the Engineer.

END OF SECTION

SECTION 02215
AGGREGATE MATERIALS

PART I GENERAL

1.01 Summary

A. Section Includes

1. Requirements for furnishing and placing materials which include Crushed Stone, Bank Gravel, Gravel Borrow Base Course, Common Borrow and Select Borrow.

2. Location of specified materials as detailed on the Drawings or as directed by the Engineer for excavation below normal depth, utility support, replacement of unsuitable material or elsewhere, as ordered.

B. Related Sections

1. Section 02220 - Excavation, Backfill and Compaction for Utilities

1.02 References

A. American Association of State Highway and Transportation Officials (AASHTO).

1. Tl 1-85, Amount of Material Finer than 0.075 mm Sieve in Aggregate.

2. T27-84, Sieve Analysis of Fine and Coarse Aggregates.

B. American Society for Testing and Materials (ASTM).

1. D 1557-91, Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10-1b (4.54-kg) Rammer and 18-in. (475-mm) Drop.

C. Standard Specification for Road and Bridge Construction of the Rhode Island Department of Transportation, amended December 2010, together with all erratic, addenda, additional revisions and supplemental specifications, all of which are hereinafter referred to as the Rhode Island Standard Specifications.

1. D 1557-91, Test Method for Moisture Density Relations of Soils and Soil

1.03 Submittals

A. Shop Drawings

1. Provide sieve analysis when gradation requirements are given in the Specification.

B. Sample

1. Furnish representative sample including location of source with Shop Drawing transmittal sheet.

1.04 Quality Assurance

A. Field Samples

1. The attention of the Contractor is directed to the fact that under Specification Section 00700, Articles 38 and 39, all materials furnished by the Contractor to be incorporated into the work shall be subject to the inspection of the Engineer. The Engineer shall be the sole judge as to the acceptability of proposed materials and said judgement shall be final, conclusive, and binding.

1.05 Delivery, Storage and Handling

A. Storage and Protection

1. The Contractor shall be responsible for taking all necessary precautions to store and protect all materials and equipment brought to the site for use on the project. This includes, but is not limited to, protecting materials from weather and theft.

PART II PRODUCTS

2.01 Materials

A. Bank Gravel

1. Granular material well graded from fine to coarse with a maximum size of 6", obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.

2. Gravel shall not contain vegetation, masses of roots, or individual roots.

3. Gravel shall be substantially free from loam and other organic matter, clay and other fine or harmful substances.

4. Gradation requirements for gravel shall be determined by AASHTO-TI 1 and T27 and conform to the following:

Sieve	% Passing
1/2”	60 – 95%
No. 4	50 – 85%
No 50	8 – 28%
No 200	0 – 8%

B. Crushed Stone

1. Well graded in size from 3/8” to 3/4” or such other sizes as may be approved.

2. Clean, hard, and durable particles or fragments, free from dirt, vegetation, or other objectionable matter, and free from an excess of soft, thin elongated, laminated or disintegrated pieces.

3. Screened stone of suitable size and grading may be used instead of crushed stone.

4. The specifications shall apply whichever material is used. See Section M-01 of the Rhode Island Standard Specifications.

C. Gravel Borrow Base Course

1. Materials and methods of placing gravel borrow base course shall conform to the requirements of Section 301 of the Rhode Island Standard Specifications.

2. All material used for bedding for water pipes, sidewalks, driveways, and for gravel roadway subbase shall conform to Section M-01 of the Rhode Island Standard Specifications.

3. All materials used for the bedding of electrical conduit shall conform to the requirements of Section M-01 of the Rhode Island Standard Specifications.

D. Common Borrow

1. Materials and methods of placing common borrow shall conform to the requirements of Section 202 of the Rhode Island Standard Specifications.

E. Sand Borrow

1. Materials for sand borrow shall conform to the requirements of Section M-01 of the Rhode Island Standard Specifications.

2.02 Source Quality Control

A. Test, Inspection

1. The Engineer may elect to sample material supplied at the source.

2. Assist the Engineer and/or personnel from the designated testing laboratory in obtaining samples

PART III EXECUTION

3.01 Installation

A. Bank Gravel

1. Spread in layers of uniform thickness not exceeding 8 inches before compaction and moistened or allowed to dry as directed.

2. Compact thoroughly by means of suitable power-driven tampers or other power driven equipment.

3. Compaction shall conform to 95 percent of minimum dry density per ASTM D 1557.

4. The percolation rate for the compacted bank-run gravel shall not exceed 5 minutes per inch.

B. Crushed Stone

1. Spread in layers of uniform thickness not greater than 6”.

2. Compact thoroughly by means of a suitable vibrator or mechanical tamper.

3.02 Field Quality Control

A. Site Tests

1. In accordance with Section 01410.

3.03 Gravel Borrow Base Course Placement

A. Prior to placing pavement, all backfill shall have been properly compacted as specified under Section 02220 to eliminate settling of backfill. No pavement shall be placed over poorly compacted backfill. Backfill and base course shall be compacted, brought to the proper elevation, and dressed so that new pavement construction shall be at the required

grade. The Contractor shall maintain the surfaces of all excavated and disturbed areas until the pavement is placed. If there is a time lapse of more than 24 hours between the completion of preparation of subgrade or placing of gravel borrow base course and placing of paving, or if subgrade of gravel borrow base course has been eroded or disturbed by traffic, the subgrade or base course shall be restored before placing paving.

B. The Contractor shall remove and stockpile of all surplus material and remove and acceptably dispose of all unsuitable material.

C. Before permanent paving is installed, the base shall be brought up to grade, and temporary pavement and excess gravel shall be removed.

3.04 Tolerances

A. See Rhode Island Standard Specifications

3.05 Schedules

A. Gravel Borrow Base Course: Materials and methods of placing gravel borrow base course shall conform to the requirements of the Rhode Island Standard Specifications. Thicknesses shall conform to the details on the plans.

END OF SECTION

SECTION 02220
EXCAVATING, BACKFILLING AND COMPACTION FOR UTILITIES AND STRUCTURES

PART I GENERAL

1.01 Description

A. Work Included: Excavating, trenching, backfilling and compacting for structural slabs, underground structures, buried pipe and utilities.

B. Related Work: The following is a list of related work items that shall be performed or provided under other sections of these specifications.

1. Division 3 - Concrete
2. Section 02076 - Removal and Disposal or Surplus, Unstable and Unsuitable Materials
3. Section 02110 - Clearing of Site
4. Section 15050 - Mechanical, Basis Materials and Methods

1.02 Reference Standards

A. Comply with the provisions of the following except as otherwise indicated.

1. Associated General Contractors of America, Inc. (AGCA) "Manual of Accident Prevention in Construction."

2. Occupational Safety and Health Administration, United States Department of Labor Requirements.

3. ANSI "Safety Requirements for Construction and Demolition."

4. American Society for Testing and Materials (ASTM).

5. National Clay Pipe Institute, Clay Pipe Engineering Manual.

1.03 Law and Regulations

A. All work shall be accomplished in accordance with regulations of local, county and state agencies and national or utility company standard as they apply.

1.04 Site Investigation

A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling, and storage of materials, availability of labor,

water, electric power, similar physical conditions at the site, the confirmation and subsurface materials to be encountered, the character of equipment and facilities needed prior to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with all available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work.

B. Subsurface Information

1. Preliminary subsurface investigations shall be made by the Contractor prior to commencement of construction. The results shall be reviewed by Engineer prior to initiation of the work. This does not relieve the Contractor from performing any investigations which said Contractor deems necessary to fully understand the subsurface conditions on this site.

2. Neither the Owner nor the Engineer assumes any responsibility for the Contractor's failure to make his own site investigation.

3. Data on subsurface conditions are not intended as representations or warrants of continuity of such condition. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn by the Contractor. Test pits and other exploratory operations may be made by Contractor at no cost to the Owner.

C. Existing Utilities

1. The Contractor shall locate all existing underground utilities in the areas of work. If utilities are to remain in place, the Contractor shall provide adequate means of protection during earthwork operations.

2. Should piping systems not shown on the plans or incorrectly located piping or other utilities be encountered during excavation, the Contractor shall consult the Owner and Engineer immediately for directions as to procedure. The Contractor shall cooperate with Owner in keeping respective services and facilities in operation.

3. Do not interrupt existing utilities and drains serving facilities occupied and used by the Owner except when permitted in writing. (See Section 02070).

PART II PRODUCTS

2.01 Materials

A. Pipe Bedding:

1. Pipe bedding shall conform to ASTM Designation D448, "Standard Sizes of Coarse Aggregate for Highway Construction", Size #67. This material shall meet the following sieve analysis.

100%	passing 1" sieve (25.0 mm)
99-100%	passing 3/4" sieve (19.0 mm)
25-55%	passing 3/8" sieve (9.5 mm)
0-10%	passing #4 sieve (4.8 mm)
0-5%	passing #8 sieve (2.4 mm)

2. Pipe bedding shall be a minimum of six (6) inches below the pipe, and shall extend up to the spring line.

B. Backfill Material – Piping: Backfill material from the pipe spring line to the underside of the slab shall be compacted, granular material conforming to the following gradation as determined by ASTM standard test C-136.

100%	passing 3/4" sieve
30-95%	passing #10 sieve
10-70%	passing #40 sieve
0-15%	passing #200 sieve

C. Structural Bedding: Engineered fill underneath concrete slabs shall consist of granular soil, free of organic materials, conforming to the following gradation limits:

Maximum Particle Size:	3"
Maximum Retained on 3/4" Sieve:	30%
Maximum Passing #100 Sieve:	45%
Maximum Passing #200 Sieve:	8%

D. Drainage fill underneath concrete slabs-on-grade shall consist of washed, narrowly graded crushed stone or crushed or uncrushed gravel; conforming to ASTM D 448; coarse aggregate grading Size 57, with 100% passing a 1.5" (3.8 mm) sieve, and 0 to 5% passing a No. 8 (2.3 mm) sieve.

PART III EXECUTION

3.01 Grades, Elevations and Locations

A. If during construction, insurmountable obstructions are encountered, the

Engineer will direct the Contractor as to what deviations may be made to avoid the obstruction and still fulfill the requirements of the improvement. The Contractor shall proceed with the work as directed at no additional expense, except where deviation from the indicated location will require removal and restoration of surface and subsurface improvements or obstructions by an amount in excess of the amount required at the indicated location, in which case the Contractor may request additional compensation as provided in the General Conditions.

B. The location of existing subsurface utilities and other improvements indicated on the Drawings are given for the convenience of the Contractor but are not guaranteed to be complete or exact in any instance. This information shall, in no case, relieve the Contractor of responsibility for the full protection or restoration of subsurface improvements.

C. Obtain information from the proper authorities concerning locations of all utilities within the scope of this work in order to avoid damage to such utilities. Neither the Owner nor the Engineer will be responsible for any such damage. Restore any structure and repair any resultant damage without additional compensation.

1. Rules and regulations governing the respective utilities shall be observed. Active utilities shall be adequately protected from damage and shall not be removed or relocated except as indicated or directed. Inactive and abandoned utilities encountered in excavation and grading operations shall be removed, plugged or capped, as directed. The locations of such abandoned utilities shall be reported in writing to the Owner.

2. Special attention is directed to the fact that live electric, telephone, gas, water and sewer, storm water utility lines and services exist within the area of the work.

3.02 Excavation

A. Prior to commencing excavation, the Contractor shall excavate test pits at all locations where utility lines have been identified or are believed to be in the area of the work. The elevation and size of the existing utility shall be obtained in order to confirm that there is no conflict between the utility systems and the new work. This information must be furnished to the Owner and Engineer prior to initiating installation of the new work.

B. Except where otherwise indicated on the Drawings or specified, excavations shall be open cut, to sufficient widths for the proper performance and installation of the work with sufficient space for shoring and bracing where required. The Contractor shall provide sheeting and shoring and shall execute all work in conformance with OSHA requirements.

C. Trenching for Pipeline Installation:

1. For pipes that are to be laid on grade, the trench shall be excavated accurately to the specified alignment, both horizontally and vertically. For pipe not to be on any particular grade, the trench shall be excavated to achieve the specified minimum depth of cover and the horizontal alignment without causing unacceptable pipe bending or joint deflections. Pipe not to be on a grade must have a minimum of 42" of cover over the pipe, unless otherwise specified, from the finished ground level to the top outside of the pipe barrel.

    a. For each section of pipe, the trench shall be excavated to the depth required on the Drawings, and the bedding evaluated. If the bedding is determined to be acceptable, bell holes shall then be accurately excavated and the trench bottom smoothed so that a continuous and uniform bearing surface is provided for the pipe,

    b. If the bedding is determined to have stones, protruding rocks, or other unsuitable substances which would possibly damage the pipe, especially where flexible pipe is used, then the trench shall be excavated six inches deeper than the specified elevations, and stone shall be evenly filled back in the trench and compacted to serve as a bedding at least four inches under the pipe barrel. Bell holes shall then be accurately excavated and the trench bottom smoothed so that a continuous and uniform bearing surface is provided for the pipe.

2. The Contractor may, at his option, shape the trench bottom or over excavate and provide granular bedding.

    a. If the Contractor shapes the trench bottom, he shall grade the bottom to a line and shape so that the pipe will have bearing for full length with a minimum of 6" of bedding. Provide bell holes for each joint of bell and spigot pipe. If in shaping the trench bottom, the Contractor overcuts the bottom, he shall provide granular bedding as specified in Paragraph 2.01-A-1 of this Section of the Specifications.

    b. Removal of unsuitable materials shall be in accordance with Section 02076 of this Specification.

D. Excavation dimensions shall be sufficient to permit proper installation of the work, and bottoms of excavations shall be as indicated. Excavations below required depths shall be refilled with bedding gravel as specified in Paragraph 2.01-A-1 and compacted. Immediately after excavations have been carried to the required grades, the exposed surface of the existing bottom shall be cleaned of all loose disturbed materials.

E. In all areas of excavation in clay or clayey silt and/or in areas where the excavated sub-grade is at or below the groundwater table, the area shall be over-excavated an additional 10 inches and replaced with a layer of well graded sand and gravel.

F. Furnish all pumping and other dewatering equipment necessary to keep excavated areas dry during construction. Water shall not be conveyed into the existing utility piping systems.

G. Excavation of earth or rock beyond indicated or authorized limits shall be refilled at no additional expense to the Owner with gravel compacted to 95% of the maximum dry density at optimum moisture content or crushed stone.

H. Excavations shall be adequately sheeted, shored and braced to permit proper execution of the work, to prevent cave-ins or settlement and to protect work persons, adjacent structures and utilities. Shoring and piling may be removed as the backfilling progresses, but only when sides are safe against caving.

I. All excavation shall be dewatered properly before installing structural fill, formwork, reinforcing steel, concrete or piping. Where running sand is encountered, dewatering shall be done by well pointing whenever possible. Where soil conditions are not favorable for use of well pointing, underdrains using ½" and smaller gravel shall be constructed to suitably located sumps, and the water removed by bailing or pumping.

3.03 Structural Fill

A. Under slabs-on-grade place the drainage course on prepared subgrade including the following:

1. Compact the drainage course to required cross sections and thickness to not less than 95% of maximum dry unit weight in accordance with ASTM D 698.

2. When the compacted thickness of the drainage course is 6" or less, place the materials in a single layer.

3. When the compacted thickness of the drainage course is greater than 6", place the materials in equal layers, with no layer more than 6" thick or less than 3" thick when compacted.

3.04 Pipe Bedding

A. The pipe bedding shall conform to Class B, as designated by NCPI Clay Pipe Engineering Manual.

1. The pipe barrel shall be uniformly supported by direct contact with the bedding material. Shovel slicing the bedding material into the haunch areas of the pipe shall be done prior to bringing the bedding material up to the pipe

spring line.

2. Bell or coupling holes shall be carefully excavated at each joint. No part of the load shall be supported by the bell or pipe coupling.

3. Bedding shall be a minimum 6” thickness below the pipe.

4. Bedding material shall be placed up to the spring line of the pipe.

5. Bedding material shall be compacted to 95% maximum density, determined in accordance with ASSHTO T99 Method C.

3.05 Backfill and Compaction

A. Granular graded backfill in accordance with Paragraph 2.01 of this specification shall be placed from the pipe spring line to an elevation 12" above the top of the pipe. This backfill shall be placed as soon as possible following pipe bedding to maintain proper alignment and to protect the pipe. Backfill shall be compacted to a minimum 95% maximum density. Unsuitable bearing materials including topsoil, fill, and organic soils shall be excavated to firm, natural ground in areas of new foundations and new slabs on grade followed by placement of compacted gravel fill as specified. Where rock is encountered it shall be excavated to 1-foot below bottom and replaced with a 1-foot layer of compacted gravel. No blasting shall occur.

B. Final Backfill

1. Final backfill shall extend from 12 inches above the pipe to the upper limit of the excavation or new final grade. Unless otherwise noted on the Drawings final backfill shall conform to Paragraph 2.01-B-2 of this specification section.

2. Backfill requirements shall conform to 3.04 A and B of this specification section unless jobsite conditions as identified on the Drawings or as determined in the field indicate otherwise.

C. Placing Backfill

1. On-site excavated materials may only be reused if the soil satisfies the gradations specified under Part 2 of this specification section for each particular location of use. All other materials are considered unsuitable and must be disposed of in accordance with Section 02076 of this specification.

2. Fill materials shall be placed in a 6” maximum lift thickness measured prior to compaction when compacted by hand-guided vibratory compaction equipment and in a 10” maximum lift thickness measured prior to compaction when compacted by hand operated vibratory compaction equipment. The maximum size material in lifts of compacted fill shall be limited to two-thirds the loose lift thickness.

In addition, fill should be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D1557. At the time of fill placement and during compaction, fill materials should be completely free of frozen material.

3. Placement and compaction of fills shall be conducted in-the-dry, on dry, compacted and approved stable sub-grades. No layer of fill should be placed until the underlying materials have been observed and judged to be in conformance with the contract documents. Field density tests to determine the actual in-place densities being attained shall be made at the Contractor's expense. Costs for density tests which fail to meet requirements shall be paid for by the Contractor.

3.06 Excess and Borrow Material

A. Excess material not needed for backfill, and material unsuitable for backfill, shall be removed from the site and disposed of off site in a manner acceptable to the Owner. Additional backfill material as required to make-up deficiency, or to replace unsuitable excavated material shall be furnished by the Contractor at approved unit costs.

3.07 Maintaining Surface

A. Whenever the trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off, and finally made to conform to the surface of the ground or specified grade. Backfilling shall be carefully performed, and the original surface or proposes grade shall be restored to the full satisfaction of the Owner.

B. The Contractor shall maintain the surface of the pipeline construction to the original ground surface or finished grade until accepted by the Owner. The job site shall be left in a neat and orderly condition to the satisfaction of the Owner.

3.08 Clean Up

A. As excavation is completed, the Contractor shall promptly clean up the entire area of all surplus earth, stone, debris, and other materials. If the Contractor fails or neglects to do so, or fails to make satisfactory progress within 24-hours of receipt of written notice from the Owner, the Owner may remove such debris and surplus material.

B. Cost of all said work performed by the Owner shall be charged to the Contractor and deducted from any monies due or to become due him under the Contract. Any earth, sand, or other material found in a pipeline before final acceptance shall be removed by the Contractor at his expense. Upon completion of the Installation of the pipeline, all debris and surplus materials resulting from the work shall be removed and the work site left in a condition satisfactory to the Owner.

END OF SECTION

SECTION 02270
SOIL EROSION AND SEDIMENTATION CONTROLS

PART I GENERAL

1.01 Related Documents

A. Drawings and General Provisions of Contract, including General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.02 Description of Work

A. Furnish and install temporary control measures as needed during the progress of the work or as ordered by the Engineer during the life of the contract to control water pollution through use of mulches, grasses, hay bale check dams, netting, fiber mats, silt fences, brush and baled hay checks, siltsacks and other erosion control devices and methods.

B. The Contractor is responsible for compliance with the rules and regulations governing the enforcement of the Rhode Island Freshwater Wetlands Act.

1.03 Submittals

A. Submittals listing proposed materials including manufacturer's product data and test reports verifying conformance with design guidelines shall also be provided.

PART II PRODUCTS

2.01 Materials

A. Mulches: Mulches may be hay, straw, fiber mats, netting, wood cellulose, corn or tobacco stalks, bark, corn cobs, wood chips, stump grindings or other suitable material and shall be reasonably clean and free of noxious weeds and deleterious materials.

B. Silt Fence: Silt fence shall be Enviro Fence by Mirafi, Propex Silt Stop manufactured by Amoco Fabrics Company, Tensar 1, Tensar 2, or equal.

C. Baled Hay Erosion Check: The baled hay shall be approximately 36"x 18"x 24".

D. Grass: Grass shall be a quick growing species suitable to the area providing a temporary cover which will not later compete with the grasses sown later for permanent cover.

E. Fertilizer and Soil Conditioners: Standard commercial grade as reviewed by the Engineer

F. Stone: 12" to 18" diameter in size.

G. Hay and Straw: Hay and straw for mulch shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. No salt hay shall be used. This mulch shall be used to stabilize slopes and assist in maintaining soil temperature during seed germination. Straw or hay mulch must be anchored immediately after spreading to prevent blowing. The following methods of anchoring straw or hay may be used:

1. Mulch Anchoring Tool: A tractor-drawn implement designed to punch mulch into the soil surface, limited to use on slopes no steeper than 3' horizontally to 1' vertically. Machinery shall be operated on the contour.

2. Mulch Netting: Install in accordance with manufacturer's recommendations.

3. Liquid Mulch Binders: Application of liquid mulch binders and tackifiers should be heaviest at edges of areas and at crests of ridges and banks to prevent windblowing. Mulch binders should be applied uniformly. Binders may be applied after mulch is spread or may be sprayed into the mulch uniformly as it is being blown onto the soil. Applying straw and binder together is the most effective method.

4. Chemical binders such as petroset, terratack, hydro mulch and aerospray may be used as recommended by the manufacturer to anchor mulch.

H. Hay Bales: Hay bales shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. Hay bales shall be approximately 36" long x 18" wide x 24" high. Bales shall be anchored with 2" x 2" x 3' long wooden stakes.

1. Siltsack: Siltsack shall be manufactured from a specially designed woven polypropylene geotextile and sewn by a double needle machine, using a high nylon thread.

   Siltsack will be manufactured to fit the opening of the catch basin or drop inlet. Siltsack will have the following features: two dump straps attached at the bottom to facilitate the emptying of Siltsack; Siltsack shall have lifting loops as an integral part of the system to be used to lift Siltsack from the basin; Siltsack shall have a restraint cord approximately halfway up the sack to keep the sides away from the catch basin walls, this yellow cord is also a visual means of indicating when the sack should be emptied. Once the cord is covered with sediment, Siltsack shall be emptied, cleaned and placed back into the catch basin.

PART III EXECUTION

3.01 Preparation

A. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other water courses, lakes, ponds or other areas of water impoundment. Such work may involve the use of temporary mulches, mats, seeding, check dams or other control devices or methods as necessary to control erosion. Cut slopes shall be seeded and mulched as the excavation proceeds, to the extent considered desirable and practicable.

B. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time. Temporary pollution control measures will be used to correct conditions that develop during construction, that were not foreseen during the design stage, that are needed prior to installation of permanent pollution control features, or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project, at no additional cost to the Owner.

C. Where erosion has been identified during the pre-construction meeting, or has been identified during construction as being a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time, by stripping of topsoil, exceed five (5) acres without review by the Engineer.

D. Contractor shall have on-site all necessary hay bales, silt fence, rip-rap, and storm drainage piping etc., prior to undertaking any work that may cause erosion.

E. The Engineer will limit the area of excavation, borrow and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible, justified and indicated on plans at no additional costs to Owner.

F. If overland waterflow becomes a problem in the construction progress then the Contractor shall take it upon himself to construct any and all ditches, temporary roads, fills and pipe culverts as necessary to alleviate a water problem which may affect progress of work. This work shall be pre-formed at no additional expense to the Owner.

G. Under no circumstances shall the amount of surface area of erodible earth material exposed at one time by excavation, borrow or fill within the right-of-way exceed five (5) acres without prior review by the Engineer.

H. The Engineer may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

I. In the event of conflict between these requirements and pollution control laws, rules and regulations of the federal, state or local agencies, the more restrictive laws, rules, or regulations shall apply.

1. The blanket shall be held in place by means of staples driven vertically into the soil. Staples shall be spaced approximately two lineal yards apart, on each side, and one row in the center alternately spaced between each side (60 staples for each blanket). Use a common row of staples on adjoining blankets. In areas of high-water velocity, as determined by the Engineer, staples shall be installed on two-foot centers.

2. The Contractor shall maintain the excelsior blanketed areas until all work on the entire contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire or other causes. Such areas shall be repaired to re-establish the condition and grade of the soil prior to application of replacement matting and shall be re-fertilized and reseeded as specified.

J. Silt Fence and Hay Bales:

1. Unless directed otherwise, or as specified on plans, silt fences and hay bales shall be placed at the following locations:

   a. A siltation fence shall be installed along all downslope site boundaries to provide a perimeter defense against overland flow. The fence will be installed prior to commencing with any other earthwork.
   b. Siltation fences shall be placed within 100 feet of wetland areas or as indicated on the plans.

2. Installation shall be per manufacturer's instructions and as shown on plans.

3.02 Installation Location of Bales Hay and Silt Fences

A. During the construction phase, baled hay will be placed and maintained around all catch basins, unless indicated otherwise. Silt fences will be installed prior to clearing and grubbing. Silt and debris will be removed from catch basins and base of silt fences at end of construction.

3.03 Construction Entrances

A. Stabilized construction entrances shall be installed at all points of access to reduce or eliminate tracking or flowing of sediment onto the town road in accordance with the following criteria:

1. Provide 1 to 2-1/2” crushed stone, min. 8" thick.

2. Construction entrance shall be as wide or wider than all points of ingress and egress.

3.04 Temporary Seeding

A. Hydroseeding shall be applied to stabilize the soils and reduce sediment losses. Mulch anchoring shall be applied as needed or as directed by the Engineer.

1. Temporary cover by hydroseeding application shall conform to the following:
   Quantity per 1000 sq. ft. Material Coverage.
   27-1/2 lbs. Wood fiber mulch
   4 lbs. Seed
   1/2 lb. Annual Ryegrass
   22 lbs. 10-6-4 Fertilizer
   69 gal. Water

2. Wood fiber mulch and seed etc., shall conform to the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, Section M. 18.07.

3. Permanent cover by hydroseeding application shall conform as specified by the Engineer.

4. All exposed soil areas to be planted shall be hydroseeded (with temporary or permanent cover) within 48 hours after achieving final grade.

5. Seeding made on critical areas exceeding 2 on 1 slopes shall be anchored if necessary, with mulch netting such as jute, paper, plastic and cotton nettings.

6. Areas to remain exposed at times other than optimum seeding dates shall be stabilized with any of the following:

   a. Straw, 1 to 2 tons/acre or 70 to 90 lbs./ 1000 sq. ft. (no Canada thistle, Johnsongrass and quackgrass allowed).
   b. Wood-fiber or paper-fiber, 1500 lbs./acre or 35 lbs./ 1000 sq. ft. (use limited to less than 3% and less than 150-foot length of slope, and during spring and fall.

c. Mulch netting such as jute, paper, plastic and cotton nettings may be used where erosion is less severe.
d. Wood chips 6 tons/acre or 275 lbs./ 1000 sq. ft.

3.05 Siltsacks

A. To install Siltsack in the catch basin, remove the grate and place the sack in the opening. Hold approximately six inches of sack outside the frame. This is the area of the lifting straps. Replace the grate to hold the sack in place.

B. With the restraint cord is no longer visible, Siltsack is full and shall be emptied.

C. To remove siltsack, place unit where the contents will be collected. Place the rebar through the lift straps and lift the Siltsack from the bottom and empty the contents. Clean out and rinse. Legally dispose of sediment. Return Siltsack to its original shape and place back into the basin.

3.06 Special Instructions

A. Silt fence shall be inspected during storm events, after each rainfall of one-inch magnitude or greater, prior to weekends, and prior to any forecasted storm events. Weekly inspection reports by the Contractor shall be submitted to the Engineer by the Contractor.

B. Damage to silt fence shall be repaired immediately upon discovery and not more than 4 hours from time of observed damage.

C. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.

D. It is the Contractor's responsibility to maintain the placement of hay bales and silt fences, remove silt from ditches and culverts and to repair any erosion of ditches and slopes.

E. In case of repeated failures on the part of the Contractor to control erosion, pollution, and/or siltation, the Engineer reserves the right to employ outside assistance or to use his own forces to provide the necessary corrective measures. Such incurred direct cost plus project engineering costs will be charged to the Contractor and appropriate deductions made from the Contractor's monthly progress payment.

F. Any erosion, siltation or general damage resulting from neglect by the Contractor to undertake temporary and permanent erosion control measures as required or directed shall result in the responsibility of the Contractor to correct the areas as determined by Engineer.

G. Contractor shall also be required to install and maintain temporary erosion control measures within a time frame agreeable to the Engineer.

H. Temporary pollution control may include construction work outside the project limits where such work is necessary as a result of utility installations and equipment storage sites.

I. The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor.

END OF SECTION

SECTION 02480
PLANTING AND SEEDING

PART I GENERAL

1.01 Work Included

A. This scope includes furnishing all labor, materials, equipment and performing all operations necessary to complete the planting and seeding in accordance with this Specification, in areas disturbed by construction that are not to be paved or have building, sidewalks, or structures over them, including spoil areas.

1.02 Related Work

A. Section 02220 - Excavating, Backfilling and Compaction for Utilities and Structures

PART II PRODUCTS

2.01 Materials

A. Fertilizer for seeded areas shall be Grade 10-10-10 complete fertilizer of uniform composition, free flowing for application with approved equipment, delivered to the site in bags or other containers, each fully labeled, conforming to local fertilizer laws, and bearing the name and warranty of the producer.

B. Lime shall be agricultural grade, ground limestone. Ground limestone shall contain not less the 88 percent of calcium carbonate equivalent and shall be of such a fineness that 90 percent will pass through a No. 10 sieve and not less than 50 percent through a No. 50 sieve.

C. Seed shall be a mixture as described in Paragraph 3.4 or an equal approved by the Engineers and shall meet the requirements of the Seed Laws for the State of Rhode Island and the U.S. Department of Agriculture Rules and Regulations under the Federal Seed act in effect on the date bids are received. Seed shall be delivered in standard containers. Seed that has become wet, moldy, or damaged in transit or storage will not be acceptable.

D. Mulch shall be straw mulch material, hay mulch material, or wood products mulch material. Straw shall be stalks of wheat, rye, oats, or other approved grain. Hay shall consist of timothy, peavine, alfalfa, or other grasses from approved sources. Wood products mulch shall consist of bark chips and wood fiber four to six inches in length manufactured particularly for use with hydroseeding equipment. These materials shall be reasonably dry before use.

PART III EXECUTION

3.01 Application

A. In areas to be seeded, fertilizer and lime shall be distributed uniformly at a rate of 1,000 pounds per acre for fertilizer and 2,000 pounds per acre for lime and shall be incorporated into the soil to a depth of at least 2 inches by discing and harrowing. The incorporation of the fertilizer may be part of the tillage operation specified above. Distribution by means of an approved seed drill or hydroseeder equipment to sow seed and distribute lime and fertilizer will be acceptable.

B. Seed shall be sown within 24 hours following the application of fertilizer and lime and preparation of the seed bed as specified above. Seed shall be uniformly sown at the rates specified below by use of approved mechanical seed drills, rotary hand seeders, power sprayers, and other satisfactory equipment. Immediately after the fertilizing, liming and seeding have been completed, the entire area shall be compacted by means of a culti-packer, roller or approved equipment weighing approximately 90 pounds per linear foot of roller. If the soil is such that a smooth roller or corrugated roller cannot be operated satisfactorily, a pneumatic roller (not wobble-wheel) will be required. The pneumatic roller shall have tires of sufficient size so that complete coverage of the soil surface is obtained. When a culti-packer or similar equipment is used, the final rolling shall be at right angles to the existing slopes to prevent water erosion.

C. Within 24 hours following covering of the seed, mulch and emulsified asphalt shall be uniformly applied to the planted areas. Mulch shall be applied at a rate of 2 tons per acre and emulsified asphalt shall be applied at 145-290 gallons per acre. The mulch and emulsified asphalt shall be applied with a power-driven spreader or blower equipment with the asphalt being injected into the as the mulch leaves the spreader. The mulch shall allow sunlight to penetrate and air to circulate but also partially shade the ground and conserve soil moisture. The exact amount of emulsified asphalt shall be determined in the field and shall be the amount necessary to bond together as mulch particles without giving a heavy coating of the asphalt material and shall prevent wind erosion.

D. On slopes of 3 horizontal to 1 vertical or steeper the seeded area shall be covered with "Curlex" blankets manufactured by American Excelsior Company or approved equal instead of the mulch and asphalt specified above. Fiber mats shall be installed per the manufacturer's written instructions and securely pinned to the ground to prevent displacement by the wind.

3.02 Maintenance

A. The Contractor shall be responsible for obtaining a satisfactory stand of grass as determined by the Owner. The period of establishment shall extend for a period of one month after completion of planting.

B. Areas that require re-fertilization, re-liming, re-seeding and re-sodding will be designated be the Engineers. When any portion of surface becomes gullied or otherwise damaged following seeding, or seedling have been winter-killed or otherwise destroyed, the affected portion shall be repaired to re-establish the condition and grade of the soil prior to seeding and shall be re-seeded as specified above.

3.03 Watering

A. Watering will be required if the planting is done when the ground is excessively dry. Water shall be applied immediately after final compaction. Watering shall be at the rate of 15,000 gallons per acre. The Contractor shall provide satisfactory means for even distribution of water at the specified rate, and in a manner that will prevent erosion due to application of excessive quantities. The watering equipment shall be of a type to prevent damage to finish surface.

B. When any portion of the surface becomes gullied or otherwise damaged after planting and before acceptance, the affected portion shall be repaired to re-establish the condition and grade of the soil prior to injury and re-planted at the Contractor's expense.

END OF SECTION

SECTION 02510
BITUMINOUS CONCRETE PAVING

PART I - GENERAL

1.01 Summary

A. Section Includes

1. Class I bituminous concrete surface course.

2. Class I bituminous binder course.

3. Class I bituminous concrete base course.

B. Related Sections

1. Section 01410 - Testing Laboratory Services

2. Section 02200 - Earth Excavation, Backfill and Grading.

3. Section 02215 - Aggregate Materials.

4. Section 02511 - Hot Poured Rubberized Sealer.

1.02 References

A. Materials and construction methods shall conform, insofar as applicable, to the requirements of the Standard Specifications for Road and Bridge Construction of the Rhode Island Department of Transportation, dated 2004, together with all errata, addenda, additional revisions, and supplemental specifications, all of which are hereinafter referred to as the Rhode Island Standard Specifications.

1.03 Submittals

A. In accordance with Section 01340 - Shop Drawings.

PART II PRODUCTS

2.01 Materials

A. Materials for Class I bituminous concrete base course shall conform to the requirements of Section 401 of the Rhode Island Standard Specifications.

B. Materials for Class I bituminous binder course shall conform to the requirements of Section 401 of the Rhode Island Standard Specifications.

C. Materials for Class I bituminous concrete surface course shall conform to the requirements of Section 401 of the Rhode Island Standard Specifications.

D. Materials for bitumen for tack coat shall conform to the requirements of Section 403 of the Rhode Island Standard Specifications.

PART III EXECUTION

3.01 Installation

A. Methods of placing Class I bituminous concrete base course shall conform to the requirements of Section 401 of the Rhode Island Standard Specifications.

B. Methods of placing Class I bituminous concrete binder course shall conform to the requirements of Section 401 of the Rhode Island Standard Specifications.

C. Methods of placing Class I bituminous concrete surface course shall conform to the requirements of Section 401 of the Rhode Island Standard Specifications.

D. Methods of placing bitumen for tack coat shall conform to the requirements of Section 403 of the Rhode Island Standard Specifications.

E. Where existing paved surfaces are to be retained and are required to join the pavement constructed hereunder, the existing jointed edges shall be cut vertically by mechanical means, to a depth of not less than 3 inches and not less than 1 foot back from their present locations or at the location as directed by the Engineer and/or shown on the Drawings, and painted with bitumen.

3.02 Tolerances

A. See Rhode Island Standard Specifications.

END OF SECTION

SECTION 02650
WATER DISTRIBUTION SYSTEMS

PART I GENERAL

1.01 Description

A. Work Included

1. This work includes the furnishing of all materials, labor and equipment for the installation and testing of all exterior water distribution piping, fitting, valves, specialties, new water service connections to existing services, replacement of existing water services, corporation stops, curb stops, curb boxes and all appurtenances and related items, complete, in-place, as shown on the Drawings, as specified herein or as otherwise directed by the Engineer or Owner, under this contract.

B. Related Work Described Elsewhere

1. Section 02101 - Project Surveying and Staking

2. Section 02205 - Soil Materials

3. Section 02215 - Aggregate Materials

4. Section 02220 - Excavating, Backfilling & Compaction for Utilities & Structures

1.02 Quality Assurance

A. The contractor shall furnish to the Owner, when requested, manufacturers written transcripts in accordance with AWWA C151.

B. The inspection, receiving, handling and storage of all materials shall conform to the requirements of AWWA C600.

C. Piping materials shall bear the label, stamp or other markings of the specified testing agency.

D. NSF Compliance: All water potable service piping, valves, fittings and specialties shall comply with the requirements of ANSI/NSF 61. Demonstration of compliance with ANSI/NSF 61 must be provided for all pipe, valves, fittings and specials.

E. Applicable Publications

1. Standards of the American Society for Testing and Materials (ASTM), latest edition.

2. Standard Specifications of the American National Standards Institute (ANSI), latest edition.

3. AWWA C800: Underground Service Line Valves and Fittings.

4. ASTM B88: Seamless Copper Water Tube.

1.03 Submittals

A. Shop Drawings, maintenance data and operating instructions for all hydrants, fixtures, backflow preventers, specialties, equipment, materials, etc., shall be submitted to the Owner.

B. The following items shall be submitted for approval:

1. Pipe, Tubing, Fittings, Joints, Corporation Stops, Curb Boxes, Hoses and appurtenant items;

2. Piping Specialties, Quick Disconnect Fittings, Strainers, Gauges, etc.

3. Valves and Actuators

4. Hydrants, Backflow Preventers, Enclosures, etc.

C. Provide all valves as specified herein and as shown on the Drawings. Submit for approval by the Owner, a schedule of all valves indicating the service, size, and connections, make, model number and any special features such as chain wheel operators, etc.

D. Comply with the pertinent provisions of Section 01340 of this Specification.

1.04 Project Conditions

A. Existing Utilities: Do not interrupt utilities serving the facilities occupied by the Owner or others unless approved, in writing, by the Owner. Provide 72-hour notification of the Owner of any interruption of utility service, and provide temporary utility service where applicable and requested by the Owner.

PART II PRODUCTS

2.01 Pipe and Fittings

A. Polyvinyl Chloride Pipe (PVC)

1. PVC Pipe and fittings < 4” diameter shall be manufactured from PVC Type I, Grade I materials conforming to ASTM D-1785. Fittings shall be socket type conforming to ASTM D-2467 or flanged type as indicated on the Drawings or as required.

2. PVC pipe and fittings, 4” to 12” diameter shall be AWWA C900 PVC Pressure Pipe, Class 200, DR 14, unless otherwise noted on the Drawings. Fittings shall be class-rated, ductile iron with mechanical joints, AWWA C153.

3. Joints:

   a. Pipe <3” diameter shall utilize threaded (ASTM-2464) or solvent welded (ASTM-2467) joints. Use Teflon tape or liquid Teflon thread lubricant on all threaded joints.

   b. Piping 4” and larger diameter shall utilize push-on type joints with factory installed solid cross-section elastomeric ring (ASTM F-477.

B. Copper Pipe and Fittings

1. Copper pipe shall conform to ASTM Designation B-88, Type K; soft tempered annealed with flared pattern cast bronze fittings conforming to ANSI B16.26 for underground installation. Type L: hard tempered and annealed with cast red bronze to wrought copper solder type fittings conforming to ANSI B16.18 or B16.22 for above ground, exposed installation.

2. Copper Tubing shall conform to ASTM Designation B75 drawn temper, annealed, type optional to suit intended purpose. Fittings shall be flared cast bronze fitting conforming to ANSI B16.18 or B16.22.

C. Ductile Iron Pipe and Fittings

1. Ductile Iron Centrifugally Cast in Metal Molds or Sand-Lines Molds, for Water or Other Liquids - ANSI A21.51 (AWWA C151-76), Class 50, 51, 52, 53. Piping shall be pressure class 350 for pipe 4” to 12” diameter and pressure class 250 for pipe greater than 12” diameter. Piping shall be provided standard thickness cement mortar lining, and interior asphaltic seal coat (AWWA C104) and exterior asphaltic coating, in accordance with AWWA and ANSI standards.

2. Fittings for water mains shall be of ductile iron and shall conform to AWWA C110 or C153, rated for pressure class 350. The interior surface of fittings shall be cement-lined, double thickness, with bituminous seal coat. Exterior surfaces shall be provided a coal tar bituminous coating, minimum 1-mil thickness.

2. Joints for Ductile Iron Pipe - Mechanical type or "push-on" type as specified in ANSI A21.11 (AWWA CIII), to be installed as per manufacturer's instructions.

3. Rubber ring gaskets shall be full-face type, AWWA C111, 1/16” thickness, of composition suitable for the application.

4. Flanged fittings shall conform to AWWA C115 and shall be furnished flat-faced and

drilled to 125 psi template in accordance with ANSI B16.1.

D. Polyethylene (PE) Piping and Fittings

Not Applicable.

2.02 Non-Metallic Valves

A. General

1. Valves shall be manufactured of the same material as the associated pipe and fittings, to assure compatibility.

B. Ball Valves

1. Ball valves shall have permanently lubricated Teflon ball seats backed with Viton O-Rings and Viton stem and body seals.

2. Ball valves shall have a pressure rating of 150 psi at 73°F.

3. Ball valves shall be of true union design.

4. The ball shall have 90-degree rotation from fully closed to fully open position and shall have straight through full port flow in the open position.

5. All ball valves shall be Plastic Piping Systems, ASAHI/AMERICA, George Fischer or equal.

C. Check Valves - Swing Type

1. The valve shall be of top entry design with a single disc. The disc shall seat under 0.5 psi back pressure and shall be suitable for horizontal or vertical installation. Swing check valves shall be rated for minimum, 70 psig at 210°F, bubble tight.

2. Check valves shall be provided with a removable cover to allow cleaning of the valve without removal from the line.

3. Check valves shall have Teflon seats and seals.

4. Check valves shall be flanged type, drilled and tapped for conformance with standard ANSI 150 lb. flanges.

5. Check valves shall be Plastic Piping Systems, ASAHI/AMERICA, George Fischer or equal.

D. Check Valves - Ball Type

1. The valve shall be of either true-union or single union design, with the ball seating under a maximum of 0.5 psig backpressure, and shall be suitable for mounting in a horizontal or vertical position.

2. The valve shall be rated for 150 psig at 140°F, bubble tight.

3. Valves shall have Teflon seats and seals.

4. Valves shall be as by ASAHI/AMERICA, George Fischer or equal.

E. Globe Control Valves

1. The valve shall be either water type or flanged type. Flanged valve, shall conform to ANSI requirements for standard 150 lb. flanges.

2. Stem seals shall be of Teflon and the stem shall be of stainless steel. The valve plug and seat ring shall be of the same material as the valve body.

3. The valve stem seal shall be of the bellows type.

4. Valves shall be as by ASAHI/AMERICA, George Fischer or equal.

2.03 Metallic Valves

A. Gate Valves

1. Gate valves shall be resilient seated, ductile iron body, bronze mounted, with inclined seats, non-rising stem type, counter-clockwise rotation to open, conforming to AWWA C509.

2. Valve Operators: Below Ground: Except for use with post-indicators, furnish valves with 2” nut for socket wrench operation. Post indicator shall conform to requirements of NFPA 24 and shall be fully compatible with the valve provided.

B. Ball Valves

1. NIBCO Fig. T-590, or equal for sized 1/2 through 2", three-piece bronze construction, 150 psi SWF conventional port, blow-out proof, Teflon seats, soldered or threaded ends with chrome plated steel handle.

2. Valves to be used on screwed or soldered piping only.

C. Check Valves (Swing Type)

1. Valves shall be Powell, Fairbanks, Jenkins or approved equal.

2. Valves 2" and smaller shall be all bronze with screw-in cap, regrinding disc and threaded ends.

3. Valves 2-1/2" and larger shall be iron body, bronze mounted with bolted cover, regrinding disc and flanged ends.

   a. Up to 125 psi - Powell Co., Fig. 559
   b. Up to 250 psi - Powell Co., Fig. 576

4. Valves 2" and smaller for copper tubing shall be all bronze with screw over cap and solder ends up to 125 psi similar to the Powell Company, Fig. 1825 or equal by Fairbanks, Jenkins or approved equal.

D. Butterfly Valves

Not applicable.

E. Tapping Sleeves and Valves

1. Tapping sleeves shall be extra heavy pattern designed to withstand the strains of making wet tap connections and they shall be of sizes suitable for use on the pipe on which the respective sleeve is to be installed, and for use with the tapping valve.

2. Tapping sleeves shall be of the mechanical joint type, designed for a working water pressure of 200 psig and shall be of the same manufacture as the tapping valve.

3. Tapping valves shall be furnished with flanged ends on the upstream side which shall register with the flange of the tapping sleeve. Downstream ends shall be furnished with a tapping flange for attaching the drilling machine, and also with a bell end for connection to the branch water main, using a mechanical joint.

F. Air and Water Solenoid Valves

Not applicable

G. Pressure Reducing Valve

1. Pressure Reducing Valves shall reduce incoming water or steam pressure to a safer constant predetermined downstream level. The downstream pressure is established by a pressure adjustment setting on the valve or by an external sensor. Pressure Reducing Valves are utilized in residential, commercial, institutional, and industrial applications.

H. Double Check Valve Backflow Preventer

1. Double Check Valve Assembly Backflow Preventers are designed to prevent the reverse flow of polluted water from entering into the potable water supply.
2. It shall have a modular check design for easy maintenance and a coated cast iron body for advanced corrosion resistance.

I. Fire Service Meter

1. At low flow rates, all flow is through the bypass meter. As flow increases, pressure loss through the bypass meter increases and the detector check valve automatically opens. This condition occurs during time of high flow and permits flow through the mainline turbine meter. As flow decreases, reduced pressure loss closes the detector check valve and flow is again directed through the bypass meter.

J. Altitude Valve

1. Altitude Valve controls the high-water level in reservoirs without the need for floats or other devices. It is a non-throttling valve that remains fully open until the solenoid is activated or the shut-off point of the hydraulic pilot control is reached. This valve is designed for one-way flow applications only. This valve is hydraulically-operated and pilot-controlled. The level pilot control senses differential in forces between a spring load and reservoir head level. When spring force is overcome by the force of reservoir head, the pilot shifts and closes main valve. Desired high-water level is set by adjusting spring force.

2. The Altitude Valve shall be a CLA Val 210-17 or approved equal.

2.04 Curb Stops, Curb Stop Boxes and Valve Boxes

A. Curb Stops or Curb Valves shall be Mueller H-15204, H-15209 or B-25209, or equal for 1” and 2” sizes. Curb stops shall be of the quarter turn cylindrical plug type with a closed bottom and top O-ring seal construction with integral stops build into the bottom of the plug and body, The curb valve design shall include markings to identify the valve position.

B. Curb Stop Boxes shall be of cast iron, extension type, with screw or slide type adjustment and flared base. The box shall be adaptable, without full extension, to the depth of cover required over the pipe, at the stop location. The word “WATER” shall be cast into the cover and the cover shall be set flush with finished grade. The curb stop shut off rod shall extend a minimum of 24” above the top of the deepest curb stop box.

C. Valve Boxes shall be of the extension type, with screw or slide type adjustment and flared base. The box shall be adaptable, without full extension, to the depth of cover required over the pipe, at the valve location. The minimum box material thickness shall be 3/16”. The word “WATER” shall be cast into the cover. Provide a minimum of two (2) “T” handle socket wrenches of 5/8” thick round stock, long enough to extend 24” above the top of the deepest valve box.

2.05 Link Seals and Wall Sleeves

A. Where so depicted the pipe to wall penetration closures shall be "Chemical Service Link-Seal" as manufactured by Thunderline Corporation - Belleville, Mich. 48111. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall opening. The seal shall be constructed so as to provide electrical insulation between the pipe and wall sleeve, thus reducing chances of cathodic reaction between these two members.

B. Sleeves through exterior building walls shall be schedule 80 black steel with 150 lb. black steel slip-on welding flanged welded at the center of the outside. Extend sleeves 1/2" beyond each side of the wall. Pack the space between sleeve and pipe with oakum to within 2" of each face of the wall. Pack the remaining space and made watertight with a waterproof compound.

C. Sleeves through masonry floors or interior masonry walls shall be schedule 40 black steel pipe, set flush with finished wall or ceiling surfaces, but extending 2" above finished floors.

D. Provide 22-gauge galvanized steel sleeves through interior partitions set flush with finished surfaces of the partitions.

E. Provide individual or strip type inserts pressed steel construction with accommodation for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods to 1/2" diameter to be passed through the insert body and shall be similar to Fee and Mason Manufacturing Company, Fig. 178. Strip inserts shall have attached rods with hooded ends to allow fastening to reinforcing rods and shall be similar to Fee and Mason Manufacturing Company Fig. 190.

2.06 Connections and Couplings

A. Couplings

1. All couplings on steel pipe shall be Style 38 couplings as manufactured by Dresser Industries, Bradford, PA. Couplings to have steel middle ring, flanges, track head and rolled thread bolts. Two rubber compounded wedge section gaskets to be furnished with each coupling. Style 440 Joint Harnesses shall be used except as noted otherwise. Lugs and bolts shall be in accordance with the manufacturer's selection for line working pressure and pipe size. Similar coupling by Rockwell International, Pittsburgh, PA or approved equal will be acceptable.

2. In some locations, it may be necessary to furnish a coupling which shall be suitable for different materials of pipe. Such couplings to connect steel pipe to cast iron pipes, etc., shall be Dresser Style 62, or approved equal. Coupling rings shall be furnished without pipe stops and gaskets shall be of the plain type. Follower rings shall be designed to adequately confine the gaskets.

3. Flexible couplings on pressure lines shall be suitably harnessed in accordance with the recommendations of the manufacturer, or otherwise protected against a separation from thrust. All joints shall be arranged to prevent rotation of the pipe by a method approved by the Owner.

4. Couplings not shown on the drawings may be installed by the Contractor to permit non-rigid connection to equipment, wall flanges, etc. and as required to facilitate piping installation.

B. Quick Couplings

1. Quick couplings shall be OPW Kamloc Quick Couplers as manufactured by Dover Corporation, Cincinnati, OH. Couplings to be furnished as a set, with one adaptor and one coupling per fitting.

2.07 Flanged Joints

A. Cast Iron Pipe Flanges shall conform to ANSI B16.1 "Cast Iron Flanges and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.

B. Flanged joints shall be made with bolts, bolt studs with nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges.

C. Bolting for services up to 500^{o} F shall be ANSI/ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B182.2 "Square and Hex Nuts". Bolt studs and studs shall be of the same quality as machine bolts.

D. Gaskets for flat face flanges shall be full face type. Gaskets for raised face flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Gaskets for stainless steel flanged connections shall be ring type, solid, virgin Teflon, white, 1/16” thickness.

2.08 Fire Hydrants

A. The hydrant hose thread, size of fire apparatus connection, and the shape, size and direction of rotation of the operating head of the hydrant shall be identical with the existing local fire department and/or public water system standards.

B. The hydrant interior shall be removable without excavating the hydrant. The main valve opening of each hydrant shall be minimum 5". The hydrant shall be provided with 6" bell connections, one (1) steamer nozzle and two (2) hose nozzles with nozzle caps securely chained to the barrel. The hydrant shall be provided a suitable drainage device, nozzles, stuffing boxes, wedge nuts, seat rings, clamp plates, etc. Threaded joints or spindles shall be bronze. The upper and lower barrels shall be of equal diameter and the upper barrel shall be of sufficient length to permit setting hydrant with the barrel flange not more than 2" above finished grade. All hydrants shall have a 6" bottom connection.

C. Provide a minimum of two (2) wrenches with handles not less than 14" long.

2.09 Warning Tape

A. All underground piping and conduit shall be provided 4-mil polyethylene identification tape, minimum 3" width. The tape shall be blue, with black letters, imprinted with "CAUTION, BURIED WATER PIPELINE BELOW"

2.10 Pipe, Specials and Valves Not Specifically Covered

Where indicated on the plans, elsewhere specified, or required by the work to be performed, pipe, specials, valves and accessories of materials, classifications, type, style, etc., not specifically covered by this section of the specifications, shall be furnished and installed by the Contractor. All such materials shall be installed in a first-class and workmanlike manner. The Contractor shall obtain prior review and approval of the Owner before ordering any such materials.

PART III EXECUTION

3.01 General

A. Product Delivery, Storage and Handling: Do not deliver water service materials to the job site until ready for installation. Water service materials shall be stored in a clean dust free environment and shall be properly handled to prevent damage to materials.

B. Handling of Pipe

1. Storage of pipe valves, fittings, etc. shall be as approved by the manufacturer so as not to expose the pipe to damage.

2. Pipe, valves, fittings etc. shall be stored in an area approved by the Owner, and in a manner so as not to create a safety hazard or nuisance.

3. Pipe, valves, fittings, etc. shall be handled in a manner approved by the manufacturer, using slings or other approved devices. No materials shall be dropped from vehicles or handled in a manner as to cause damage.

C. Inspection of Materials

1. Carefully inspect all pipe, fittings, valves, equipment, and accessories for cracks, flaws or other defects, prior to installation. Any items which are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings or nameplates with sufficient data for identification to determine their conformance with specified requirements.

2. The interior of pipe and fittings shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during installation operations.

3. Exercise all necessary care to prevent entry of foreign matter into piping, fittings, or install any item which is not clean. During construction, until system is fully operational, all openings in piping and equipment must be kept closed at all times except when work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed for this purpose.

D. Water Service Locations:

1. The locations of water service line connections and replacement presented on the Drawings is based upon the best available information, and must be confirmed in the field by the Contractor.

2. A water service connection is defined as the installation of new water service tubing or piping, as specified, from the new water main, to a point at which the connection is made to the existing copper water service, as indicated on the drawings or as directed in the field.

3. A water service connection replacement is defined as the installation of new water service tubing or piping, as specified, from the new or existing water main, to the specified curb stop location, and beyond, as required for connection, as indicated on the drawings or as directed in the field.

3.02 Installation of Pipe Systems

A. Removal of Existing Water Services: The Contractor shall be responsible for removing existing services where indicated on the Drawings or as directed by the Engineer. The work will require the removal of the existing water service pipe from the corporation stop to the curb stop, and the removal of the existing curb stop including curb box. The Contractor shall shut off the existing water service at the corporation stop. Corporation stops which cannot be operated ore are observed to be leaking, shall be tightened, capped or replaced with suitable plugs, if necessary, to stop the leakage from the water main. The work required for the removal of existing water services will include pavement removal, excavation, backfilling, refill and all other necessary restoration work required to satisfactorily complete the removal of the existing water service and its appurtenances. The Contractor shall be

responsible for the proper disposal of the items removed.

B. Pipe, Fitting and Valve Installation

1. Watermain pipe, fittings, specials and accessories shall be installed in accordance with AWWA C600, latest revision. Pipelines shall be installed straight and true to line and grade and in such manner as to form a close constriction joint with the adjoining pipe segment, and to prevent sudden offsets in the grade line. All piping shall be maintained accurately to line and grade. Any pipe that has the grade joint disturbed after laying shall be re-laid.

2. Valve boxes shall be provided for all valves and they shall be set plumb. Valve boxes shall be centered on the valve operating nut. Care shall be taken that no part of the riser section, and its pad, shall bear on any part of the valve. Provision shall be made to keep any stones, mud or debris from entering the riser section during and after backfilling. Any blockage of the box shall be remedied by the Contractor at this own expense. Valves and riser section shall be centered on valves and the cover shall be set flush with the finished surface. The bottom of the cover shall have a minimum clearance of 3” from the top of the rise pipe.

3. The installation trench shall be kept free from water to prevent flotation of the pipe, and pipelines shall be constructed in dry conditions, and shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when the work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe or fittings. Valve installations shall not be made when the trench or weather conditions are unsuitable for the work. All excavations and valve structures shall be kept free of water during installation of the valves and jointing operations, and for such additional lengths of time as may be required to insure the satisfactory installation of the valve assemblies and appurtenant work.

4. All fittings shall be anchored to prevent any movement of the fittings or the adjacent pipe. In general, this anchorage shall be provided by the installation of Class B Portland Cement concrete thrust blocks, and clamps, yokes, tie rods as specified and shown on the Drawings, as restrain all fittings and appurtenances. Hand excavation may be required for thrust blocks. The Owner may require concrete to be placed at points on the pipeline other than at fittings, depending upon field conditions. All concrete used for thrust blocks shall be exposed for a minimum of sixteen (16) hours before being covered. Insofar as possible, thrust blocking shall be placed so that the pipe and fitting joints will be accessible for repair.

5. Taps for water service corporation stops shall be made where shown on the Drawings or as directed by the Owner. The tapping machine shall be of approved design and in good operating condition. Only a clean, sharp drill-tap tool of the proper size and thread shall be sued. The tapping machine shall be firmly clamped to the pipe at a 90^{o} angle, threads shall be clean and sharp and sufficiently deep so that

no more than three (3) threads show when the stop is inserted and tightened with the operation nut on top. The stop shall be tightened only enough to make a watertight joint and not over-tightened.

6. Jointing of mechanical joint fittings, specials and valves shall be provided in accordance with the recommendations of the pipe manufacturer, and as specified. The mechanical joint fittings, joint restraints systems, specials and valves shall be suitable for jointing with the pipe with which they are used. The Contractor shall provide all necessary adapters for the proper jointing of pipe, pipe fittings, specials and valves. The last 8" of the outside spigot end of pipe and the inside of the bell of the mechanical joint shall be thoroughly cleaned to remove all oil, grit and other debris from the joint. When assembling a joint, it is essential that the gland be brought into place and bolts tightened in a manner to insure maintaining of the unit assembly.

7. Provide flanges at all final connections to equipment, traps and valves to facilitate dismantling. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

8. All pipe shall be installed without springing or forcing. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment or building elements with piping connections or piping supports.

9. Install all work so that all parts required are readily accessible for inspections, operation, maintenance and repair. Minor deviations from the drawings may be made to accomplish this, but changes of magnitude shall not be made without prior written approval from the Owner. No work shall be closed in, covered and/or hidden from view before it has been examined by the Owner.

10. Any and all unsatisfactory work or materials shall be corrected and/or removed immediately after being condemned, and furnish other work and materials, satisfactory to the Owner, at no additional cost.

11. All packing, gaskets, discs, seats, diaphragms, lubricants, etc., shall conform to recommendations of the valve manufacturer for the intended service.

12. Valves shall be installed with the stems positioned in the vertical position, above the centerline of the pipe.

13. Provide to the Owner, one operating wrench for every ten (10) valves of each type (but not less than 2 wrenches per type).

C. Sleeves and Plates

1. Provide sleeves for all pipes passing through walls and foundations.

2. Lay out, size and locate all sleeves such that they be set and/or installed prior to pouring concrete. In the event sleeves must be placed after wall, grade beam, etc., has been constructed, submit in writing to and obtain approval from the Owner, quantity and proposed method of core drilling and installing. Cored openings must be clean and neat without cracking or spalling.

3. Unless otherwise specified, sleeves shall be standard weight galvanized steel pipe having square cut ends with anchoring lugs welded on. Horizontal sleeves through walls, grade beams, foundations and partitions shall be flush with finished wall faces and have a water stop. Vertical sleeves through floors shall extend 3 inches above finished floor and be flush on ceiling or under side.

4. Size sleeves such that internal diameter is a minimum of 2" larger than the outside diameter of the bare pipe for un-insulated lines and 2 in. larger than outside diameter of the insulation and jacket for insulated lines. Center pipes and sleeves. Sleeves in pits or below grade shall be painted or coated with one coat of coal tar pitch paint and have an integral waterstop.

5. All pipes passing through walls or floors except in factory spaces, equipment rooms, pits, below grade, or concealed above ceilings shall be provided with chrome plated brass solid type escutcheon plates large enough to conceal the pipe sleeve and fitting snugly around pipe or insulation. Approved manufacturer and model numbers are Ritter Pattern and Casting Company, Inc., 1, 3A or 36A.

3.03 Welded Pipe Connections

A. Welders assigned to the work shall be duly qualified in accordance with ASME Section IX Boiler and Pressure Vessel Code for Welder's Qualification Test, Welding Procedures and Quality Requirements, and Procedures and Tests for Qualifying Welders. Qualification proof shall be available on request of the Owner.

B. The base metal may be prepared for welding by shearing, gas cutting, etc. Metal shall be cleaned of grease, oil, paint, rust, scale, burrs, pipe cuttings or anything else which may be detrimental to the finished weld.

C. Welding Methods

1. No welding shall be done if the metal temperature is below 0°F or if the surfaces are wet. Between 0°F and 32°F the metal shall be heated until warm to the hand.

2. In the installation of socket weld fittings and valves a 1/16" clearance shall be left between the end of the pipe and the shoulder in the socket.

3. Butt welds shall be prepared with welding grooves by machining or flame cutting and grinding. Ends shall be free of scale and oxide, smooth, and leveled, leaving a

1/16" land on the bottom of the welding edge. A minimum 3/32" separation shall be allowed between the lands. A 1/16" separation shall be allowed between the lands. A 1/16" separation shall be used for gas welding.

4. The 2 pieces to be welded shall be held for welding by alignment fixtures. Tack welds in the grooves may be used if fixtures cannot be used but shall be kept to a minimum.

5. The number of passes for welding joints and the method of welding shall be sufficient to satisfy good practice and pressure requirement specified. The average thickness of each layer of welding metal shall not exceed 1/8 inch. Complete fusion shall be obtained and car shall be taken that full penetration is obtained through thickness of metal without stalactite or dripping. All slag and flux shall be removed by wire brushing before each succeeding pass is made. The completed weld shall be free from all defects including undercutting, porosity and cracking. Welds shall present a smooth, regular workmanship appearance.

6. Welding equipment shall be properly grounded to prevent induced current in structural steel, piping or other metals.

3.04 Testing of Installed Piping Systems

A. Preparation

1. The Contractor shall furnish all equipment and labor necessary to perform the field tests called for in this Specification.

2. The Contractor shall give ample notice to the Owner that tests are to be conducted. The Owner shall witness all pipeline tests or otherwise shall give written authorization to the Contractor to perform un-witnessed pipe tests.

3. No test shall be performed until all anchors, thrust blocks, supports, test gauges, plugs, bulkheads, blanks, etc., are installed.

4. Piping that connects to or is continuous with lines installed by others shall be isolated from such lines by valves or test blanks located at or near the junctions. When necessary to include parts of such lines in the test, the Owner shall be given prior notice so that test conditions may be mutually agreed upon. Special test conditions must be approved in writing prior to performing any such tests.

5. Underground pipe joints shall be exposed during the test program. When piping is required to be painted or insulated, the paint or insulation shall not be applied to the pipe joints until the tests are completed.

6. Safety precautions shall be taken to prevent open ends of piping being in position to cause injury to personnel when blowing out or testing systems.

7. One or more calibrated indicating test gauges shall be connected directly to the piping as necessary to coordinate the pressuring operation. The indicating gauges shall be visible to the operator controlling the pressure. Pressure gauges used shall have dials graduated over a range approximately 2 times the intended medium test pressure.

8. The interior of all piping shall be free from loose mill scale, sand, dirt, slag, weld, spatter, rust and other foreign matter, when installed.

9. After installation of piping, all those lines requiring hydrostatic testing shall be flushed with water. Terminal visual inspection in the presence and to the satisfaction of the Owner must be made after flushing procedure is completed. A minimum of 5 gallons is to be flushed from each corporation stop or use point under full flow to ensure adequate cleaning of valve seats. Inspect and replace valve seats where necessary to ensure nonclusion of particulates. Flushing shall be considered complete when no sediment is visible in a water sample in a clean glass vessel, standing for five minutes.

B. Pressure Testing

1. As far as is practicable, all pressure tests shall be complete system tests conducted in the presence of the Owner. All pressure vessels, instruments, and equipment connected to the piping system shall be included in the tests. The piping system shall be hydrostatically tested after flushing has been completed.

2. Every precaution shall be taken during testing to ensure the safety of the operator. Systems to be pressurized shall be provided with appropriate gauges and pressure relieving devices, furnished by the Contractor.

3. All joints are to be left uninsulated and exposed for examination during testing.

4. Equipment not to be subjected to the pressure test shall be either disconnected from the piping or isolated by blinds or other means during the test. Valves may be used provided that the valve is suitable for the proposed test procedure.

5. Pressure gauges shall not be subjected to pressure in excess of their scale range. All pieces of equipment which do not have their test pressure indicated or whose test pressures are below the piping system test pressure shall be excluded from the test.

6. Pressure relief and thermal relief valves shall be excluded from these tests.

7. Before every test, the piping systems shall be visually inspected to assure that there are not visual defects and that all connections are tight.

8. Control valves, unless being tested, shall be set and maintained in the full-open

position.

9. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.

10. All in-line instruments, gauge glasses, flow meter pots, liquid level float gauges, and all other pressure parts of instruments shall be included in these tests, where feasible.

11. Joints found to be defective shall be repaired and retested. Retesting of pipelines after repairs shall be done at the pressures originally specified for the test.

C. Hydrostatic Tests

1. The hydrostatic test pressure shall be calculated in accordance with the applicable section of ANSI B31.3, but shall not exceed the maximum test pressure of any vessels or components included in the test.

2. Temperature and head adjustments shall be made in accordance with ANSI B31.3, paragraphs 337.4.1 and 337.4.2.

3. All hydrostatically tested systems shall be tested in a one and one-half times the design pressure or to a minimum pressure of 100 psig, whichever is greater. All test pressures shall be maintained a minimum of ten minutes before visual examination of joints begins.

4. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.

5. During the tests, hydrostatic pressures shall be monitored and corrections shall be made to compensate for thermal expansion or contraction. By this procedure, the test pressure shall be kept within five (5) psig or one percent, whichever is greater, of its intended value. All joints shall be visually examined for leakage during the test.

6. No repair welding shall be done on any section of piping that contains water.

D. Test Reports: The Contractor shall prepare a "Test Report" record for each piping system or pipe segment tested, including the following data and information:

1. Date and duration of Test;
2. Pipe Line Identification;
3. Type of test, pressure applied and length of time at test pressure and pressure at end of test;
4. Name of personnel and company performing test;
5. Comments, if any.

END OF SECTION

SECTION 02661
INSTALLATION OF WATER PIPING SYSTEMS

PART I GENERAL

1.01 Related Documents

A. Drawings and general provisions of the Contract, including General Conditions and Division I Specification Sections, apply to this Section.

1.02 Work Included

A. This section covers the furnishing, installation, testing and disinfection of the buried water service pipeline system, including all pipe, fittings, valves, hydrants, wet taps, thrust blocks, and all appurtenant work, complete in-place and accepted.

1.03 Related Work

A. Section 02220 - Excavation, Backfilling and Compaction for Utilities
B. Section 02122 - Tree Protection and Trimming
C. Section 02650 - Water Service Lines

1.04 Quality Assurance

A. Reference Standards: Except as modified or supplemented herein, the installation of the pipeline system shall meet the requirements of the following standard specifications.

1. American Water Works Association

   a. C600-93: Installation of Ductile-Iron Water Mains and their Appurtenances.
   b. C0651-92: Disinfecting Water Mains.

B. Submittals:

1. Submit name and evidence of qualification of firm contracted to perform pressure testing and disinfection for approval prior to commencement of the work.

2. Submit name of testing laboratory and evidence of qualification to perform the required bacteriological testing. The approved qualified independent testing laboratory will furnish certified reports of the required bacteriologic tests. Submit three (3) copies of the reports.

1.05 Job Conditions

A. Protection:

1. Prevent foreign material from entering the pipe, fittings and valves during installation. No debris, tools, clothing or other materials shall be placed in the pipe fittings and valves. Whenever pipeline installation is stopped, seal the open end of the pipe with a watertight plug to prevent trench water, debris or other material from entering the pipe. Take adequate measures to prevent flotation.

2. Pipe shall be installed in dry excavations. If water is present in the trench after installation, then the plug shall be left in place until the trench has been pumped dry.

3. The Engineer or Owner's Representative will be present during the times the Contractor operates all valves, hydrants, blow-offs and curb stops and other control unit.

B. Unsuitable Conditions: No pipe shall be installed when, in the opinion of the Engineer of Owner's Representative, trench or weather conditions are unsuitable.

1.06 Product Delivery, Storage and Handling

A. The Contractor shall examine all materials upon delivery so as to insure an accurate assessment of any broken, damaged or otherwise defective materials requiring replacement.

B. All pipe, fittings, valves, and appurtenances shall be carefully handled, stored and protected in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall such materials be dropped or dumped into the trench. Any material broken or damaged by the Contractor through negligence or by accident shall be replaced by the Contractor at no additional expense to the Owner. Remove any broken or damaged materials from the construction site and do not use in any portion of the construction. Any broken, damaged, or otherwise defective materials which are included in the construction shall be removed and replaced at no additional expense to the Owner.

PART II PRODUCTS

2.01 Materials

A. All materials to be used shall be furnished as specified and in accordance with the applicable sections of these Contract Specifications.

2.02 Concrete for Thrust Blocks and Encasements

A. Concrete shall have a minimum compressive strength of 3,000 psi after 28 days.

PART III EXECUTION

3.01 Preparation

A. Excavation: Perform excavation in accordance with the requirements of Section 02220 Excavation, Backfilling and Compaction for Utilities.

B. Cleaning and Inspection: The interior of all pipe, fittings, valves and appurtenances shall be thoroughly cleaned of all foreign material and inspected for cracks, flaws or other defects before installation and shall be kept clean until the work is accepted. All joint contact surfaces shall be kept clean until the joint is completed. Mark all defective, damaged or unsound materials with bright marking crayon or paint and remove from job site.

C. Excavation of Existing Facilities: When connections are to be made to existing pipelines or appurtenances, the actual elevation of which cannot be determined without excavation, the Contractor shall excavate for and expose the existing facility before laying any pipe or conduit. The Engineer or the Owner's Representative will inspect the existing facility and will make any necessary adjustments in the line or grade of the proposed pipeline to accomplish the connection.

3.02 Installation of Pipe

A. General:

1. As each length of pipe is placed in the trench, the joint shall be completed as specified herein and pipe shall be brought to the correct line and grade. No spalls, shims or lumps shall be used to raise the pipe to grade, secure the pipe in place with the specified bedding materials tamped under and around the pipe except at the joints. Bell holes shall be excavated so that after placement only the barrel of the pipe receives bearing pressure from the trench bottom. No joints shall be covered in any way until the joints have been inspected. Do not walk on small diameter pipe or otherwise disturb any conduit after jointing has been completed.

2. When necessary, pipe shall be cut without damage to the pipe or cement lining leaving a smooth end at right angles to the axis of the pipe. When push-on joint type pipe is cut in the field, the plain end shall be beveled with a heavy file or grinder to remove all sharp edges. All pipe cutting shall be done with approved mechanical cutters, Flame cutting using an oxyacetylene torch shall not be used.

3. In addition to the requirements specified herein, the pipe fittings, valves and appurtenances shall be installed in strict accordance with the printed recommendations of the respective material manufacturer and as approved.

B. Pipe Laying:

1. Pipe shall be laid true to line and grade and joined in such a manner that the offset of the inside of the pipe at any joint is held to a minimum. The maximum

allowable joint deflection shall be as shown in Table 4 and Table 5 of AWWA C-600 for push, on joint pipe and mechanical joint pipe, respectively.

2. Deflections from a straight line or grade, as required by vertical curves, horizontal curves or offsets shall be made using fittings or specials as indicated on the drawings or as otherwise designated by the Engineer or the Owner's Representative to accommodate field conditions.

3. Install all valves and tapping sleeves at the locations indicated on the drawings or as otherwise designated by the Engineer or the Owner's Representative to accommodate field conditions.

4. Valves shall be adequately supported with crushed stone or other suitable means so that the pipe will not be required to support the weight of the valve.

5. Valves shall be installed in the closed position.

6. Valve boxes shall be installed on all buried valves. Install boxes such that no stress is transmitted to the valve. Set boxes plumb and directly over the valve with the top of the box placed flush with the finished grade. Backfill and thoroughly compact around each box. Care shall be exercised to prevent stones, mud or debris from entering the boxes during and after backfilling.

7. Unless specifically authorized otherwise by the Engineer or the Owner's Representative in writing, the pipeline shall be installed so that a positive or negative grade is maintained between high and low points to avoid airpockets. If permanent air vents are not provided, record location of all high points so they may be readily located.

8. Install pipe with bell ends facing *the direction of laying, unless directed otherwise by the Engineer or the Owner's Representative. Where pipe is laid on a grade of 10 percent or greater, the installation shall proceed uphill with the bell ends facing upgrade.

9. Record "as-built" locations and depths of all pipe, fittings, valves and connections to existing water mains prior to backfilling. All bends, fittings and valves shall be located with three measurements to permanent aboveground structures, not including ties to the new or existing water system.

C. Jointing the Pipe:

1. Push-on joints:

a. Thoroughly clean the groove and bell socket and insert the gasket making sure that it faces the proper direction and that it is correctly seated.

b. After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturer's recommendations. The lubricant is supplied in sterile cans and every effort should be made to keep it sterile.

c. Be sure that the plain end is beveled. When pipe is cut in the field, bevel the plain end with a heavy file or grinder to remove all sharp edges. Push the plain end into the bell of the pipe, taking care to prevent contact of the jointing surfaces with the ground. Keep the joint straight while pushing. Make deflection after the joint is assembled. Pipe that is not furnished with a depth mark shall be marked before assembly to assure the spigot end is fully inserted into the bell end.

2. Mechanical Joints:

a. Wipe clean the socket and the plain end. The plain end, socket, and gasket shall be washed with a soap solution to improve gasket seating. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.

b. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess, taking care to prevent contact of the jointing surfaces with the ground. Keep the joint straight during assembly. Make deflection after joint assembly, but before tightening bolts.

c. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts.

d. Tighten the bolts with a torque limiting wrench to the normal range of bolt torque as indicated in Table 3 of AWWA C600. Overtightening to compensate for poor installation practice will not be permitted. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

3. Push-on Restrained Joints:

a. Thoroughly clean the bell socket of all dirt, sand, gravel or foreign matter and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.

b. Apply lubricant onto the exposed surface of the gasket and pipe spigot end to retainer weldment. Make conventional push-on joint assembly ensuring that pipe is fully inserted, in alignment, with first assembly stripe in the socket. Insert right-hand locking segment into slot and slide segment down around pipe. Insert left hand locking segment into slot and slide segment up around pipe. Wedge rubber retainer between locking segments. (For pipe diameters of 12 inches and larger, multiple locking segments and rubber retainers are used. Repeat locking segment and retainer installation steps accordingly.) After completion of joint assembly, set any desired deflection in the joint in accordance with the manufacturer's maximum deflection limits.

c. When restrained joint pipe is cut in the field, gripper rings shall be used to provide joint restraint. Cut pipe square using gasoline powered abrasive saw. Bevel the field cut end with a disk grinder. Make an assembly mark on the pipe barrel as a guide to assure that the pipe is inserted the proper depth into the socket. Follow same procedure as above for inserting gasket. Insert the beveled end of the pipe into the socket to the guide mark. Position the gripper ring segments into the bell locking segment cavity so that the locking segment handles protrude beyond the bell face, Install the bolts into the locking segment handles. Tighten the first pair of handles to approximately 35-foot pounds torque, then tighten second pair of handles to approximately 35-foot pounds torque. Do not deflect the joint prior to tightening. (For pipe diameters 24 inches and larger, four gripper ring segments with a jack screw between two segments are used. In this case, tighten three pairs of handles together, and then the last pair.)

4. Mechanical Couplings

a. The ends of the pipes shall be prepared and the couplings installed in strict accordance with the coupling manufacturer's printed recommendations.

D. Wet Taps:

1. Wet taps shall be made at a time and in a manner authorized by the Engineer or the Owner's Representative.

2. The work of installing tapping sleeves and valves and for making the wet taps under full main pressure shall be done only by workmen who are thoroughly experienced in this type of work.

3. The Contractor shall furnish the services of factory-trained personnel and special factory equipment, as necessary, for making wet tap connections, at no additional expense to the Owner.

4. The Contractor shall take all precautions necessary to prevent contamination of the existing potable water system when making the wet tap. Before the tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder.

5. The tapping sleeve, valve, adaptor and tapping machine assembly shall be pressure tested in-place before making the tap.

6. The wet tap connections shall be made in accordance with the printed recommendations of the tapping machine manufacturer and as directed.

E. Reaction Anchorage and Blocking:

1. Provide thrust blocks, anchors, joint harness or other approved means for preventing pipe movement at all push-on or mechanical joint plugs, tees, crosses; bends deflecting 11-1/4 degrees or more; reducers and valves.

2. Construct thrust blocks in accordance with details shown on the drawings, sized to accommodate the specified test pressure of the pipeline. Thrust blocks shall extend from the fitting to solid undisturbed earth and shall be constructed so the joints are accessible for repair. If adequate support against undisturbed earth cannot be obtained, provide joint harnesses.

3. Provide joint harness or other supports for fittings installed in fills or other unstable soil, above grade, or exposed within structures as required by the drawings, as specified in other sections of the Specifications or as necessary to prevent movement.

F. Concrete Encasement: Install concrete encasement where indicated on the drawings and as directed in the field by the Engineer or the Owner's Representative. Block all pipes in place to prevent flotation.

G. Installation of Concrete for Thrust Blocks and Encasements: All concrete used for thrust blocks and encasements shall remain uncovered for at least 16 hours after installation.

H. Protection of Metal Surfaces: Protect all ferrous metal rods, clamps, bolts, and other accessories subject to submergence or contact with earth or fill material and not encased in concrete with 2 coats of coal tar paint. Apply first coat to clean, dry metal surfaces and allow to dry before applying the second coat.

3.04 Field Quality Control

A. Alignment Tests:

Each section of pipe will be checked by the Engineer or the Owner's Representative in order to suitable assistance to the Engineer or the Owner's Representative. The Contractor shall repair any poor alignment, displaced pipe, or other defects discovered, as directed by the Engineer or the Owner's Representative.

B. Hydrostatic Tests:

1. After the pipe has been laid and the trench has been backfilled, all newly laid pipe or any valved section thereof shall be subjected to a pressure and leakage test, in accordance with Section 02710 of the contract Specifications and as approved by the Engineer or the Owner's Representative.

2. All newly rehabilitated pipelines shall be subjected to a similar test as directed and approved by the Engineer.

3. The Contractor shall provide all pumps, pipe, connections, gages, measuring devices, and all other apparatus necessary for the test and shall conduct the test in the presence of and to the satisfaction of the Engineer or the Owner's Representative. The Owner will supply water to the Contractor for testing purposes at no expense to the Contractor.

3.05 Disinfection of Potable Water Pipelines and Systems

A. General:

Flushing and disinfection of potable waterlines shall be done in accordance with the procedures set forth in Section 02710, "Testing and Disinfection of Potable Water Piping' of these Contract Specifications, and shall be witnessed by the Engineer or the Owner's Representative unless otherwise approved. Said procedures, as applied to newly rehabilitated (cleaned and lined) existing water mains, may be modified in the field as directed by the Engineer. Prior to commencement of any disinfection operations, the Contractor will submit his proposed sequence and methods of flushing and disinfection to the Engineer for approval by the Engineer or the Owner's Representative.

B. Water Quality Testing:

Upon completion of the final flushing of the pipelines (including temporary bypass piping), and prior to placing the pipelines in service, all water quality sampling and bacteriological testing will be administered and performed as specified in Section 02710 of these Contract Specifications.

END OF SECTION

SECTION 02710
TESTING AND DISINFECTING OF POTABLE WATER PIPING

PART I GENERAL

1.01 Related Documents

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

1.02 Work Included

A. The work covered under this section of the Specifications shall include furnishing of all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with conducting tests for leakage and disinfecting all completed water pipelines in accordance with this Section of the Specifications and as directed by the Engineer. The Contractor shall also be responsible for performing sampling and testing for the water quality tests indicated in this Section.

B. The Work of this Section includes both exterior (yard) piping and interior piping of all potable water systems, valves and appurtenances.

1.03 Related Work

A. Section 02661 - Installation of Water Piping Systems

1.04 References

A. American Water Works Association Standard for Pressure and Leakage Testing for Ductile-Iron Mains and Appurtenances - AWWA C600 (latest revision).

B. American Water Works Association Standard for Disinfecting Water Mains AWWA C651 (latest revision).

PART II PRODUCTS

2.01 Materials

A. Chlorine for disinfection shall be provided and used by the Contractor, and shall conform to AWWA Specification B-300 (Hypochlorite) and C651, latest revisions.

B. The Contractor shall furnish the Engineer or the Owner's Representative a certificate of compliance that the disinfectant specified above conforms to these AWWA standards.

PART III EXECUTION

3.01 Hydrostatic Testing

A. Tests for leakage shall be conducted on all portions of completed water pipelines and appurtenances, and all methods and procedures for performing the testing of water mains (both interior and exterior pipeline systems) shall be subject to the approval of the Engineer. Unless otherwise permitted, the testing shall be conducted with partial backfilling over the barrel of any new pipe, between new pipes, pipe fittings, valves and appurtenances of the section before testing. Completed interior pipelines (exposed service) shall be subjected to hydrostatic test pressures as specified herein. Interiors of all pipe shall be cleaned of all dirt and foreign materials, the water pipelines may be tested in convenient sections as approved by the Engineer or the Owner's Representative.

B. Testing of water mains shall conform to the requirements of Section 4, Hydrostatic Testing, of the AWWA Specification C 600 (latest revision), except as herein specified.

C. The test shall be run for at least two (2) hour duration.

D. The test pressure shall be one hundred fifty (150) psi, plus or minus five (+5) psi. Test pressure shall not vary by more than ±5 psig for the duration of the test.

E. The test pressure for interior pipeline systems (piping, pumps, valves and appurtenances) shall be held for at least two hours after all visible leaks, if any, have been stopped and until each and every pipe and fitting and all leaks have been inspected for defects, breakage or leakage. Pipe, fittings or valves found defective shall be replaced by the Contractor, and all leaking joints shall be made tight by the Contractor satisfactory to the Engineer or the Owner's Representative. The tests shall be repeated as often as necessary, at no additional expense to the Engineer or the Owner's Representative, to assure that all piping and valves are free of defects, and that all joints are tight.

F. Maximum allowable leakage shall be as specified in the following table for the appropriate pipe diameter. Leakage shall be defined as the quantity of water that must be supplied into the pipe or any valved section thereof to maintain pressure within five (5) psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time. The flow meter for measuring leakage shall be accurate to within 0-1 gallons.

1. The Maximum allowable leakage shall be:

Nominal Diameter	4”	6”	8”	10”	12”	14”	16”
Allowable Leakage per 1,000 ft. (gph)	0.37	0.55	0.74	0.92	1.10	1.29	1.40

G. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

H. Testing of water mains shall be performed by the Contractor at his expense as witnessed by the Engineer. Notarized records of the test results shall be submitted by the Contractor to the Engineer for approval.

1. In case the specified rate of leakage for the portion of the pipeline being tested is exceeded, the Contractor shall find and repair the leaks and the pipelines shall be retested, repeatedly if necessary, by the Contractor, until the required conditions are met, at no additional expense to the Owner. All visible leaks are to be repaired, regardless of the amount of leakage.

J. Piping specialties which are not intended to be subjected to the test pressures specified shall be removed and replaced with suitable spool pieces until they have been completed. Upon completion of tests the piping specialties which have been removed shall be satisfactorily installed in the work.

K. The Contractor shall provide all materials, temporary work, equipment, labor, instruments and do all work necessary to satisfactorily complete the testing of pipelines and shall remove all temporary work at no additional expense to the Owner. Equipment not designed for the system test pressures shall be isolated from the system during testing.

3.02 Disinfecting New Interior and Exterior Piping and Appurtenances

A. All portions of completed potable water piping and appurtenances are to be disinfected by the Contractor before acceptance for operation by the Engineer.

B. The water mains will be disinfected per AWWA C651-14. All discharged water will be dechlorinated/neutralized utilizing sulfur dioxide, sodium bisulfite, sodium sulfite, or sodium thiosulfate. Once the water has been dechlorinated it will be tested for residual chlorine which will not exceed the RIDEM ambient water quality criteria of 0.019 ppm. Dechlorinated water will be discharged to the storm sewer system pending approval of the owner of the storm sewer system as appropriate.

C. Pipelines shall be disinfected by the Contractor in conformance with AWWA Specification C 651-14 (latest revision). In particular, the Contractor shall follow all of the disinfection procedures of Section 9 - "Disinfection Procedures When Cutting Into or Repairing Existing Mains" of AWWA Specification C 651 and it relates to tie-in of new piping to existing piping.

D. The Contractor shall be responsible for satisfactory disposal of all flushing water and chlorinated water at no additional expense to the Owner. The Contractor shall be responsible for contacting State and local regulatory agencies to determine special provisions for the disposal of heavily chlorinated water.

E. The Contractor shall use either the "Continuous-Feed Method" or the "Slug Method" of disinfecting water mains, as described in AWWA 0651. In either case, the Contractor shall be responsible for measuring the chlorine concentration at regular intervals in

accordance with the procedures described in the current edition of Standard Methods for the Examination of Water or Wastewater or AWWA Manual M 12, or using appropriate chlorine test kits as specified in AWWA C651, Appendix A.

F. Prior to potable water pipeline installation, the Contractor shall submit to the Engineer a description of the methodology which he will employ for the disinfection and flushing of the pipelines for approval by the Engineer. This shall include equipment which will be used and proposed chlorine dosage rates.

F. After the pipelines and appurtenances have been flushed clean (less than 1.0 Cl_2 residual), water quality sampling will commence. The Contractor shall arrange for samples of the water contained in the mains to be taken by an approved testing laboratory for bacterial analysis in accordance with Standard Methods for the Examination of Water and Wastewater at no additional cost to the Owner. All water quality sampling and bacteriological testing will be administered and performed under the supervision of the Engineer or the Owner's Representative.

1. Only after the analyses of the samples are approved by the Rhode Island Department of Health and Engineer or the Owner's Representative shall the mains be made part of the water system. In event that positive reports of coliform are received, the Contractor shall flush and re-chlorinate pipelines and appurtenances as many times as may be necessary to obtain approved results.

2. The tests shall show the complete absence of coliform bacteria. The Laboratory testing results shall also show evidence that the water is consistent in quality with the water in the system to which the pumping station will be connected. Water quality must be acceptable to the Rhode Island Department of the Environmental Management.

3. Samples shall be obtained from corporation cocks with copper gooseneck assemblies installed as directed along the pipelines to be disinfected. After samples have been collected, the gooseneck assembly shall be removed and retained for future use.

G. The Contractor shall be advised that water pipeline and appurtenance disinfection well be accomplished by specially trained personnel with a minimum of three (3) years of documented experience.

H. The Contractor's workers who are responsible for the water main work should be aware of the potential health hazards with chlorine and should be trained to observe carefully the prescribed construction practices and disinfection procedures. The effectiveness of disinfection depends in large measure on maintaining clean pipes and avoiding major contamination -during construction.

1. An adequate amount of reducing agent should be applied by the Contractor to water being disposed of in order to neutralize thoroughly the chlorine residual remaining in the water before final disposal, Arrangements for final disposal, including procurement of

any necessary discharge permits by State or local regulatory agencies, shall be made by the Contractor.

J. To prevent possible backflow or siphoning of contaminants into the existing water distribution system(s) which are in service, the Contractor will be required to provide a reduced pressure principal backflow prevention device in the temporary piping which is supplying water from the distribution system to the water main being treated and to provide such other safety and control measures as directed by the Engineer. The Contractor shall not disrupt the existing potable water system service.

3.03 Disinfecting Existing Water Mains and Appurtenances

A. When the existing water distribution mains are exposed, liberal quantities of hypochlorite shall be applied to the open trench areas.

B. The interiors of all pipe and fittings, couplings and sleeves, used in making connections to the existing water distribution piping, shall be swabbed or sprayed with a one (1 %) percent hypochlorite solution before installation.

C. Contractor shall abide by all requirements of AWWA C651, Section 9: Disinfection Procedures When Cutting Into or Repairing Existing Mains.

3.04 Required Water Quality Tests

A. The Contractor will administer and perform all water quality sampling and testing under the supervision of the Engineer or the Owner's Representative.

B. The Contractor will take the required water samples after completion of flushing and disinfecting of the water mains, equipment and appurtenances, as directed by the Engineer or Owner's Representative. If, through no fault of the Engineer or the Owner's Representative, the new water mains, equipment, or appurtenances, or existing facilities become contaminated (subsequent to the successful disinfection and testing of the aforementioned), due to Contractor error or other ongoing construction operations, the Contractor shall bear the costs of all supplemental water quality testing and analysis expenses required by the Engineer or the Owner's Representative. The Engineer may also require additional testing if deemed necessary, at no additional expense to the Owner.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART I - GENERAL

1.01 Description

A. This section specifies furnishing and placing of reinforcement for concrete floor repairs, foundation wall penetrations, floor slabs, foundation walls and slabs, equipment pads, etc.

B. Details of reinforcement and accessories not indicated shall be in accordance with ACI 315, and with the Concrete Reinforcing Steel Institute's "Recommended Practice for Placing Reinforcing Bars."

1.02 Quality Control

A. Fabricate bars to within plus or minus 1 inch of the design length.

B. Place bars to within plus or minus 1/2 inch of vertical location and to within plus or minus 2 inches of the horizontal location.

C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, the resulting arrangement of reinforcing shall be subject to the acceptance of the Engineer.

1.03 Submittals

A. Submit shop drawings to the Engineer showing reinforcing steel details, bending and cutting dimensions, placement plans and details, and marking for each reinforcement item.

B. Submit to the Engineer a certified copy of mill tests on each heat, showing chemical and physical analysis.

1.04 Product Delivery, Handling, and Storage

A. Deliver reinforcing bars to the fabricator in bundles, limited to one bar size, grade, and length of bar, securely tied, and identified with plastic tags in an exposed position identifying the mill, the melt or heat number, and the grade and size of bars.

B. After fabrication, bundle and tag reinforcing steel for identification at the job site. Provide tags identifying the steel by reinforcement item marking shown on accepted shop drawings and giving quantity of items contained in each bundle.

PART II PRODUCTS

2.01 Materials

A. Reinforcing bars shall be deformed type conforming to ASTM A615, Grade 60.

B. Welded wire fabric shall be plain type conforming to ASTM A185, and shall be supplied in sheets.

C. Tie wires shall be mild steel or annealed iron, minimum 16 gauge.

D. Provide supports such as chairs, spacers, blocks, hangers, or other devices to support and position reinforcement without displacement. Supports of any type coming in contact with formwork shall be plastic or stainless steel.

2.02 Fabrication

A. Fabricate each unit of reinforcement to conform to the type, shape, and size indicated on accepted shop drawings.

B. Perform cutting and bending of reinforcing bars before shipment to the site. Bend bars cold and in a manner which will not injure the material.

2.03 Finishes

A. All reinforcement shall be free of mill scale, rust, dirt, grease, oil, and other foreign matter which will inhibit bond.

B. After placing reinforcement, coat with a polymer-modified Portland cement coating.

PART III EXECUTION

3.01 Placing and Fastening

A. Reinforcing steel shall be clean and free of mill scale, rust, dirt, grease, oil, and other foreign matter when placed in the work.

B. Arrange and place reinforcement in contact with, and tied to, existing reinforcement in areas to be patched. Place reinforcement in same plane as existing reinforcing where possible. Where existing reinforcement consists of square bars, provide new reinforcement with equivalent cross- sectional area.

C. Support and secure reinforcement to prevent displacement or movement due to construction loads. Maximum spacing of bar supports shall be four feet.

D. Do not bend reinforcement around openings or sleeves. Wherever pipes, conduits, sleeves, inserts, or other such items interfere with placing of reinforcing, obtain the Engineer's acceptance of placement before placing concrete.

E. Coat all reinforcement with a polymer-modified Portland Cement coating to prevent corrosion and to improve bond with new concrete.

3.02 Splicing and Lapping

A. Furnish reinforcing bars in full lengths to the extent possible. Splices and laps shall occur only where approved by the Engineer.

B. All splices and laps shall be 30 diameters of the bar, or a minimum of 15 inches.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART I GENERAL

1.01 Description

A. This section specifies placing, curing, protecting, and finishing cast-in-place concrete.

B. Concrete work shall conform to ACI 301 and 318.

1.02 Concrete Tolerances

A. Top of slabs shall be finished with a 1/4" maximum deviation from a 5-foot-long straightedge placed anywhere on the surface.

B. Cross-sectional dimensions of beams and slabs shall be within plus or minus 1/4".

C. Sizes and locations of sleeves, and floor and wall openings shall be within plus or minus 1/4".

1.03 Submittals

A. Report the location in the finished work, start of placement and finish times, and temperature readings of all repaired areas.

1.04 Jobsite Conditions

A. All adjacent exposed concrete and reinforcing steel shall be properly prepared before placing new concrete. All necessary formwork shall be properly constructed and braced.

B. At least 24 hours prior to actual placement, notify the Engineer of the intention to produce and place concrete. Provide such information to the Engineer not later than 3:00 pm on the day prior to placement.

C Do not place concrete until the adequacy of forms and falsework, the absence of debris in the forms, the conditions of spacing and location of reinforcement and embedded items have been viewed by the Engineer.

D Do not place concrete until conditions and facilities for the storage, handling, and transportation of concrete test specimens are in compliance with the requirements of ASTM C31.

PART II PRODUCTS

2.01 Materials

A. Portland Cement Concrete: Section 03310.

B. Concrete Reinforcement: Section 03200.

PART III EXECUTION

3.01 Transportation and Placement of Concrete

A. Conform to the concreting procedures in ACI 304, and the requirements specified here.

B. Transporting

1. Discharge concrete into the forms not more than 1-1/2 hours after mixing has begun. Do not add re-tempering water at the jobsite, nor exceed the specified maximum water content.

2. Transport concrete to the jobsite in revolving drum truck mixers in a manner that will assure efficient delivery of concrete to the point of placement without adversely altering the desired and specified properties such as water-cement ratio, slump, and homogeneity.

C. Convey concrete from the mixer to the place of final deposit in the forms by one of the following methods:

1. Buckets or hoppers with discharge gates having a clear opening equal to not less than one-third the maximum interior area or five times the maximum aggregate size being used, whichever is greater, and side slopes not less than 60 degrees to the horizontal.

2. Buggies or wheelbarrows equipped with pneumatic tires.

D. Placing

1. Deposit concrete at or near its final position in the formwork, in a manner that will not adversely alter the desired and specified properties such as water-cement ratio, slump, and homogeneity. Place concrete full- depth for the entire area to be placed.

2. Do not allow concrete to free-fall more than three feet. Exercise care to prevent distortion, leakage, or movement of the forms.

3. If concrete is pumped, use equipment and procedures that are suitable and adequate to maintain a steady flow at the discharge end of the pipe, and to maintain the specified properties of slump, unit weight, and homogeneity. A Materials Testing Laboratory may require adjustments in the concrete proportions as necessary to provide the specified concrete properties. Pumping through aluminum piping is prohibited. Use pipe having at least three times the nominal maximum size of coarse aggregate. All sampling of pumped concrete will be at the discharge end of the pipe. Provide labor and assistance as required in obtaining and handling test specimens.

E. Consolidate all concrete by the use of mechanical vibrators operated within the mass of the concrete. Conform to the requirements of ACI 309.

3.02 Cold-Weather Concreting

A. General

1. When mixing, transporting, placing, finishing, and curing concrete in cold weather, conform to ACI 306 and the directions of the Engineer.

2. Cold weather is defined as any combination of low air temperature and wind velocity which may result in damage to freshly-placed concrete due to freezing and thawing at an early age. Concrete mixed or placed when the air temperature is below, or expected to fall below, 40^0 F for more than one consecutive day will be considered cold-weather concrete and will require special treatment.

B. Concrete Temperature

1. Maintain the concrete temperature, as placed, sufficient to assure freedom from frost damage until protection can be established, and to offset heat loss in the interval between mixing and placing. Do not allow the temperature of the concrete to be less than 50^o F, nor more than 90^o F, at the time of placement.

2. When the air temperature is below 35^o F, or when the temperature is expected to fall below 35^o F within 24 hours, do not place concrete without written permission from the Engineer. When required to maintain specified concrete temperature, heat water and aggregates by methods which will preclude the occurrence of appreciable fluctuations in concrete temperature from batch to batch, or flash set in the cements.

C. Preparation and Curing

1. Do not place concrete until satisfactory arrangements for covering, insulating, or housing of fresh concrete are made in advance of placement. The protection system shall be adequate to maintain, in all parts of the concrete, the temperature and moisture conditions specified here. Curing conditions, in addition to providing adequate temperature control, shall include procedures to prevent undesirable drying of the fresh concrete.

2. Maintain a minimum internal concrete temperature of at least 50^{o} F during the specified curing period. Maintain the temperature of the concrete above 70^{o} F for the first 5 days after the concrete is placed.

D. Provide, install, and maintain adequate and effective temperature recording devices. Record the maximum and minimum temperature readings in each 24-hour period throughout the curing period. Include a copy of the temperature readings in the permanent records of the job.

3.03 Finishing of Concrete Surfaces

A. Provide a scratched finish on all unformed slab surfaces. After the concrete has been placed, consolidated, struck-off, and leveled to the specified tolerances, roughen the surface with stiff brushes, brooms, or rakes before initial set.

B. A rough-form finish is acceptable for all surfaces not exposed to view or which are to be permanently covered.

3.04 Joints and Embedded Items

A. Joints

1. Reinforcement shall be continuous through all cold joints between existing and new concrete.

2. Sawcut existing concrete around areas to be concreted to a minimum depth of 1/2 inch to avoid a feather-edged patch. Water or air blast all loose particles from existing concrete surfaces. Use bonding compound to ensure maximum adhesion.

3. Make joints as straight as possible with no unnecessary re-entrant corners.

B. Embedded Items

1. Clean items to be embedded of all grease, oil, dirt, or other foreign material which would inhibit bond.

2. Items made from aluminum shall not be embedded in new concrete.

3. Before depositing concrete, check the location and support of all embedded items.

END OF SECTION

SECTION 03310
PORTLAND CEMENT CONCRETE

PART I GENERAL

1.01 Description

A. This Section specifies Portland Cement Concrete, including materials, batching, mixing, delivering, testing, and inspection.

1.02 Quality Control

A. The Contractor shall retain a Materials Testing Laboratory to obtain and test samples of concrete. The use of such testing services shall not relieve the Contractor of his responsibility to furnish materials and construction in compliance with these Specifications.

B. All concrete shall be provided by a local ready-mix plant.

C. The minimum number of test cylinders shall be three for each full truck-load of concrete when pouring patches in concrete slabs. For general structural concrete, the minimum number of cylinders shall be four for each 25 cubic yards of concrete.

D. If the strength of any truck-load of concrete at 28 days falls below 3500 psi, all patches constructed from that truck-load shall be removed and recast, at no additional cost to the Owner.

1.03 Submittals

A. Mix design and proportions of concrete components shall be submitted to the Engineer before mixing or placement is begun.

PART II PRODUCTS

2.01 Materials

A. Use Portland cement, Type I, conforming to ASTM C150. Use only one brand of cement throughout the work.

B. The use of calcium chloride admixtures is strictly forbidden.

C. Mixing water shall be potable and exhibit no deleterious effects upon the desired concrete properties.

D. Course aggregate shall be well-graded crushed stone conforming to ASTM C33 and shall have a maximum diameter of 3/4-inch. Fine aggregate shall be washed natural sand conforming to ASTM C33.

2.02 Mixes

A. Provide ready-mixed concrete composed of Portland cement, aggregates, water, and admixtures as accepted by the Engineer; secured from a single local plant; conforming to ASTM C94; capable of being placed without excessive segregation; and capable of developing the specified characteristics.

B. Provide concrete with a minimum 28-day strength of 4000 psi.

C. Provide a concrete mix consisting of a minimum of 6.5 sacks of cement per cubic yard. The maximum water-cement ratio shall not exceed 0.45 by weight.

D. The maximum aggregate size shall be 3/4".

E. The maximum slump shall be four inches, unless super- plasticizing admixtures are employed.

PART III EXECUTION

3.01 General

A. Batch, mix, and deliver Portland Cement Concrete in accordance with ASTM C94. Batch all components at the central batching plant. Add admixtures only after review by the Engineer. Produce concrete in accordance with ACI 301.

END OF SECTION

SECTION 03603
EPOXY BONDING COMPOUND/GROUT

PART I GENERAL

1.01 Description

A. This Section specifies furnishing and installing two-component epoxy-resin system for bonding of structural materials and for grouting reinforcing steel, anchor bolts, and base plates.

1.02 Submittals

A. Submit certificate of compliance attesting to compliance of products with the requirements of this Section.

B. Submit manufacturers' application and installation instructions for products.

1.03 Jobsite Conditions

A. Safety

1. Applicators shall wear protective clothing, gloves, goggles and barrier creams. Provide positive ventilation for enclosed spaces.

PART II PRODUCTS

2.01 Materials

A. ASTM C 881; suitable for structural bonding of dry, damp, or wet materials free of standing water; especially suitable for bonding plastic concrete or mortar to sound hardened concrete and suitable, when mixed with aggregate, to prepare high-strength grout for grouting of base plates and anchor bolts; Type, Grade, and Class per ASTM C 881 as follows:

1. Type:

a. Type II for bonding freshly mixed concrete to hardened concrete.

b. Type III for bonding skid-resistant materials to hardened concrete and for mixing with aggregate to formulate high-strength grout for grouting of reinforcing steel, anchor bolts, base plates, and similar items.

2. Grade:

a. Grade 2 for application to horizontal surfaces.

b. Grade 3 for application to vertical surfaces.

3. Class:

a. In accordance with the following temperatures of the hardened concrete to which the epoxy bonding system is being applied:

(1) Below 40° F: Class A

(2) Between 40° and 60° F: Class B

(3) Above 60° F: Class C

B. Properties of Cured Grout Material (Neat)

1. Tensile strength, per ASTM D 638, 14-day cure at 73° F: 3000 psi minimum.

2. Tensile elongation, per ASTM D 638, 14-day cure at 73° F: 1.4 to 3.4 percent.

3. Compressive Strength, per ASTM D 695, 28-day cure at 73° F: 9000 psi minimum.

4. Compressive Modulus, per ASTM D 695, 28-day cure at 73° F: 350,000 psi minimum.

C. Aggregate

1. As recommended by the manufacturer.

D. Degreasing and Etching Chemical

1. Composition and Materials: Blend of organic and inorganic acids with a special solvent system incorporating wetting agents for emulsification.

2. Color: Water White

3. Flash Point: Above 150^0 F.

4. Weight per gallon: 9.0 pounds

PART 3 EXECUTION

3.01 General

A. Mix and apply epoxy compound in accordance with manufacturer's instructions.

3.02 Preparation of Concrete Surfaces

A. Surfaces shall be clean and sound. Surfaces may be dry, damp, or wet, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, and disintegrated materials by mechanical abrasion methods such as sandblasting. Sandblast structural and reinforcing steel to remove loose material and expose sound metal.

B. If the concrete surfaces are sound and it is only necessary to remove laitance, grease or dust, the Contractor may, with the prior written approval of the Engineer, forego sandblasting and wash the concrete with a degreasing and etching chemical applied in accordance with the manufacturer's written instructions and as specified herein.

C. Application of degreaser and etching compound. Pre-wet concrete surfaces with clean water. Brush concentrated cleaner onto concrete surface. Let stand three to four minutes and reapply, brushing stained areas vigorously. Rinse off with fresh water applied at a minimum pressure of 800 psi and a minimum volume of five gallons per minute.

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART I GENERAL

1.01 Description

A. Work Included

Miscellaneous metal fabrications for equipment supports, pipe support frames, structural modifications, etc.

B. Related Work

1. Section 15050: Mechanical-Basic Materials and Methods

2. Section 09900: Painting

1.02 Quality Assurance

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. The Contractor shall submit welder qualifications certificates for all welding personnel employed on this project.

B. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

1.03 Submittals

A. Comply with pertinent provisions of Section 01340.

B. Product Data: Within 10 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this Section, with the work of the adjacent trades;

4. Manufacturer's recommended installation procedures, approved by the Owner, will become the basis for accepting or rejecting the installation procedures to be used on the work.

PART II PRODUCTS

2.01 Materials

A. In fabricating items that will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.

B. Comply with following standards, as pertinent.

1. Steel plates, shapes, and bars: ASTM A36.

2. Steel bars and bar-size shapes: ASTM A36.

3. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.

4. Stainless steel sheets: AISI type 302 or 304, 24 gage, with number 4 finish.

5. Concrete Inserts

a. Threaded or wedge type galvanized ferrous castings of malleable iron complying with ASTM A27.

b. Provide required bolts, shims, and washers, fabricated of stainless steel.

6. Steel plates to be bent or cold framed: ASTM A 283, Grade C.

7. Steel tubing (hot formed, welded or seamless); ASTM A 501.

2.02 Fasteners

A. General

1. Provide stainless steel fasteners.

2. Provide fasteners of type, grade, and class required for the particular use.

B. Comply with following standards as pertinent:

1. Bolts and Nuts: Provide hexagon-head regular type complying with ASTM A307, grade A.

2. Washers

   a. Plain Washers: Comply with Fed Spec FF-W-92, round, carbon steel.

   b. Lock Washers: Comply with Fed Spec Ff-W-84, helical spring type carbon steel.

3. Toggle Bolts: Provide type, class, and style needed but complying with Fed Spec Ff-B-588.

4. Anchorage Devices: Provide Molly Parabolts or equal.

2.03 Other Materials

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Owner.

2.04 Shop Paint

A. Conforming to Section 09900 of this Specification.

2.05 Fabrication

A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Fabricate with accurate angles and surfaces that are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

C. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item.

D. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.

E. The Contractor shall obtain accurate "as-built" measurements before fabrication of any steel members has begun.

PART III EXECUTION

3.01 Site Conditions

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 Coordination

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 Installation

A. General

1. Set work accurately into position, plumb, level, true, and free from rack.

2. Anchor firmly into position.

3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.

4. Grind exposed welds smooth and touch-up shop prime coats.

B. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

END OF SECTION

SECTION 07920
SEALANTS AND CAULKING

PART I GENERAL

1.01 Description

A. Work Included

Throughout the Work, seal and caulk joints and wall penetrations where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of moisture and air. The required applications include, but are not necessarily limited to, the following:

1. Interior building walls and partition walls in concrete masonry, dry wall, metal, plywood and where required to insure a watertight building.

2. Expansion joints in the cast-in-place concrete.

3. All joints between dissimilar materials.

B. Related Work

1. Documents affecting work of this Section include, but are not necessarily limited to, Sections in Division 1 of these Specifications.

2. Section 09900 - Painting.

1.02 Quality Assurance

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 Submittals

A. Comply with pertinent provisions of Section 01340.

B. Product Data

Within 10 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. Manufacturer's recommended installation procedures

which, when approved by the Owner, will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Samples

Upon request of the Owner, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1. Submit samples of each color required (except black) for each type of joint sealer exposed to view. Samples will be reviewed by the Owner for color, installation requirements and performance in this application.

1.04 Product Handling

A. Comply with pertinent provisions of Section 01620.

B. Do not retain at the job site material which has exceeded the shelf life recommended by its manufacturer.

1.05 Job Conditions

A. Examine the joint surfaces and backing, and their anchorage to the structure, and the conditions under which the joint sealer work is to be performed, and correct conditions detrimental to the proper and timely completion of the work and performance of the sealers. Do not proceed with the joint sealer work until unsatisfactory conditions have been corrected.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range.

PART II PRODUCTS

2.01 Material, General

A. Sealant for interior walls shall be a two-part Polyurethane-Dynatrol II manufactured by Pecora or approved equal, color to match adjacent surfaces.

B. Joint Beads

Extruded Polyethylene foam rod equal to one of the following:

1. Ethafoam SB - Dow Chemical.

2. Minicel Backer Rod - Hasken, Inc.

NOTE: Bead diameter shall be 40% greater than width of joint.

C. Primer shall be of the type recommended by the manufacturer of the sealant. Primers shall be non-staining.

D. The sealant for expansion joints cut in the concrete flooring system shall be Flexjoint Pouring Grade Sealant, by ATO Chem, or equal.

E. Caulking shall be Tremco Acrylic Latex Caulk or equal.

F. Joint back-up filler 1/4" or deeper - closed cell neoprene, polyurethane foam rod, or polyethylene foam rod.

PART III EXECUTION

3.01 Surface Conditions

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 Preparation

A. Concrete and Ceramic Tile Surfaces:

1. Install only on surfaces which are dry, sound, and well brushed, wiping free from dust. At open joints, remove dust and trapped solid materials by mechanical methods or compressed air as required.

2 To remove oil and grease, use sandblasting or wire brushing.

3 Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.

4 Remove laitance and mortar from joint cavities.

B. Steel Surfaces:

1. Steel Surfaces in Contact with Sealant:

a Sandblast as required to achieve acceptable surface for bond.

b. If sandblasting is not practical, or would damage adjacent finish, scrape the metal or wire brush to remove mill scale and rust.

c. Use solvent to remove oil and grease, wiping the surfaces with clean white rags only.

2. Remove protective coatings on steel by sandblasting or by using a solvent which leaves no residue.

C. Aluminum Surfaces:

1. Aluminum Surfaces In Contact With Sealant:

a. Remove temporary protective coatings, dirt, oil and grease.

b. When masking tape is used for protective cover, remove the tape just prior to applying the sealant.

2. Use only such solvents to remove protective coatings as are recommended for that purpose by the manufacturer of the aluminum work, and which are non-staining.

3.03 Installation of Backup Material

A. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.

B. Installation Tool

1. For installation of backup material, provide a blunt-surfaced tool of wood or plastic, having shoulders designed to ride on the adjacent finished surface and a protrusion of the required dimensions to assure uniform depth of backup material below the sealant. Do not, under any circumstance, use a screwdriver or similar tool for this purpose.

2 Using the approved tool, smoothly and uniformly place the backup material to the depth indicated on the Drawing or otherwise required, compressing the backup material 25% to 50% and securing a positive fit.

3.04 Priming

A. Use the primer approved by the Owner for the particular installation, applying in strict accordance with the manufacturer's recommendation approved by the Owner.

3.05 Bond-breaker Installation

A. Provide an approved bond-breaker where recommended by the manufacturer of the sealant, and where directed by the Owner, adhering strictly to the manufacturer's installation recommendations.

3.06 Installation of Sealants

A. Prior to start of installation in each joint, verify the joint type according to details on the Drawings, or as otherwise directed by the owner and verify that the required proportion of width of joint to depth of joint has been secured.

B. Equipment:

1. Apply sealant under pressure with power-actuated hand gun or manually-operated hand gun, or by other appropriate means.

2. Use guns with nozzle of proper size and providing sufficient pressure to completely fill the joints as designed.

C. Thoroughly and completely mask joints where the appearance of primer or sealant on adjacent surfaces would be objectionable.

D. Install the sealant in strict accordance with the manufacturer's recommendations, thoroughly filling joints to the recommended depth.

E. Tool joints to the profile shown on the Drawings, or as otherwise required are such profiles are not shown on the Drawings.

F. Cleaning Up:

1. Remove masking tape immediately after joints have been tooled.

2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.

3. Upon completion of the work of this Section, promptly remove from the job sit all debris, empty containers, and surplus material derived from this portion of the Work.

END OF SECTION

SECTION 11200
EQUIPMENT

PART I GENERAL

1.01 Description

A. Work Included

1. The scope of work includes the installation and interconnecting assemblage of the new equipment provided under the specifications. See Dwgs. P-1 & P-2.

   a. Two (2), Pressure Bladder Tanks (PPT-1, PPT-2);
   b. One (1), Triplex Distribution Booster Pump systems (P-201 A/B/C);
   c. One (1), Water Storage Tank (T-200);
   d. One (1), Cartridge Filter (CF-1);
   e. One (1), Well Level Transducer (LT-100);
   f. One (1), Mechanical Flowmeter (FQI-100);
   g. One (1), Storage Tank Pressure (level)Transducer (PT-201);
   h. One (1), Distribution System Pressure Transducer (PIT-202);
   i. One (1), Distribution Flow Meter and Transmitter (FE/FIT-203);
   j. One (1) pH Sensor and Monitoring System (AE/AIT-204);
   k. One (1), PLC Monitoring & Alarm Panel;

2. Installation of new piping, valves, fittings, etc. as required to provide a complete, functional system.

3. Installation of appurtenances, accessories and related equipment items as provided or necessary to complete the installation of all equipment.

4. Providing all necessary pipe supports, anchors, placement devices and supplementary steel for hanging, placement and support of all equipment, piping, valves, fittings and specials.

6. Installation of all instrument wiring, power distribution, accessories and appurtenances.

7. Cleaning, check-out, startup and testing of all equipment.

B. Related Work Described Elsewhere

1. All wiring, disconnect switches, thermal protection, power feed, and control instrumentation for motors and equipment shall be furnished and installed under Division 16, Electrical.

2. All piping, supports, fittings, valves, specialties etc. shall be furnished and installed under Division 15, Mechanical.

1.02 Quality Assurance

A. Only skilled workmen regularly employed and engaged in the installation of the materials specified shall be employed.

B. At the request of the Owner, Contractors employing welding operators shall be prepared to furnish proof of the competency of each operator.

C. Applicable Publications

Standards of the American Society for Testing and Materials (ASTM), latest Edition.

1.03 Submittals

A. Shop Drawings, maintenance data and operating instruction for all equipment, accessories, appurtenances and materials shall be submitted to the Owner.

B. Shop Drawings shall include all dimensional data, installation details and requirements, utilities requirements, materials of construction, fabrication details and all other information necessary to provide a full and complete evaluation of the submitted material.

C. All submittals shall comply with the pertinent provisions of Section 01340 of this Specification.

PART II PRODUCTS

Not applicable in this Section. Refer to the Equipment Procurement Specifications, other sections of this Specification and the Design Drawings for the necessary information.

PART III EXECUTION

3.01 Delivery, Storage and Handling

A. The Contractor shall be responsible for the delivery of equipment components and materials procured by the Contractor, to the jobsite. The Contractor shall be responsible for providing detailed instructions and procedures of the handling and storage of each equipment or material item.

B. As is deemed necessary by construction scheduling, equipment requiring storage shall be stored in areas provided by the Owner, in accordance with Vendor recommendations.

D. All handling, placement and installation of the equipment shall be by the Contractor in accordance with the Vendor recommendations. The Contractor shall be responsible to remedy any and all damage or impairment due to improper handling of said equipment.

3.02 Cleaning and Inspection

A. Clean piping, ducts and equipment of all foreign substances inside and out before being placed in operation.

B. If any part of a system should be clogged or fouled by foreign matter when being placed into operation, disconnect the system, clean and reconnect wherever necessary to locate and remove obstructions. Repair or replace any work damaged in the course of removing obstructions when the system is reconnected, at no additional cost to the Owner.

C. Carefully inspect all pipe, fittings, equipment, and accessories prior to installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately. All pipe, fittings, equipment and accessories shall have factory affixed markings, stampings or nameplates with sufficient data for identification to determine their conformance with specified requirements.

D. Exercise all necessary care to prevent entry of foreign matter into piping, fittings and equipment or to install any item that is not clean. During construction, until system is fully operational, all openings in piping and equipment must be kept closed at all times except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.

3.03 Installation

A. All equipment shall be installed by the Contractor in conformance with the equipment manufacturer's recommendations and requirements.

B. Anchorage Systems

1. Anchor bolts and other anchorage items, as specified by the manufacturer, to be embedded in concrete as well as installation templates shall be furnished by the Contractor.

2. All equipment shall be installed plumb, on level mounting bases, with vibration protection as necessary.

C. Pipe Connections

1. All pipe connections and elevations shall be confirmed and coordinated with the Owner prior to the start of installation.

2. Provide flanges at all final connections to equipment, to facilitate dismantling. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

3. Unless otherwise indicated, install, and supply piping, including shut off valves and strainers to coils, pumps and other equipment, at line size with reduction in size being made only at inlet to control valves or pumps. Install supply piping from outlet of control valve at full size to connection of equipment served.

4. Connections of the piping to the equipment with bolts more than finger-tight will not be permitted until the equipment has been leveled, grouted in, and the installation inspected and approved by the Owner and the manufacturer of the equipment. In the event the piping does not exactly match the equipment connection, the piping installation shall be revised until it does match those connections. In the case of flanged connections, it must be possible to insert the bolts by hand without "springing" the piping.

5. All piping connections to pumps and other equipment shall be made in such a manner as to avoid any strain being transmitted from the piping to the equipment. Flanged piping shall be carefully installed to that the pipe flanges exactly match and are perfectly parallel to the flanged equipment connections.

6. All packing, gaskets, discs, seats, diaphragms, lubricants, etc., shall conform to recommendations of the manufacturer for the intended service.

D. Access

1. Make easily accessible all equipment such as dampers, controls, valves, etc., and any and all other equipment and apparatus, as may be required to be reached for operation and maintenance.

2. No work shall be closed in, covered and/or hidden from view before it has been examined and approved by the Owner.

E. Interconnecting Wiring: All interconnecting wiring shall be as presented on the Drawings and the Owner approved Shop Drawings.

3.04 Inspection

A. The Contractor shall furnish and install the necessary lubricants for initial startup and operation of each item of equipment as recommended by the manufacturer. In

addition, he shall furnish the Owner a three-month' supply of all necessary lubricants and greases of the recommended types.

B. Immediately prior to operation of any item of equipment the installation thereof shall be carefully inspected and checked by a competent and experienced representative of the Vendor and by the Owner. The Vendor representative shall make necessary adjustments, review the installation and instruct plant-operating personnel in operation of the specific equipment. Written notice of approval shall be furnished to the Owner, by the Vendor.

END OF SECTION

SECTION 16010
ELECTRICAL - GENERAL PROVISIONS

PART I GENERAL

1.01 Description

A. Work Included

1. The electrical work includes the following:

   a. Complete interconnecting power distribution wiring.
   b. Grounding.
   c. Testing.
   d. Connection to and installation of all instruments, instrument cabinets and panels.
   e. Removal of existing electrical equipment & wiring as indicated on Electrical Plan.
   f. Complete installation of stand-by generator & associated equipment.

2. Provide all conduit; conduit fittings, junction boxes and fittings; conduit hangers, clamps and supports; pull boxes; splice boxes; wires and cables; insulating materials; wire connectors; ground connectors; identification nameplates; tags; and all other equipment and accessories necessary, implied or specified herein or indicated on the Drawings or schedules, including all necessary anchors, sleeves, hangers, and such other items as may be required for attaching or connecting this work to the work of others.

3. Work to be performed, furnished, installed, located, set or connected by others as listed or described herein or in other sections of these specifications shall be coordinated with the electrical contractor.

4. The Contractor shall familiarize himself with the existing facilities and difficulties by visiting the job site and shall be responsible for the execution of all the work related to these specifications. No claims will be allowed resulting from any discrepancies.

B. Related Work Described Elsewhere

1. The responsibility for electrical work and items in connection with electrically operated equipment furnished by others or under other divisions of these specifications is as follows:

   a. Equipment sections: Furnishing power and control wiring, control interlocks and miscellaneous equipment.

1.02 Materials and Workmanship

A. All the materials shall be new and shall conform to the standard of the Underwriters' Laboratories, Inc. in every case where such a standard, listing or label has been established for the particular type of material in question.

B. Laws and regulations. The installation shall comply with all State and local laws and regulations applying to electrical installations in the applicable City or Town, with all applicable requirements to the National Electrical Code and its latest revisions.

C. The electrical contractor shall obtain all permits, pay all fees and give all proper authorities all requisite notices.

D. Names of manufacturers, catalog numbers, models or types, when used in this Section of the Specifications and the included drawings, are intended to indicate the standards of type and quality of material, when apparatus or equipment is mentioned, any first-class product made by a reputable manufacturer may be used providing it conforms to the requirements of these Specifications and meets with the approval of the Owner.

1.03 Drawings

A. The Drawings illustrate the layout of the ELECTRICAL work and indicate the approximate locations of apparatus and equipment. The exact routing of conduit shall be determined by the structural conditions and other obstructions as determined by final field measurements made at the time of the installation. This shall not be construed to mean that the design of the systems may be changed but refers only to exact runs of conduit between given points.

B. Review all Drawings that affect the location of any apparatus and equipment to avoid possible interference and permit full coordination of all work. The right to make any reasonable change in location of apparatus and equipment up to the time of roughing-in is reserved by the Owner and such change shall be made without additional expense to the Owner.

C. It shall be the responsibility of the Contractor to see that all electrical equipment such as junction and pull boxes, controls and such other apparatus as may require maintenance and operation from time to time is made easily accessible. Although the equipment may be shown on the Drawings in certain locations, the construction may disclose the fact that such locations do not make its position readily accessible. In such cases, this contractor shall call the attention of the Owner to the condition before advancing the construction to a state where a change will reflect additional expenses.

1.04 Shop Drawings and Samples

A. Before ordering material shipped to the job, submit shop drawings for approval giving all dimensions and details. Each drawing shall be marked for this project.

B. Shop Drawings and samples shall be provided in accordance with Section 01340 of these Specifications.

C. General bulletins or catalogs will not be accepted as Shop Drawings unless the equipment on which approval is to be obtained is specifically marked and all information pertaining to the item, including dimensions were required for installation, is included.

D. In case any of the above materials are delivered or installed on the job for which Shop Drawings or requests samples have not been approved and/or which are not in accordance with the Specification, the Contractor will be required to remove such materials and substitute approved materials at his own expense and as directed.

1.05 Guarantee

A. The Contractor shall guarantee all systems, to be free from short circuits, open circuits, loose connections over-heating and such other defects.

1.06 Equipment and Scaffolding

A. The Contractor performing work under this section shall be responsible for furnishing all tools and equipment, scaffolding and other temporary construction required for the execution of the work.

1.07 Inspection and Tests

A. All connections at cabinets, switches, circuit breakers and all splices shall be made at the time of final inspection and testing. All circuits shall be continuous from service switches to each panel. Each system shall test free from short circuits and ground and shall have an insulation resistance between conductors and ground based on maximum load not less than requirements of the latest edition of the National Electrical Code.

B. Voltages shall be tested at the line side of the main secondary breaker with all circuit breakers in the open position.

C. The Contractor shall be responsible for correct voltages, and correct phase designations on all equipment.

D. All testing equipment necessary to satisfactorily conduct the tests mentioned above shall be provided. The tests shall be made under the direction of the Owner at no additional expense to the Owner.

E. Failure or defects in workmanship or materials revealed by tests or inspection shall be corrected promptly and tests shall be repeated. Defective material shall be replaced promptly at no additional expense to the Owner. The results of all tests conducted shall be forwarded in writing to the Owner, insofar as practical a normal full load test shall be made on the power and lighting systems.

1.08 Notification

A. The Contractor shall arrange with the Owner for all switching and connecting on all electric lines.

1.09 Coordination

A. 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 the various phases of construction and before the ordering or fabrication of the various parts of the work, so as to ensure compliance with the Drawings and Specifications, and as necessary to provide the installations complete and in satisfactory operating condition.

END OF SECTION

SECTION 16100
BASIC MATERIAL AND METHODS - INTERIOR

PART I GENERAL

1.01 Description

A. Work Included

1. The work covered by this Section of the Specifications includes the furnishing of all labor, equipment, appliances and materials, and performing all operations in connection with providing and installing the interior electrical work, complete, in strict accordance with this Section of the Specifications and the applicable Drawings and subject to the terms and conditions of the Contract.

B. Related Work Described Elsewhere

1. Division 15 – Mechanical

2. Applicable requirements of Section 16010 shall apply to this Section.

3. Section 01510 - Temporary Utilities

PART II PRODUCTS

2.01 Raceway Systems

A. All conductors for feeders, branch circuits and controls, shall be installed in raceways as herein specified and as indicated. Raceways shall be of the sizes indicated and shall bear the label of the Underwriter's Laboratories, Incorporated. Raceways shall include rigid polyvinyl chloride (PVC) conduit & liquidtight flexible PVC conduit.

B. Raceways shall be installed as follows:

1. Conduits installed shall be Schedule 40 polyvinyl chloride (PVC).
2. All conduits shall contain a grounding conductor.

C. Liquidtight flexible PVC conduit shall be furnished and installed where indicted and for final connections to motors, transformers, and equipment. Exposed (in view) liquid tight flexible conduit to motors, transformers and devices shall not exceed 18 inches; other lengths shall be as required. Liquidtight flexible conduit shall be Anaconda Metal Hose Company, "Sealtite" type "UA".

D. Supports shall be provided for conduit at distance as required by the NEC. The supports shall consist of approved types of clamps or straps required for type of conduit secured by screws, bolts or expansion bolts.

E. Expansion fittings shall be provided at building expansion joints. Expansion fittings shall be PVC.

F. Vapor seals shall be installed at all locations required by the National Electrical Code.

2.02 Boxes and Fittings

A. Provide junction boxes, pull boxes and conduit bodies as indicated, specified herein or wherever they shall be necessary to facilitate the pulling of wires and cables.

B. Junction or pull boxes not over 100 cubic inches in size shall be standard outlet boxes. Junction and pull boxes over 100 cubic inches in size shall be constructed of PVC with screw covers and gaskets. Boxes shall be secured in position independently of conduits entering them. Boxes shall be installed so they are readily accessible.

C. Outlets and boxes shall be secured to conduit by means of locknuts (inside and outside) and insulating bushings.

D. Boxes and fittings shall be PVC.

2.03 Wires and Cable

A. All wire and cable shall be of the sizes, wire numbers and types shown on the Drawings or specified herein and be provided by the Electrical Contractor.

B. All wire and cable work shall be in strict accordance with the requirements of the National Electrical Code and its latest revisions, both with respect to material and workmanship except where insulation thickness and covering are required by these Specifications in excess of Code requirements.

C. The minimum size wiring for power branch circuits and all circuits emanating from panelboards shall be a minimum of No. 12 AWG. Minimum size for control and signal wiring shall be a minimum of No. 14 AWG.

D. All wiring within the building shall be Type THWN/THHN. All wiring shall have insulation thickness for 600 volts in accordance with the National Electrical Code with dual rating of 75 degrees C. wet/90 degrees C. dry.

E. Wire and cables shall be single conductor except where otherwise specified or indicated on the Drawings. Conductors of sizes No. 6 AWG and larger shall be stranded. Wires of sizes smaller than No. 6 AWG shall be solid.

F. Conductors shall be soft-drawn copper and have a conductivity of not less than 98 percent of ASTM standards for annealed copper.

G. Wires and cables shall be carefully handled during storage and installation to avoid mechanical injury to the conductor, insulation and covering.

H. Wires and cables shall be as manufactured by the Okonite Company, General Electric Company, Plastic Wire and Cable Company, or an approved equal.

I. "Y ER EAS", or and approved equal, shall be used as a lubricant where necessary when pulling wire or cable. No wire or cable shall be pulled into the circuit system until all work which could cause injury to the wiring has been completed. All wires and cables shall, insofar as practicable, be continuous from origin to termination without running splices. The installation of wires and cables shall include the provision of all hanger, racks, cable cleats and supports necessary to make a neat and substantial installation.

J. Each feeder cable in pull boxes, panels and at equipment shall be tagged with the proper feeder number and phase designation. Wires and cables of all branch circuits shall be identified by adhesive bands as manufactured by Brady Metal Products, Thomas and Betts or an approved equal.

K. The Electrical contractor shall use feeding tubes where cables pass into mouth of conduits. To avoid injury to sheathing, cable shall not be subjected to a bending radius less than 6 times its overall diameter.

2.04 Gutter Wiring

A. All gutter wiring in panels and such other equipment shall be neatly formed and tied with cable ties and straps. The ties and straps shall be Burndy, General Electric, Thomas and Betts Company, Types TY-5, TY-15, TY-25 and TY-35 or an approved equal.

2.05 Color Coding

A. All sizes of wires and cable shall be factory color-coded with a separate color for each phase and neutral used consistently throughout the power and lighting systems. The neutral wire of all branch circuits shall have a white covering and all connections to single pole switches shall be so made that the operation of the switch opens the ungrounded conductor. Color coding shall be as listed below:

B. 480 Volts, 3 Phase, 4 Wire System:

1. Phase A - Brown
2. Phase B - Orange
3. Phase C - Yellow
4. Neutral - Gray

C. 120/208 Volts, 3 Phase, 4 Wire System:

1. Phase A - Black

2. Phase B - Blue
3. Phase C - Red
4. Neutral - White

D. All grounding conductors shall have green insulation.

E. Sizes AWG #4 and larger may be taped for color coding, providing all exposed cables outside of raceways be completely color-taped or printed in accordance with IPCEA S-19-81 Method 3.

2.06 Caulking Compound

A. The plugging for conduits and ducts shall be of putty-like consistency workable with the hands at temperatures as low as 35^{o} F., shall not slump at a temperature of 300 degrees F., and shall not harden materially when exposed to air. The compound shall readily caulk and adhere to clean surfaces of fiber conduit, concrete, masonry, lead, rubber, polychlorprene, polyvinylchloride and the common metals. The compound shall have no injurious effects on the materials or the hands of workman. The compound shall form a seal with the above-mentioned materials without dissolving, noticeably changing characteristics or removing any of the ingredients.

2.07 Nameplates and Indexing

A. Equipment not normally supplied with directory frames, whether supplied under this Section or other Sections of these Specifications, shall be provided with dark engraved Bakelite nameplates with engraving through to white core. Nameplate markings shall be approved by the Owner. Only a part of the required nameplates are indicated. Nameplates on boxes shall supplement painting.

B. Engraved Bakelite nameplates with engraving through to a white core shall be provided on the following equipment including equipment provided under other Sections:

1. Panelboards and power centers.
2. Control panels.
3. Boxes.
4. Motor starters and controls
5. Any other unit of equipment shown on the Drawing and/or directed by the Owner.

C. All nameplates for equipment 120 volts and above shall indicate voltage.

2.08 Motor and Control Wiring

A. Unless otherwise noted, the work under all electrical sections of the Specifications shall include providing all conductors, raceways and connections necessary to operate motors and their control and signal equipment. This shall include all wiring indicated on all or any of the Contract Drawings for pumps, pressure switches, motor starters and such other related items

as may be furnished under any division. The Contractor shall provide a suitable fused disconnect switch for each motor and its controller.

B. Unless otherwise noted, the work under this Section of the Specifications shall include all conductors, raceways and connections necessary to operate motors and their control for collateral equipment installed under other sections and Owner's equipment.

C. Motor starters shall be full voltage, non-reversing combination fused disconnect switch magnetic motor starters. Starters shall be size 1 minimum rated at 600 volts maximum, and shall be furnished with three universal type auxiliary contacts and over current protection in all phases. A 120 volt control transformer shall be provided with each starter. The combination starters located in the passivation room shall have NEMA 4X fiberglass enclosures and hand-off-automatic selector switches. The starters located in the pretreatment room shall be NEMA type 12 complete with stop/start push-button control stations. Starters shall be as manufactured by Cutler Hammer, Allen Bradley or an approved equal.

D. Motor controls, selector switches and push button stations, pilot lights and accessories shall be heavy duty oil tight type and rated for 480 volts. Motor controls shall be as manufactured by Cutler Hammer, Allen Bradley or an approved equal.

2.09 Grounding

A. All conduit, supports, transformers, breakers, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code.

B. Every non-metallic raceway shall include a grounding conductor which shall be connected as required by the National Electrical Code. Sizes of grounding conductors shall be in accordance with Table 250-95 of the National Electrical Code.

C. The grounding system shall have a resistance not greater than 25 ohms and shall be measured prior to placing equipment in operation. Water meters shall be bonded around with copper jumper.

D. All ground connectors shall be clamp style and bolts, nuts and washers other components of the connectors shall assure a permanent corrosion-resistant assembly. Connectors shall be as manufactured by Burndy Engineering Co. Inc., Thomas and Betts Co., Cadweld by Erico Products Company, or an approved equal.

E. All building steel, water, sewage and gas piping shall be grounded with a common ground.

END OF SECTION

SECTION 16200
TESTING AND COORDINATION OF SYSTEMS

PART I GENERAL

1.01 Work Included

A. Furnish all plant, labor, equipment, appliances, and materials, and perform all operations in connection with testing the systems and providing complete short circuit and coordination studies, in strict accordance with this section of the Specifications and the applicable Drawings, and as directed, complete in place and accepted, and in satisfactory operating conditions.

1.02 Related Work Described Elsewhere

A. Applicable requirements of Section 16010 shall apply to this section.

PART II PRODUCTS

(None for this section)

PART III EXECUTION

3.01 Testing

A. During the progress of the work it shall be subject to the inspection of the Owner and to such other inspectors as may have jurisdiction, including those of the local Electrical Inspector.

B. As the various parts of the work are installed and completed the Contractor shall make preliminary insulation resistance tests to insure that the systems are free from short circuits and grounds and that all connections, switches, controls and equipment are in proper operating condition.

C. At the time of final tests, all splices must be completed and all connections made at equipment, apparatus, cabinets panelboards, circuit breakers, switches, starters, grounding and such other items for all electrical systems. All circuits, feeders, lines and controls must be continuous for services to each and every outlet. Functional tests as may be required to satisfy the owner that the work has been accomplished as intended by the specifications and drawings, and to prove the integrity of the work shall be made.

D. The insulation resistance between conductors and between conductors and grounds for the secondary distribution systems shall be not less than the requirements of the latest edition of the National Electrical Code.

E. The Contractor shall be responsible for correct voltages, tap settings, trip settings and correct phasing on all equipment. Secondary voltages shall be measured at the line side of the main breakers with the breakers in an open position, at panelboards, and at such other locations on the distribution systems and branch circuits as directed by the Owner.

F. High voltage D.C. tests shall be provided as specified under Section 16100.

G. Measure minimum and maximum voltages, measure voltage between phase wires and neutral, and immediately deliver to the Owner a report on all voltage measurements.

H. Malfunctions on the above-mentioned equipment shall be promptly corrected with assistance from the manufacturer of the equipment.

I. Failure or defects in workmanship or materials revealed by tests shall be corrected promptly and tests shall be reconducted. Defective materials shall be replaced promptly at no additional expense to the Owner. The cost of electrical current for all tests shall be paid for by the Contractor. The results of all tests conducted by the Contractor shall be forwarded in writing to the Owner. A full load test shall be made on the power systems.

END OF SECTION

EQUIPMENT PROCUREMENT SPECIFICATION
PUBLIC WATER SUPPLY

FOR

ROUTE I-95 REST AREA TOURIST INFORMATION CENTER PUBLIC WATER SYSTEM UPGRADE

FOR

RHODE ISLAND DEPARTMENT OF TRANSPORTATION
2 CAPITOL HILL
PROVIDENCE, RHODE ISLAND
02903

PWS ID RI2980178

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PART I GENERAL

1.01 Work Included

A. This specification includes all equipment, materials, labor, fabrication, components, accessories and appurtenances necessary to upgrade and improve the existing public water supply and distribution system that will serve the Rhode Island Welcome Center located in Richmond, RI. The scope of equipment to be provided shall include all accessories and appurtenances, whether or not specifically mentioned or fully detailed, but which are deemed necessary or reasonably required to render the furnished equipment in complete and fully operable condition. The system components to be furnished by the Vendor are as follows:

1. One (1) 230 VAC single Phase 3 HP well pump replacing existing
2. One (1), 5,025 gallon, single-wall, HDPE, Water Storage Tank, including supports, manway, connection fitting, lifting lugs, anchors tabs, accessories and appurtenances, as specified herein;
3. One (1) triplex, skid-mounted, Booster Pump System, including three (3) centrifugal booster pumps, pump suction manifold with isolation valves, pump discharge manifold with isolation and check valves, pressure gages, steel channel base, frame mounted controls, three (3) variable frequency drives, accessories and appurtenances. The triplex skid control panel is fed with 240V single phase which is the only supply available on site. That is the input voltage to the VFD's. the VFD's output 3-phase 208V to the three 2 HP pumps.
4. Two (2), Pressure Bladder Tanks;
5. One (1), leg-supported, Cartridge Filter System;
6. One (1), PLC-based monitoring, interlock and control panel including programming, operator interface, panel-mounted instruments and gages, pre-wired and factory tested.
7. Field-Mounted Instrumentation including:
   a. Two (2) Well Pump Pressure Switches;
   b. One (1) Potable Water Storage Tank Fill Isolation Ball Valve, with Electronic Positioner;
   c. One (1) Potable Water Storage Tank Pressure Transducer Level Sensor and Transmitter;
   d. One (1) Distribution Flowmeter and Transmitter;
   e. One (1) Distribution Pressure Transducer and Transmitter;
   f. Two (2) Well Pressure Transducers and Data Loggers;
8. Field-Mounted Instrumentation including:
   a. One (1), Distribution pH Sensor, Transmitter, Monitor/Analyzer and Recorder;

B. A**ll equipment, mechanical and plumbing devices, media, chemicals, lubricants, joining and sealing materials and other materials furnished for use in this potable water treatment system shall conform to ANSI/NSF 60-1988 or ANSI/NSF 61-1991, where applicable.**

C. All Vendor bids shall be submitted to the following:

Northeast Water Solutions, Inc.
567 South County Trail
Suite 116
Exeter, RI 02822
Attn: Mr. Robert F. Ferrari, PE

D. The Vendor shall assume the responsibility of providing equipment and components of high quality and proven operation.

1.02 Work by Vendor

A. The term "Vendor" shall refer to the equipment manufacturer or representative submitting a proposal in accordance with this Specification.

B. The Vendor shall satisfy all conditions of this specification, including but not limited to submittal of all information requested. Refer to Part I, Section 1.04 of this Specification for Vendor submittal requirements.

C. All Vendor quotations provided in response to this specification shall include freight (FOB) to Rhode Island Welcome Center, Located on I-95 north between exits 4 and 7 in Rhode Island, including taxes, and any other costs. Vendor bids shall be valid for a minimum of sixty (60) days from the date of submittal.

D. The Vendor shall furnish the equipment as specified herein. The equipment shall include all accessories and appurtenances, whether or not specifically mentioned or fully detailed, but which are deemed necessary or reasonably required to render the furnished equipment in complete and fully operable condition.

E. The Vendor shall furnish all supervision, labor, materials, tools, equipment and supplies necessary to perform final system fabrication design, fabrication, factory testing, and delivery of the equipment. The Vendor shall be responsible to certify that system components provided by sub-vendors and/or subcontractors comply with this Specification.

F. The Vendor shall provide three (3) copies of the complete operations and maintenance manual (O&M), as well as all installation instructions for each item of equipment provided.

G. The Vendor shall furnish all special tools required for routine service and maintenance on equipment furnished as specified herein. The special tools supplied for each specific piece of equipment or system component shall be packaged separately and labeled to clearly indicate with which item of equipment they are to be used. The Vendor shall provide written notification to the Owner with this Proposal of any special tools, instruments or other equipment necessary for the installation, checkout, calibration, startup, or operation of the

system.

H. All equipment and systems provided shall comply with or exceed all local, State, and Federal codes in effect at that time. The water storage tank, distribution pumps, cartridge filter housing and cartridges, pressure bladder tanks, piping, valves, fittings and all accessories and appurtenances shall conform to ANSI/NSF 61. All electrical work shall be in accordance with the latest edition of NFPA 70, the National (USA) Electrical Code. All equipment shall be supplied and/or manufactured in the United States of America unless specifically approved by the Owner.

1.03 Owner Responsibilities

A. The "Owner" refers to Rhode Island Department of Transportation, Two Capitol Hill Providence, Rhode Island, 02903 or their authorized representative.

B. The Owner shall provide access to the job-site and Pump House to receive smaller equipment components. The atmospheric water storage tank and the distribution pump skid shall have delivery scheduled such that it can be delivered, off-loaded and installed directly onto prepared housekeeping pads within the Pump House, with no on-site storage.

C. The Owner shall provide the necessary utilities including electrical power, heat, lighting, water and ventilation for the installation and operation of the equipment and systems.

D. The Owner shall provide a clean, dry, weather tight Pump House with a level, finished reinforced concrete floor and minimum interior clearance as shown on the plans clear height.

1.04 Vendor Submittals

A. Submittals Provided With Proposal:

1. One (1) original signed quotation proposal plus all specified supporting documentation.

2. Statement of materials and workmanship warranty.

2. Statement of delivery schedule from date of Receipt of Order. The schedule shall assume a 1-week turn-around time for Shop Drawing Review.

B. Shop Drawing and Equipment Documentation Submittals

1. Fabrication of the equipment shall not start until final shop drawings are approved by the Owner. Any rework required as a result of fabrication prior to Owner approval of Shop Drawings, shall be done at the expense of the Vendor. The

Owner shall review all shop drawings and other submittals, returning one (1) copy of each document to the Vendor designated either "Acceptable", Rejected", or "Revise and Resubmit as Noted".

a. Documents which are "rejected" must be a modified, corrected or re-designed as required, with new documents submitted to the Owner for approval, prior to initiation of fabrication.
b. Documents which are noted "Revise and Resubmit as Noted" must be re-submitted for final review by the Owner after the noted corrections are made. Each shop drawing and other document submittal shall be limited to a maximum of one (1) re-submittal. Reviews of subsequent re-submittals in addition to that specified above shall be at the expense of the Vendor.

2. All Shop Drawings shall be submitted on standard "A" size (8.5" x 11") or “D” size 24" x 36" drawings, unless otherwise approved by the Owner. Each Shop Drawing submittal shall consist of three (3) black line copies of all drawings and all other information.

3. Shop Drawings and related documents shall be provided for the water storage tank and accessories, booster pumps, pump drives and controls systems, pressure-bladder tanks, cartridge filter, electronic ball valve, instrumentation components and the monitoring & control panel, at a minimum. The shop drawings shall include the equipment manufacturers’ standard data sheets, exploded view mechanical diagrams, wiring diagrams, parts lists and standard informational literature. The monitoring & control panel drawings and documentation shall include a panel elevation drawing, wiring diagrams, ladder logic diagrams and termination list, at a minimum.

4. The Potable Water Storage Tank submittals shall include the following:

a. Tank dimensions; plan, elevations and sections;
b. Fitting and connection identification and details, lifting lug details;
c. Accessories including vent fittings, support saddles, etc.;
d. Tank anchor bolt details;
e. Statement of conformance to UL, NFPA, AWWA, NSF 61, ASTM and ASME standards;
f. Statement of shipping dead load weight;

C. Submittals Prior to Shipment of Equipment

1. The Vendor shall submit three (3) copies of the installation procedures and operation and maintenance manual for the tank provided.

a. Detailed drawings and list of all tank components and fittings, model numbers, sizes and manufacturer.
b. Tank installation procedures, including positions of lifting lugs and

methods of lifting and setting in place; anchoring; grounding; installation of accessories, access ladder and platform; hydrostatic testing; field installation of insulation; etc.

c. Equipment maintenance description, both preventive and corrective, with suggested daily, weekly, monthly, semiannual and annual inspections and procedures. This should include trouble-shooting guide in tabular format listing malfunction symptoms, probable causes and remedies.

d. Spare parts list indicating recommended quantities.

1.05 Quality Assurance

A. General

1. The Vendor shall perform all factory tests necessary to ensure that materials and workmanship are in accordance with the specifications including all tests called for by applicable codes.

2. In the event of failure to meet the equipment or component performance specifications or test requirements, the Vendor shall change, replace, adjust or otherwise correct and retest the equipment to obtain the specified performance.

B. Welding

1. Qualification of welders and procedures shall be at Vendors expense.

2. All welding procedures and welder certificates shall be made available for inspection by the Owner.

C. Codes, Standards and Regulations

The design, fabrication, materials, workmanship, installation, erection and testing shall be in accordance with the edition in force at the time of contract award, of applicable portions of the following codes, standards, regulations and ordinances:

1. American Iron and Steel Institute (AISI) Publications – Latest Edition:

2. American National Standards Institute (ANSI) Standards – Latest Edition:

a. B31.1 Power Piping Code;
b. B16.5 Pipe Flanges and Flanged Fittings;

3. American Society for Testing and Materials (ASTM) Standards – Latest Edition:

a. A36-81a Structural Steel;
b. D648 Heat Distortion Temperature;

c.	D638	Tensile Properties;
d.	D790	Flexural Properties of Plastic;
e.	D883	Definitions of Terms Relating to Plastics;
f.	D1505	Density by Density Gradient Technique;
g.	D1693	Environmental Stress Crack Resistance;
h.	D1921	Particle Size (sieve analysis) of Plastic;
i.	D2765	Degree of Cross-Linking Ethylene Plastics as Determined by Solvent Extraction;
j.	D2837	Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials;
k.	D3892	Practice for Packaging/Packing of Plastics;
l.	F412	Definitions of Terms Relating to Plastic Piping;
m.	ARM Std.	Low Temperature Impact Resistance (Falling Dart Test);

4. American Welding Society (AWS) Standards – Latest Edition:

a.	B3.0-77	Welding Procedure and Performance Qualification;
b.	D1.1-82	Structural Welding Code;

5. Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. (MSS) Publications – Latest Edition:

a.	SP58	Pipe Hangers and Supports - Materials, Design and Manufacture;
b.	SP69	Pipe Hangers and Supports - Selection and Application;

6. National Fire Protection Association (NFPA) Publication – Latest Edition:

a.	No. 70	National Electrical Code – Latest Edition

7. Steel Structures Painting Council (SSPC) Specifications – Latest Edition:

a.	PA 2-1982	Measurements of Dry Paint Thickness with Magnetic Gages

8. National Society of Mechanical Engineers (ASME) – Latest Edition;

a.	RTP-1	Reinforced Thermoset Plastic Corrosion Resistant Equipment;

9. Electrical materials, design, fabrication and workmanship shall conform to the latest edition of the applicable codes and standards as listed below. In the event of a conflict, they shall take precedence in the listed order.

a. National Electrical Code (NEC).
b. Underwriters Laboratories (UL).
c. American National Standards Institute (ANSI).

d. National Fire Protection Association (NFPA).
e. National Electrical Manufacturers Association (NEMA).
f. Institute of Electrical and Electronic Engineers (IEEE).
g. Insulated Power Cable Engineers Association (IPCEA).

10. American Water Works Association Standards – Latest Edition

C. Materials

1. Materials shall conform to the specification requirements herein or, where unspecified, shall be materials that have demonstrated acceptability for the intended service and are approved in writing by the Owner.

2. All materials shall be in accordance with ASTM Specifications, where such exist, or with other nationally recognized institutional standards. Proprietary materials or others for which no generally recognized standard exists shall not be used without prior written concurrence from governing authorities, insuring organization, the Engineer, and the Owner.

3. All materials shall be new and of first quality. Defective fabrications shall not be repaired and used in the construction of the equipment. No peening, caulking, or filling shall be permitted in repairing cracks, pinholes, or blowholes. Defective welds in fabricated components shall be repaired by chipping out the defective weld and re-welding.

4. Materials containing asbestos, mercury, PCB's and chlorofluorocarbons shall not be used. All non-metallic materials shall be submitted in accordance with Section 1.04 of this specification to the Owner for approval.

1.06 Delivery, Storage, Handling

A. All equipment shall be delivered to the job site, Rhode Island Welcome Center Center, Located on I-95 north between exits 4 and 7 in Rhode Island.

B. Shipping containers shall be designed to accept all stresses and loads experienced during packing, lifting, transport, unloading and storage of the equipment.

C. Once delivered to the site, each individual equipment component, package, container and system shall be inspected for conformance to specifications and packing lists and for evidence of damage. Upon successful completion of the inspection, the equipment will be approved for installation, by the Owner or their authorized representative.

D. The Owner shall not accept financial responsibility for damage to the equipment or any individual component which occurs prior to delivery and acceptance of the final installation.

E. The water storage tanks shall be shipped on an open, flat-bed truck, protected from weather conditions and damage. Upon delivery to the jobsite the tank shall be transferred directly from the truck to the prepared support pads within the Mechanical Room. Accessory component shipping containers shall be designed to accept all stresses and loads experienced during packing, lifting, transport, unloading and storage of the equipment.

F. If temporary storage of the equipment is necessary following delivery to the job-site, the Contractor shall provide temporary, secure storage, or the Pump House may be utilized for storage.

1.07 Warranty

A. The Vendor shall provide a written materials and workmanship warranty for all equipment and all sub-components provided to the Owner. The Vendor shall warrant to repair or replace, at no cost to the Owner, any materials, equipment, sub-components or parts found to be defective in materials or workmanship, under normal use and operating conditions, for a minimum period of one (1) calendar year following the date of the Owner's written acceptance of the equipment or component system.

B. The Vendor shall also provide documentation of all pass-through warranties from sub-component vendors.

PART II PRODUCTS

2.01 Potable Water Storage Tanks (T-200)

A. Provide one (1) horizontal, cylindrical, single-wall, atmospheric, aboveground water storage tank. The tank shall be of white, high-density, UNV stabilized, linear polyethylene construction, NSF 61 compliant, of adequate design and wall thickness to support hydraulic and equipment loads. The tanks shall conform to the design criteria presented in Table 2.01-1, below.

B. The tank shall be of single-wall construction, designed for storage of liquids with a specific gravity of up to 1.9. The tank shall be vented to atmosphere.

C. The tank shall be provided with one (1), 16” diameter, manway connection, with a cover of black polyethylene.

D. Through wall tank connections shall be factory installed double-threaded, bolted fittings of polypropylene materials, with EPDM gaskets and 316 SS connecting hardware. Connections shall be checked for fit, roundness, proper alignment and orientation.

E. External piping shall be joined to the through wall tank fittings via flanged connections. Bolt patterns shall conform to ANSI 16.5 150# standards. Flanged faces shall be perpendicular to the penetration/connection axis and shall be flat to within +/- 1/32". Gaskets shall be of minimum 1/8" thickness. There shall be a minimum 4" dimension from the flange face to the outside wall of the tank.

F. The tank shall be provided with a minimum 1-year warranty against failure due to material or workmanship defects. The warranty shall be based upon potable water service and installation in conformance with the manufacturer’s recommendations.

G. Tank Testing – By Contractor:

1. Upon completion of the installation, the tank shall be hydrostatically tested by the Contractor to assure the liquid-tight integrity of the tank and to assure that no damage has occurred during shipment, transfer or installation. To conduct the hydrostatic test, all tank connections shall be capped or otherwise sealed, and the tank shall be filled with potable water. The tank shall be provided with a calibrated pressure gage with a 0-15 psig pressure span.

2. Upon filling of the tank the liquid pressure at the bottom tank fitting tank shall be continuously monitored, with the tank required to maintain the test pressure for 24-hours. If there is indication of leakage of water or a degradation of the test pressure thereby indicating a leak, the tank fittings, gages and connected piping shall be checked and the tank re-tested. The Contractor and/or tank manufacturer

shall be responsible for taking any corrective action to assure the tank meets the performance and tightness specifications.

H. The tank shall be as manufactured by Norwesco, Inc., at their Lancaster, Ohio facility (NSF 61 Certified) or equal, conforming to the design criteria presented in Table 2.01-1:

Table 2.01-1
Water Storage Tank Design Criteria

No of Tanks	1
Contents	Potable Water
ANSI/NSF Standard	NSF 61
Configuration	Horizontal, Cylindrical
Maximum Specific Gravity	1.1
Maximum Temperature	72°F
Nominal Volume	5,025 Gallons
Materials of Construction	HDPE
Tank Dimensions	92”Ø x 190” L
Maximum Tank Height	100” at Access Manway
Access Manway	1 @ 16”Ø
Connections:	
Tank Fill	2”
Level Sensor	1” FPT
Pump Suction	3” FPT
Vent	In Manway

2.02 Triplex Booster Pump Station

A. Provide one (1), skid-mounted, triplex pump system including three (3) centrifugal booster pumps, pump suction manifold with isolation valves, pump discharge manifold with isolation and check valves, pressure gages, steel channel base, frame mounted controls, three (3) variable frequency drives, accessories and appurtenances. The triplex skid control panel 240V single phase which is the only supply available on site. That is the input voltage to the VFD’s. The VFD’s output 3-phase 208V to the three 2 HP pumps.

B. Centrifugal Pumps: Each pump shall be of close-coupled design. The pump casing shall be of cast 316SS, concentric volute type, fitted with ANSI Class 150 flanged stainless steel suction and discharge connections. The pump discharge flange shall be oriented in the vertical position. Inlet and outlet flanges shall conform to 150# ANSI B16.5.

1. The pump casing shall be provided with accessible vent, prime and drain connections, with stainless steel plugs.
2. Mechanical seals shall be standard John Crane Type 21 with carbon/silicon-carbide faces, Viton elastomers and 316 stainless steel metal components.
3. The impeller shall be provided with a floating seal ring, shall be of 316 SS

materials, and a closed design.

4. Pump drive motors shall be rated for a 208 VAC, 1 phase, 60 Hz power supply with a voltage range of +/-10%.
5. Each pump shall conform to the design and operating criteria presented in Table 2.02-1, below:

Table 2.02-1
Water Distribution Pump Design and Operating Criteria

Pump ID #	P-201A, P-201B, 201C
Quantity:	Three (3)
Manufacturer:	Goulds Water Technologies
Model No.:	NPE 1ST
Size:	1 x 1-1/4 – 6
Casing Material:	316 SS
Mechanical Seal:	316SS, Carbon/silicon Carbide– John Crane 21
Drive:	Variable Frequency Direct Drive
Speed:	3500 rpm
Motor:	2 HP TEFC
Power:	208 vac/1 ph/60 Hz
Impeller Dia.:	5.75"
Inlet:	2" Raised Face Flange
Outlet:	2" Raised Face Flange
Pump Capacity @ 3500 rpm	10 gpm @ 127 ft. TDH 20 gpm @ 119 ft. TDH 40 gpm @ 92 ft. TDH

C. Variable Frequency Drives: – Water Distribution Pumps (VFD-201A, VFD-201B, VFD-201C)

1. Provide three (3), microprocessor-based, variable speed pump controllers (VFD) for use with the AC induction motors on the potable water distribution pumps.

2. The VFD's shall be provided in a NEMA 12 enclosure mounted on the booster pump skid.

3. The Variable Frequency Drive (VFD) for each pump shall be provided a local, fused disconnect switch at the pump skid.

4. The VFD's shall have an LCD Display and programming keyboard

5. The VFD's shall provide pump run-out protection, deadhead protection, multiple pump operation with lead/lag alternation, adjustable pressure drop, minimum speed with time delay, over pressure shutdown, and low flow shutdown.

6. The VFD's shall accept a proportional output signal from the distribution service pressure monitor and control the pump speed to maintain the discharge line pressure within a pre-set range.

7. The VFD's shall be provided with fused disconnect switches.

8. Each VFD shall be rated for a 208 VAC, 1 phase, 60 Hz power supply, with a voltage range of +10% to -15%. The triplex skid control panel 240V single phase which is the only supply available on site. That is the input voltage to the VFD's. The VFD's output 3-phase 208V to the three 2 HP pumps.

9. The VFD's shall be hydromulti CPC series drives, as manufactured by Grundfos Pumps, or approved equal.

D. Pump Skid and Interconnecting Piping:

1. The pump skid base shall be fabricated of 4" carbon steel channel structural elements, welded to provide a stable base mounting. The superstructure to support the drives and controls shall be fabricated of 1.5" square tubular carbon steel structural elements. The completed frame shall be prepared to an SSPC near white metal finish, then provided with a prime paint coating and then two (2) coats of epoxy paint.

2. The pump suction and discharge manifolds shall be fabricated of Copper or Schedule 80 PVC pipe materials. The suction manifold shall be of 2" Ø pipe, provided a center feed with symmetric branch supply service to each pump. Each pump supply branch service shall be provided a 2"Ø ball type isolation valve, a compound pressure indicator, and a 2"Ø inlet connection. The pump discharge manifold shall have pressure gage with isolation cock immediately downstream of the 2"Ø discharge connection at each pump, then immediately adapt to 2" Ø discharge pipe. Each pump discharge shall be provided a vertically mounted, 2"Ø Crane Duocheck G series stainless steel wafer check valve and a 2"Ø ball-type isolation valve located downstream of each check valve. Each pump discharge pipeline shall connect into a 2"Ø discharge manifold pipe.

3. A pressure transducer for control of each respective VFD shall be installed immediately downstream of each isolation ball valve in the pump discharge manifold.

2.03 Pressure Bladder Tanks

A. Provide two (2) floor-mounted, pre-pressurized, pressure bladder tanks for installation in the Pump House. One (1) pressure-bladder tank shall be used for control of the water supply well pumps and one (1) shall be used for control of the water distribution pumps.

B. The pressure bladder tanks shall be Well-X-Trol, as manufactured by Amtrol, or equal, conforming to the following:

Table 2.03-1
Pressure Bladder Tank Design and Operating Criteria

	Well Control Pressure Tank	Distribution Pressure Tanks
ID #	PPT-1	PPT-2
Quantity:	1	1
Model No.:	WX-205	WX-350
Pump Flow Rate:	10 gpm	0 to 17 gpm
Total Tank Volume	34 gallons	119 gallons
Tank Acceptance Volume	10.5 gallons	34.3 gallons
Pump Cut-In Pressure	30 psig	40 psig
Pump Cut-Out Pressure	50 psig	55 psig
Factory Pre-Charge Pressure	38 psig	38 psig
Connection	1.25” NPTF	1.25” NPTF
Minimum Pump Run Time	1 minutes	2 minutes
Maximum Operating Pressure	100 psig	100 psig

C. Each pressure tank shall be provided with an indicating pressure gage, adjustable operating setpoints, a pressure relief valve and a drain valve.

D. Each pressure tank shall be of carbon steel construction, non-ASME code design, with a butyl rubber diaphragm and polypropylene liner.

2.040 Cartridge Filter System

A. Provide one (1), floor-mounted cartridge filter housing and one (1) case of filter cartridges, for filtration of the raw well water supply.

B. The filter housing shall be fabricated of electropolished 304 SS, top-entry, provided with bolted closure and a pressure relief drain fitting. The housing shall accept standard, double open-end filter cartridges.

C. The filter cartridges shall be of pleated design, non-shredding construction, rated for rust and sediment solids capture, with a 25u nominal separation rating.

D. The cartridge filter unit shall be NSF 61 compliant, as manufactured by Harmsco Filtration Products, or equal, and shall conform to the design and operating criteria presented below:

Table 2.04-1
Cartridge Filter Design and Operating Criteria

Filter ID #	CF-1
No. of Housings:	1
Manufacturer/Model #	Harmsco Model WB-40SC-2
Max. Pressure Drop:	2.0 psig (clean water w/ filter cartridge)
Inlet/Outlet Connections:	2" NPT
Drain Connection	1" NPT
Max Operating Pressure:	150 psig
Vessel Material:	304 SS
Seal O-Rings:	Ethylene Propylene
Closure:	Flanged, Bolted
Max. Cartridge Diameter:	2.75"
Cartridge Length:	20"
Filter Cartridges /Vessel:	4
Filter Cartridges	
Micron Rating:	25u Nominal
Cartridge Length	9-5/8"
Filter Media:	Hurricane Poly-Pleat

2.05 Instrumentation and Controls

A. Provide all equipment, materials, components, accessories and appurtenances for the instrumentation components to complete the Water Supply & Distribution System as shown on the Process & Instrumentation Diagram and as specified herein. The instrumentation and controls equipment necessary for the system shall include the following basic components:

1. Two (2) Pressure Switches for control of the water supply well pump (PS-100, PS-200).

2. One (1) Water Storage Tank Pressure Transducer for continuous monitoring and control of the water level and volume in the water storage tank (PT-201);

3. One (1) electrically operated water storage tank fill isolation valve with limit switches (EBV-200);

4. One (1), distribution system automatic, electronic flow sensor, insertion fitting, and flow transmitter (FE/FIT-203);

5. One (1) in-line distribution system pressure transducer with indicating transmitter (PIT-202);

6. Two (2) submersible pressure transducers for monitoring the water level in the water supply well (LT-100, LT-200)

7. One (1), PLC-based monitoring, interlock and alarm panel.

B. Pressure Switches (PS-100, PS-200)

1. Provide two (2) pressure switches for activation/deactivation of the well pumps. The pressure switch shall be of the electro-tube type, as manufactured by Square D, Model 9013FSG1J21, or equal, conforming to the following:

a.	Switch Type:	Diaphragm Actuated
b.	Power:	120 vac, 15A
c.	Repeatability:	+/- 1% of operating range
d.	Operating Range:	Cut-in: 10 to 45 psig, Cut-out: 20 to 60 psig
e.	Adjustable Differential:	15 to 30 psig
f.	Connection:	¼" Female NPT
g.	Mounting Orientation:	Vertical

C. Water Storage Tank Pressure Transducer Level Transducer (PT-201):

1. Provide one (1) pressure-based level transducer to measure the water level in the Water Storage Tank.
   a. The level transmitter shall be the vented, pressure actuated type.
   b. The level transmitter shall have a range of 0 to 10 psig, label reading psi.
   c. The level transmitter shall have a 4 to 20 mA dc, 2 wire, short circuit protected output, with lightning protection option.
   d. The level transmitters shall have a static accuracy of 0.10%.
   e. Level transmitters shall be of 316 SS construction w/75' PVC jacketed cable.
   f. Level transmitters shall have a ½"ø MNPT connection.
   g. Level transmitters shall be KPSI Model No. 30S1474B (010.000-000.000) A3 0075A as manufactured by Measurement Specialties, or equal.

D. Water Storage Tank Fill Isolation Valve (EBV-200)

1. Provide one (1) electronically positioned, NC ball valve to control the supply of treated water to the water storage tanks (T-200).

   a. The storage tank fill valve shall be an electrically actuated ball type valve.
   b. The storage tank fill valve shall be 1-1/2"Ø, with true-union connections.
   c. The storage tank fill valve shall have PVC body, 316SS disc and stem, and

EPDM seat(s).

d. The storage tank fill valve shall have limit switches to detect valve full open and full closed.

e. The valve positioning motor shall have a motor run time of 5 seconds (@ 60 Hz) to achieve full-open position from a closed start position, or full-closed position from an open start position.

2. The storage tank fill valves shall be a Plast-O-Matic Series EBVA-1-1-100-EP-S-PV, or equal.

E. Distribution System Flowmeter/Totalizer (FE-203, FIT-203)

1. Flow Transmitter: Provide one (1) flow transmitter for continuous monitoring of the flow rate and total output of the potable water distribution system.

a. The flow transmitter shall have a NEMA 4X enclosure and be capable of integral field mounting (on the sensor).

b. The flow transmitter shall have one (1) permanent and one (1) resettable totalizer.

c. The flow transmitter shall have one (1) sensor input and one (1) 4 – 20mA current output.

d. The flow transmitter shall be powered by 12 to 24 VDC ± 10% regulated.

e. The flow transmitter shall have a NEMA 4X faceplate and be suitable for panel mounting.

f. The flow transmitter shall be +GF+ Signet Model No. 3-9900-1P, or equal.

2. Flow Sensor: Provide one (1) rotary flow sensors for continuous monitoring of the flow rate and total output of the water treatment system, and potable water distribution system.

a. The flow sensor shall be a low-flow, paddlewheel type, for integral mounting to the flow transmitter.

b. The flow sensor shall be sized for installation in a ½" to 4" diameter pipe.

c. The flow sensor shall be of polypropylene construction.

d. The flow sensor shall be +GF+ Signet Model No. 3-2536-P0, or equal.

3. Flow Sensor Insertion Fittings: Provide one (1) insertion fitting for installing the flow sensors into the monitoring locations. The insertion for the Potable Water Distribution System shall be provided on a 2" diameter, Schedule 80 PVC "Tee" Fitting, +GF+ No. MPV8T020F.

F. Distribution System Pressure Transducer & Indicator (PIT-201)

1. Provide one (1) in-line pressure transducer/transmitter for continuous monitoring water pressure in the water distribution system piping. The pressure transducer shall be as manufactured by Omega, Model PX219-100GI, or equal.

   a. In-Line Pressure Transducer/Transmitters

Quantity:	One (1)
Manufacturer:	Omega
Model Number:	PX219-100GI
Type:	In-Line Pressure Transmitter (Gauge Pressure)
Range:	0 to 460 feet (0-200 psig)
4 - 20 mA Output:	2 wire
Electrical Connection	DIN 43650 Plug Connector Supplied
Range:	0 to 100 psig
Operating Temperature:	-54 to 121°C (-65 to 250°F)
Accuracy:	0.25% FS BFSL
Response Time:	2 mS Typical
Proof Pressure:	150%
Burst Pressure:	300%
Wetted Parts:	316 Stainless Steel, Borosylicate Glass, Silicon Nitrate, Epoxy
Pressure Port:	¼" NPT

   b. Pressure Snubber

Quantity:	One (1)
Manufacturer:	Omega
Type:	Pressure Snubber for Water or Light Oils
Part Number:	PS-4E

G. Well Level Pressure Transducers (LT-100,)

1. Provide one (1) submersible pressure transducers for continuous monitoring of the liquid level in the water supply wells. The transmitter shall be housed in a 1-1/4" black polyethylene stilling well which shall run continuously (no joints) from the top of the well casing to the transmitter location. The level transducer shall be provided with the Lightning Protection Option, and shall be as manufactured by Esterline, or equal.

a. Well Mounted Level Transducer

Quantity:	One (1)
Manufacturer:	Endress + Hauser
Model Number:	Waterpilot FMX21
Type:	Submersible Water Level Transmitter
Range:	0 to 300 feet (0-130 psig)
Output:	4 to 20 mA
Input Current:	20 mA Max.
Zero Offset:	±0.12 mA, Max.
Reference Accuracy:	±0.2% of set span
Response Time:	400-500 mS
Operating Temperature:	-10 to 70°C
Wetted Parts:	316 Stainless Steel, Delrin, Polyurethane Cable, Viton or Kalrez
Cable Length:	300 feet
Lightning Protection	Yes

b. Transducer Vent Bellows

Quantity:	One (1)
Manufacturer:	Esterline
Model Number:	Android Bellows

H. PLC Monitoring, Interlock and Alarm Panel

1. DC Power Supply: Power for the analog sensors shall be provided using a 24 V DC regulated power supply. The power supply shall have the following minimum specifications:

   a. Unit shall accept an input voltage range of 104 to 127 VAC.
   b. Full load operating ambient temperature range w/o de-rating shall be 0^0 to 50^0 C.
   c. Total voltage regulation shall be +/- 0.1% or better.
   d. Output voltage shall be 24V and adjustable +/- 5%.
   e. Output current shall be 0.8 amp or greater.
   f. Power supplies shall be fused.
   g. Power supply shall be Sola Model 81-24-180-01, or approved equal.

2. Programmable Logic Controller (PLC)

   a. PLC Power Supply
      (1) The PLC supply shall be sized for all loads plus a reserve capacity of 25%.
      (2) The power supply shall be compatible with the PLC, chassis, and I/O cards being supplied.
      (3) The power supply shall have a fuse to protect against input over-current.

b. PLC Processor
   (1) The PLC processor shall be supplied with 6K of memory.
   (2) Processor shall have a battery backup capable of retaining all stored programs through a continuous power outage or up to one year.
   (3) Processor shall utilize 16-bit architecture.
   (4) Processor shall have a communications port for data highway plus communications.
   (5) Processor shall be capable of executing the following minimum instruction sets:
      a) Relay-type
      b) Timer and Counter
      c) Arithmetic Functions
      d) Logical Functions
      e) Conversion Functions
      f) Comparison
      g) Data Transfer
      h) PID Control
   (6) The processor shall be Allen-Bradley SLC505 series with Ethernet capability, or approved equal.
   (7) A safe and orderly shutdown on power failure shall be provided and outputs de-energized. Manual restart of the process shall be required upon power restoration.

c. I/O Cards
   (1) Provide high density analog input card(s) that will accept 8 point analog input, accepting a 4 to 20 mA input current range, and have 12 bit resolution.
   (2) Provide analog output card(s) that will provide 4 isolated differential outputs each, provide a 4 to 20 mA output current range, and have 12 bit resolution.
   (3) Provide an RTD Input Module compatible with a platinum 100Ω three (3) wire, single input RTD assembly.
   (4) Provide 24v, direct current input card(s) that will accommodate 16 isolated discrete inputs.
   (5) Provide 120 VAC, high density relay output cards that will accommodate 16 discrete outputs.

d. Chassis: Provide PLC chassis that accepts all I/O modules. Chassis shall have a minimum of three (3) spare slots for connection of future I/O cards.

e. Interfacing and Peripherals
   (1) Provide with Ethernet remote communications capability.
   (2) Provide all cables necessary for communication.

3. PLC Input/Outputs

   a. Provide a minimum 25% spare points for each type of PLC I/O card used. All spare points shall be wired to the terminal strips. As directed by Owner, incorporate pre-wired spare points into the active point data base at no increase in Contract price. Include changing point names, descriptions, ranges, or statuses from spare to the new point. Include related documentation changes. Spares utilization will be subject to the following limitations:
      (1) The incorporation will not significantly alter the control software and hardware functions, i.e. adding a device alarm input.
      (2) The incorporation will not significantly alter the local area panels or field wiring to the device, i.e. addition of signals to terminations.
      (3) The change will not be made subsequent to the Shop Drawing and P&ID approval.

4. 4-20 mA Signal Isolators

   a. Each 4-20 mA instrument sensor input signal shall be provided a single-channel signal isolator/transmitter. Each isolator/transmitter shall receive the 4-20 mA process current input and will provide an isolated 4-20 mA output signal, galvanically isolated from all other signals to prevent interaction or interference. The isolators shall also compensate for load resistance variations. The transmitter/isolators shall conform to the following requirements:
      (1) Input/Output Current: 4-20 mA
      (2) Power: 115 VAC
      (3) Input Voltage Drop: <1.5 volts at full scale
      (4) Input Overvoltage Protection: Bipolar Transient Voltage Suppression
      (5) Input Excitation: 24 V DC +/- 10%, 22 mA maximum, Fully Isolated
      (6) Output Trim Range: Zero and Full-Scale adjustment to +/- 4%
      (7) Output Limit: Max 27 mA
      (8) Output Load: 0 to 1000 ohms
      (9) Output Load Resistance: +/- <0.01%
      (10) Accuracy: +/- 0.05% of Output Span
      (11) Ambient Temperature: -25ºC to 75ºC

   b. Isolator Transmitters shall be Model 631T-0100, as manufactured by Acromag, or equal.

5. Operator Interface Terminal (OIT)

   a. The Vendor shall provide an operator interface unit with a color touch screen

and DXF capability that meets the following requirements:

(1) 8 K minimum memory allowing configuration of up to 100 screens.
(2) Configurable for operator acknowledgement of alarms.
(3) Configurable for operator access to PLC registers, timers, counters, and discrete I/O.
(4) Configurable for alarm indication, messages, system diagnostics.
(5) Configurable for operator entry of PID loop parameters and tuning.
(6) Provides protection against unauthorized changes in configuration or setpoints.
(7) The display enclosure shall be rated NEMA 12.

b. Setpoint Indications and Actual Values: The operator interface shall be configured to display, but not be limited to, the following operating and control setpoints:

(1) Well Water Level (LT-100) UM = feet
- Display Actual Values (local & remote monitoring)
- Display & Modify Operating Setpoints (local & remote monitoring)

(2) Well Water Level (LT-200) UM = feet
- Display Actual Values (local & remote monitoring)
- Display & Modify Operating Setpoints (local & remote monitoring)

(3) Potable Water Storage Tank Water Level (PT-200) UM = gallons
- Display Actual Values (local & remote monitoring)
- Display & Modify Operating Setpoints (local & remote monitoring)

(4) Water Storage Tank Fill Valve Position (EBV-200) UM = Open, Closed, Between
- Display Actual Position (local & remote monitoring)

(5) Distribution System Flowrate and Volume (FIT-203) UM's = gpm & gal
- Display Actual Level Value (local & remote monitoring)
- Display & Modify Operating Setpoint (local & remote monitoring)

(6) Distribution System Pressure (PIT-202) UM = psi
- Display Actual Position (local & remote monitoring)
- Display & Modify Operating Setpoint (local & remote monitoring)

c. Alarm Indications: The Monitoring, Interlock and Alarm Panel shall be provided with an audible and visual alarm. The operator interface shall be configured to display the following alarms:

(1) LAA LT-100 Well #1 Low Level Alert
(2) LAL LT-100 Well #1 Low Level Alarm
(3) LAA LT-200 Well #2 Low Level Alert
(4) LAA LT-200 Well #2 Low Level Alarm
(5) F/O EBV-103 Electronic Ball Valve Fail-to-Open
(6) F/C EBV-103 Electronic Ball Valve Fail-to-Close
(7) LAA T-200 Potable Water Storage Tank Low Level Alert

(8)	LALL T-200	Potable Water Storage Tank Low Level Alarm
(9)	LAH T-200	Potable Water Storage Tank High Level Alarm
(10)	FTS-201A	Fail-to-Start - Distribution Pump (P-201A)
(11)	FTS-201B	Fail-to-Start – Distribution Pump (P-201B)
(12)	FTS-201C	Fail-to-Start – Distribution Pump (P-201C)
(13)	PAL-202	Low Distribution Water Pressure
(14)	PAH-202	High Distribution Water Pressure

6. Mechanical Switches

   a. The Water Storage Tank Fill Isolation Valve (EBV-200) shall be provided with a mechanical Hand-Off-Auto (H-O-A) switch to be mounted on the face of the PLC Control Panel.

   b. Water Storage Tank Fill Isolation Valve (EBV-200) shall be provided with an "Open/Close" switch to manually actuate valve when the H-O-A is in the "Hand" position. This switch shall be mounted adjacent to the H-O-A on the face of the PLC Control Panel.

7. Wiring, Terminations, and Accessories

   a. All processor input and output modules shall be uniquely numbered by rack, slot and group so each can be readily identified.

   b. Each input and output card shall be protected by a fuse of appropriate size with blown fuse indication.

   c. All wiring within the enclosure shall be clearly tagged identifying to which PLC I/O terminals they are wired.

   d. All wiring entering the enclosure shall be terminated at an appropriate rail mounted terminal block.

   e. Wiring in the enclosure shall utilize plastic wiring ducts. Wiring outside ducts shall be bundled together and secured with plastic tie-raps.

   f. All wiring shall comply with the National Electrical Code (latest edition) and all equipment shall be installed in accordance to manufacturer's recommendations.

   g. Wiring for all 4-20 mA analog input signals shall be shielded cable. Cable shall be Belden No. 8760, U.L. Style 2092, 18 AWG minimum or equal.

   h. Conductors shall be color coded as follows:

(1) Discrete 120 VAC input/output
Hot wire - red
Neutral wire - white
120 VC panel power
Hot wire - red
Neutral wire - white
Ground wire – green
(2) 24 VDC low voltage to analog modules
24 VDC+ - blue
Common – blue
(3) PLC I/O shall be 169A.
(4) Motor wiring shall be 14 ga or larger.

i. Minimum wire size in the control panel for control and signal devices shall be 14 AWG, for PLC I/O 16 AWG.

j. A 120 VAC duplex convenience receptacle shall be located in the PLC control panel with power supplied from the control transformer.

k. All electrical components shall be grounded in accordance with NEC requirements and manufacturer's recommendations.

l. A disconnect switch shall be provided in the PLC panel to shut off all power to the PLC panel.

m. Corrosion inhibiting emitters shall be mounted inside the panel.

8. Uninterruptible Power Supply

a. The PLC, Operator Interface Terminal, and Control Panel components shall be provided with an Uninterruptible Power Supply (UPS) which meets the following requirements:

(1)	Output Capacity:	600 Watts/1000VA
(2)	Nominal Voltage Output:	120 VAC
(3)	Output Frequency:	50/60 Hz
(4)	Output Connections:	(4) NEMA 5-15R (Battery Backup) (4) NEMA 5-15R (Surge Protection)

b. The UPS shall be APC Power Saving Back-UPS Pro 1000, or approved equal.

c. The UPS shall be provided a dedicated enclosure, as identified below.

9. Enclosures

a. The PLC/Control Panel enclosure, and the UPS enclosure shall meet the following requirements:
   (1) Each enclosure shall be of fiberglass construction
   (2) The panel shall have a gasket seal between door and enclosure.
   (3) The panel door shall be continuously hinged.
   (4) The panel shall be wall mounted.
   (5) Panel shall be rated NEMA 12.

b. Acceptable manufacturers are Hoffman, Hammond, or approved equal.

2.06 pH Instrumentation and Controls

A. Provide all equipment, materials, components, accessories and appurtenances for the instrumentation components to complete the Water Treatment System as shown on the Process & Instrumentation Diagram and as specified herein. The instrumentation and controls equipment necessary for the system shall include the following basic components:

1. One (1), distribution pH sensor (AE-204), pre-amplifier (PA-204) analyzer/controller (AIT-204);

2. One (1) distribution pH data-logger (AR-204).

B. Distribution pH Monitoring System

2. Provide one (1) pH sensor and insertion fitting, preamplifier, analyzer/monitor and data logger to monitor the pH of the water discharged to the distribution system:

3. pH Analyzer/Indicator/Transmitter (AIT-204)

a. Provide one (1) microprocessor based pH Analyzer/Indicator/Transmitter with single input (channel).

b. The pH monitoring range of the pH Analyzer/Indicator/Transmitter shall be -2 to 16 s.u., with a resolution of measurement of 0.0015 s.u and an electrical stability (accuracy) of 0.01 s.u.

c. The pH Analyzer/Indicator/Transmitter shall have, three (3) on/off dry contact relays.

d. The pH Analyzer/Indicator/Transmitter shall have one (1), 4-20 mA output.

e. The display shall be a 128 by 64 graphic backlit display with icon-based programming. Control settings and adjustments shall be keypad entries made at the front panel of the controller. The user interface shall provide for calibration, entering and adjusting control and alarm setpoints, and manual testing of the control outputs. Additionally, the controller shall provide menu access, pH response adjustment, timer limit, manual control output activation, adjustable maximum pulses per minute, adjustable proportional band and self-diagnostic error messages.

f. The pH analyzer enclosure shall be of thermoplastic construction, NEMA 4X rated, with integral wall mounting flanges and a hinged, lockable cover provided with a full view window.

g. The pH Analyzer/Indicator/Transmitter shall be 120 VAC, hardwired.

h. The pH Analyzer/Indicator/Transmitter shall be Walchem W100W Series, Model No. WPHPW110HANNNN, or equal.

3. pH Preamplifier (PA-204)

Item	Description
Quantity:	One (1)
Manufacturer:	Walchem, or equal
Model No:	190783
Power Rating:	±5 VDC, 5 mA maximum
Input Impedance:	±5 VDC, 5 mA maximum
Electrical Connections:	BNC Connector & Screw Terminals
Enclosure:	Epoxy Coated NEMA 4X

4. pH Sensor (AE-204)

Item	Description
Quantity:	One (1)
Manufacturer:	Sensorex, or equal
Model No:	S656CD
Sensor Type:	pH, Flat Face, Temperature Compensation
Sensor Mounting Type:	Submersion
Max. Temperature:	100°C
Measuring Range:	0 to14 s.u.

5. pH Sensor Insertion Fitting

Item	Description
Quantity:	One (1)
Manufacturer:	Sensorex, or equal
Model No:	S675TC-P1K-25'BNC/TL
Material:	CPVC
Insertion Depth:	12" Maximum
Insertion Diameter/Connection:	1" NPT
Sensor Connection:	BNC

6. pH Sensor Insertion Fitting Isolation Ball Valve

Item	Description
Quantity:	One (1)
Manufacturer:	Sensorex, or equal
Model No:	BV-1
Type:	Full Port 1” ϕ Ball Valve

7. pH Data Logger (AR-204)

Item	Description
Quantity:	One (1)
Manufacturer:	OMEGA Engineering
Model No:	CP-OM-PROCESS101A
Input Range:	20 mA
Measurement Range:	-2 to 30 mA
Reading Rate:	4 Hz to 1 reading every 24 hours
Memory:	1,000,000 readings

PART III EXECUTION

3.01 Inspection

A. The Vendor shall provide qualified personnel on-site during the equipment installation to verify compliance with all installation instructions provided by the Vendor. The Vendor shall provide written notification of any and all deviations or discrepancies from the installation instructions as well as written certification of the final installation conforming to said installation instructions.

3.02 Preparation

A. Unless otherwise approved by the Owner, the equipment shall be shipped to the site ready for immediate installation by the Owner. Field installation shall require only mounting on a prepared supports or surfaces, and connection of external piping, power and/or signal connections.

B. Field mounted sensors, instruments, mechanical accessories and appurtenances shall be packed in secure, moisture tight containers, fully cushioned against impact with the contents clearly identified on the containers.

C. Spare parts, tools, and miscellaneous items shall be packed securely into shipping boxes with the contents clearly identified on the containers.

3.03 Factory Testing

A. Factory testing shall include the following at a minimum:

1. Comprehensive testing of the Monitoring, Interlock and Control Panel for wiring integrity and continuity, operator interface screens and setpoint modification capability, output signal and alarm generation, function and PLC programming.

B. All defects or deficiencies identified during the factory testing shall be corrected, by the Vendor, prior to shipment.

C. Written records shall be kept for each test showing date, system or equipment tested, test method and test results. Test records for each test shall be submitted to the Owner for review and approval, prior to shipment of the tank to the jobsite.

3.04 Delivery, Storage and Handling

a. The Vendor shall be responsible for providing the proper packing and transport of all equipment to the job site. The equipment shall be delivered free of defects or damage. Delivery storage and handling shall be in conformance to all

requirements of Section 1.06 of this Specification.

b. The principle public water system equipment including the well pump, atmospheric water storage tank, distribution pump system, cartridge filter, and Control Panel shall be shipped to the site as shop-fabricated units or systems. Face piping and accessories may be dismantled for final re-assembly at the job-site. Field installation shall require mounting, external piping fit-up, power, interconnections between equipment components and anchoring as necessary.

c. Smaller, individual equipment items, components, instruments, etc., shall be consolidated, packaged and shipped to the job-site, for field installation. Spare parts, tools, and miscellaneous items shall be packed securely into shipping boxes with the contents clearly identified on the containers.

d. The Vendor shall prepare, package and ship the equipment in accordance with the following criteria, at a minimum.

1. All gasket surfaces, flange faces, and machined or ground-metal surfaces, except those designed for welding, shall be thoroughly cleaned and protected with suitable wood, metal or other substantial covering to insure their full protection.

2. All female threaded connections shall be cleaned and closed with pipe plugs or snap-in protection plugs.

3. Painted or primed surfaces shall be protected during moving and handling by special provisions including padding, blocking, and the use of canvas or nylon slings.

4. All tanks and vessels shall be protected from mechanical damage.

5. Small diameter piping shall be protected from mechanical damage and shall not be over stressed.

E. The Vendor shall advise the Owner of any special precautions and procedures for handling and storage of the equipment.

F. Notification of Delivery

1. The Vendor shall notify the Owner in writing, a minimum of ten (10) business days prior to the scheduled delivery:

a. The delivery date,

b. Container or packaging measurements and weights.

c. Storage and handling requirements.

2. The Vendor shall notify the Owner forty-eight (48) hours prior to the delivery to allow for final scheduling of rigging and off-loading personnel.

G. The Vendor shall correct any damage to equipment or materials due to shipping or handling or any defective shop fabrication which is identified during delivery, installation or testing.

3.05 Equipment Installation and Inspection

A. The Vendor shall provide the services of an experienced, competent, and authorized representative to visit the site of work and check, adjust if necessary, and approve the equipment installation.

B. Installation of equipment and materials shall be in accordance with the manufacturer's recommendations provided by the Vendor. Bolts, nuts, anchors, washers, shims, spacers and mountings, lifting lugs and all other types of supports necessary for equipment and material installation shall be provided. Installation shall conform to the recommendations of the manufacturer, unless otherwise specified or indicated. Improper setting, misaligning, binding or other defects of installation shall be corrected as directed. Equipment and appurtenances shall be accurately located at locations indicated.

C. The Vendor shall provide the services of mechanical, instrument and electrical service engineers and the services of factory service engineer(s) should this become necessary for rapid resolution of field problems, at no additional cost to the Owner.

3.06 Mechanical Installation

A. Work Included

1. This work includes the furnishing of all materials, labor and equipment for the installation and testing of all equipment, mechanical piping, fitting, valves, specialties, and related items under this contract.

2. Provide all necessary pipe supports, anchors, placement devices and supplementary steel for hanging, placement and support of all mechanical equipment, piping, valves, fittings and specialties.

B. Mechanical Piping

1. All water supply piping, unless otherwise noted, shall be Type L Copper, provided with either soldered, Victaulic or flanged connections, or Schedule 80 PVC with flanged or cemented joints.

2. Connections to valves, tanks or equipment shall be made with flanged, Victaulic or threaded connections, unless specifically approved by the Owner or specified elsewhere herein.

3. The minimum pipe size for water system piping shall be 3/4". Vents shall be a minimum 1/2" or as noted on the Drawings.

4. Horizontal pipes shall be supported at uniform spacing. Continuous supports using angles or channel members may be substituted in lieu of the individual supports.

5. Changes in pipe size shall be done with the appropriate size concentric reducing fitting.

6. No connection at any tank, equipment component, valve, or any other item of equipment, shall support the weight of any pipe.

7. Pipelines shall be installed straight and true, parallel to structure lines with a minimum use of offsets and couplings. Provide only such offsets as may be required to provide necessary headroom or clearance and to provide necessary flexibility in pipe lines.

8. Changes in direction of pipelines shall be made only with fittings to pipe bends. Changes in size shall be made only with fittings.

9. Unless otherwise indicated, install all supply piping, including isolation valves, to equipment, tanks and control valves at line size, with reduction in size being made only at inlet to the control valve or equipment component.

10. All pipe shall be cut to each measurement and installed without springing or forcing. Particular care shall be taken to avoid creating, even temporarily, undue loads, forces or strains on valves, equipment or building elements with piping connections or piping supports.

11. Install all work so that all parts required are readily accessible for inspections, operation, maintenance and repair. Minor deviations from the drawings may be made to accomplish this, but changes of magnitude shall not be made without prior written approval from the Owner.

12. Make easily accessible all equipment, sample locations, controls, valves, etc., and any and all other equipment and apparatus, as may be required to be reached from time to time for operation and maintenance.

13. All piping connections to filters, tanks and other equipment shall be made in such a manner as to avoid any strain being transmitted from the piping to the equipment.

14. All packing, gaskets, discs, seats, diaphragms, lubricants, etc., shall conform to recommendations of the valve manufacturer for the intended service.

15. Valves shall be installed with the stems positioned in the horizontal or above the centerline of the pipe. All valves shall be accessible for operation, maintenance or removal.

16. All piping and connected equipment, including flow meters, filters, strainers, traps and other specialties and accessories shall be supported in a manner that will not result in or produce objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or in the building structure either during erection, cleaning, testing or normal operation of the systems. Piping shall not shake or buckle between supports or anchors or prevent proper movement due to expansion and contraction. Piping shall be supported at equipment and valves such that they can be disconnected and removed without further supporting the piping. Piping shall not introduce any strains or distortion to the connected equipment.

17. Hangers and supports shall be installed complete, including lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessory items. Hangers and supports for horizontal piping shall have adequate means of vertical adjustment for proper alignment of pipe and shall be provided with lock nuts.

3.07 Electrical Installation

A. Work Included

1. Provide all conduit; conduit fittings, junction boxes and fittings; conduit hangers, clamps and supports; splice boxes; wires and cables; wire connectors; ground connectors; identification nameplates; tags; and all other equipment and accessories necessary, implied or specified herein or indicated on the Drawings or schedules, including all necessary anchors, sleeves, hangers, and such other items as may be required for attaching or connecting this work to the work of others.

B. Electrical Installation Materials and Workmanship

1. All the materials shall be new and shall conform to the standard of the Underwriters' Laboratories, Inc. in every case where such a standard, listing or label has been established for the particular type of material in question.

2. The installation shall comply with all Federal, State and local codes, laws and regulations applying to electrical installations. Additionally, the electrical installation shall comply with all applicable requirements to the National Electrical Code and its latest revisions.

3. All conduits shall be heavy wall rigid, threaded polyvinyl chloride (PVC). Minimum size shall be 3/8 inch. All conduits shall be threaded at both ends. Threadless fittings will not be acceptable.

4. Flexible PVC conduit shall be furnished and installed for final connections to equipment. Exposed (in view) liquid tight flexible conduit shall not exceed 18 inches.

5. Supports shall be provided every 5 ft. for all conduits wherever possible, within 3 ft. of outlets, boxes or fittings. The points of support shall be determined in the field.

6. The complete conduit system shall be PVC throughout its entire length and the entire system shall be electrically continuous and shall be thoroughly grounded in accordance with the requirements of the National Electrical Code and its latest revisions.

7. Provide junction boxes and conduit fittings wherever they shall be necessary to facilitate the pulling or splicing of wires and cables.

   a. Junction boxes shall be standard PVC or fiberglass outlet boxes with screw covers and gaskets. Boxes shall be secured in position independently of conduits entering them. Junction boxes shall be installed so they are accessible.

   b. Junction boxes shall be secured to conduit by means of stainless steel locknuts (inside and outside) and PVC insulating bushings.

8. All wire and cable work shall be in strict accordance with the requirements of the National Electrical Code and its latest revisions, both with respect to material and workmanship.

3.08 Pressure Testing - Piping Systems

A. The water supply well pump installation shall conform to the requirements of the RI Department of Health and ANSI/AWWA A100-97. The well shall be a drilled 6" bedrock well with a carbon steel casing, sanitary seal and pitless adapter.

B. The casing shall have 18" exposed above grade, provided with a sanitary seal and pitless adapter. The casing shall be driven a minimum of 10 feet into the bedrock, and shall be grouted into the bedrock.

C. The pump riser piping shall be polyethylene water service piping rated for minimum 160-psig service. A torque arrestor fabricated of natural rubber shall be installed immediately above the pipe connection into the submersible well pump. Torque arrestors

manufactured of extruded PVC are NOT acceptable.

D. A 1.25" PE stilling tube shall be installed within the well, to house the well pressure transducer. The stilling tube shall be mounted in parallel with the riser pipe, installed to a depth approximately 5 ft. above the well pump.

E. The power cable installed in the wells with the well pumps shall be affixed to the riser pipe in a secure manner to prevent tension upon the cable or twisting of the cable. The cable shall be secured to the riser with positive attachments installed at the following intervals:

Height Above Well Pump	Attachment Interval
0 to 50 ft.	5 ft. Intervals
50 to 150 ft.	10 ft. Intervals
>150 ft.	20 ft. Intervals

1. If cable guards are used in conjunction with PVC or polyethylene pipe to prevent abrasion, install the 1st cable guard 15 ft. above the submersible pump, and then at 25 ft. intervals thereafter.

3.09 Pressure Testing - Piping Systems

A. As far as is practicable, all pressure tests shall be complete system tests conducted in the presence of the Owner. All instruments, and equipment connected to the piping system, excepting the atmospheric water storage tank, shall be included in the tests. The piping system shall be pressure tested after flushing has been completed, to a pressure of 100 psig. The water storage tank shall be independently hydrostatically tested in a 100% full condition.

B. Preparation:

1. The Contractor shall furnish all equipment and labor necessary to perform the field tests called for in this specification.

2. The Contractor shall give ample notice to the Owner that tests are to be conducted. The Owner shall witness all pipeline tests or otherwise shall give written authorization to the Contractor to perform un-witnessed pipe tests.

3. No test shall be performed until all anchors, hangers, supports, test gauges, plugs, bulkheads, blanks, etc., are installed. Tests shall be made against bulkheads, or valves, where permitted by the Owner.

4. Piping that connects to or is continuous with lines installed by others shall be isolated from such lines by valves or test blanks located at or near the junctions. When necessary to include parts of such lines in the test, the Owner shall be given prior notice so that test conditions may be mutually agreed upon. Special test conditions must be approved in writing prior to performing any such tests.

5. When piping is required to be painted or insulated, the paint or insulation shall not be applied to the pipe joints until the tests are completed. Underground pipe joints shall be exposed while testing.

6. Every precaution shall be taken during the testing to ensure the safety of the operator. Systems to be pressurized shall be provided with appropriate gauges and pressure relieving devices, furnished by the Contractor. Safety precautions shall be taken to prevent open ends of piping being in position to cause injury to personnel when blowing out or testing systems.

7. One or more calibrated indicating test gauges shall be connected directly to the piping as necessary to coordinate the pressuring operation. The indicating gauges shall be visible to the operator controlling the pressure. Pressure gauges used shall have dials graduated over a range approximately 2 times the intended medium test pressure.

3. Before every pressure test, the piping system to be tested shall be visually inspected to assure there are no visual defects and that all connections are tight.

4. After erection of piping, all those lines requiring pressure testing shall be flushed with potable water. The interior of all piping shall be free from loose mill scale, sand, dirt, slag, weld spatter, solder residue, rust, debris, solvent cement, burrs and other foreign matter. Terminal visual inspection in the presence and to the satisfaction of the Owner must be made after flushing procedure is completed. A minimum 1-minute flush duration from each use point under full flow shall be used to ensure adequate cleaning of valve seats. Inspect and replace valve seats where necessary to ensure nonclusion of particulates. Flushing shall be considered complete when no sediment is visible in a sample of flush water standing for five minutes.

5. Equipment that is not to be subjected to the pressure test shall be either disconnected from the piping or isolated by blinds or other means during the test. Valves may be used provided that the valve is suitable for the proposed test procedure.

6. Pressure gauges shall not be subjected to pressure in excess of their scale range. All pieces of equipment that do not have their test pressure indicated or whose test pressures are below the piping system test pressure shall be excluded from these tests.

7. Pressure relief and thermal relief valves shall be excluded from these tests.

8. Control valves, unless being tested, shall be set and maintained in the wide open position.

9. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.

10. All in-line instruments, gauge glasses, flow meter pots, liquid level float gauges, and all other pressure parts of instruments shall be included in these tests, where feasible.

11. Joints found to be defective shall be repaired and retested.

12. Retesting of lines after repairs shall be done at pressures originally specified for the test.

C. Hydrostatic Pressure Testing

1. The test pressure shall be calculated in accordance with the applicable section of ANSI B31.3, but shall not exceed the maximum test pressure of any vessels or components included in the test.

2. Temperature and head adjustments shall be made in accordance with ANSI B31.3, paragraphs 337.4.1 and 337.4.2.

3. All hydrostatically tested systems shall be tested to a minimum pressure of 100 psig. All test pressures shall be maintained a minimum of ten minutes before visual examination of joints begins.

4. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.

5. During the tests, hydrostatic pressures shall be monitored and corrections shall be made to compensate for thermal expansion or contraction. By this procedure, the test pressure shall be kept within five (5) psig or 1%, whichever is greater, of its intended value. All joints shall be visually examined for leakage during the test.

6. No repairs or corrective action shall be done on any section of piping that contains water.

D. Test Reports: The Contractor shall make a record of the test on a "Test Report" form for each piping system tested, which shall consist of the following data:

2. Pipe Line Identification:
3. Date of test:
4. Type of test:
5. Test pressure applied:
6. Time duration of test pressure:
7. Pressure at end of test:
8. Tested by:
9. Comments:

3.10 Hydrostatic Testing – Potable Water Storage Tank

A. The atmospheric Potable Water Storage Tank shall undergo hydrostatic testing for watertight integrity following completion of the tank installation and interconnecting pipe connections.

B. Preparation:

1. The Contractor shall furnish all equipment and labor necessary to perform the field tests called for in this specification.

2. The Contractor shall give ample notice to the Owner that tests are to be conducted. The Owner shall witness all pipeline tests or otherwise shall give written authorization to the Contractor to perform un-witnessed pipe tests.

3. No test shall be performed until all anchors, hangers, supports, test gauges, plugs, bulkheads, blanks, etc., are installed. Tests shall be made against closed valves on interconnecting piping.

4. Piping that connects to or is continuous with lines installed by others shall be isolated from such lines by valves or test blanks located at or near the junctions. When necessary to include parts of such lines in the test, the Owner shall be given prior notice so that test conditions may be mutually agreed upon. Special test conditions must be approved in writing prior to performing any such tests.

6. When piping is required to be painted or insulated, the paint or insulation shall not be applied to the pipe joints until the tests are completed. Underground pipe joints shall be exposed while testing.

7. Every precaution shall be taken during the testing to ensure the safety of the operator. Systems to be pressurized shall be provided with appropriate gauges and pressure relieving devices, furnished by the Contractor. Safety precautions shall be taken to prevent open ends of piping being in position to cause injury to personnel when blowing out or testing systems.

8. One or more calibrated indicating test gauges shall be connected directly to the tank drain connection, as necessary to monitor the water level and static head in the tank, during the test. The indicating gauge shall be visible to the operator. Pressure gauges used shall have dials graduated over a range approximately 1.5 to 2 times the intended medium test pressure.

9. Before the hydrostatic test, the storage tank and connected piping shall be visually inspected to assure there are no visual defects and that all connections are tight.

10. After installation of the storage tank, erection of piping, all those lines requiring pressure testing shall be flushed with potable water. The interior of the tank and the interconnecting piping shall be free from loose mill scale, sand, dirt, slag, weld spatter, solder residue, rust, debris, solvent cement, burrs and other foreign matter. Terminal visual inspection in the presence and to the satisfaction of the Owner must be made after flushing procedure is completed. Flushing shall be considered complete when no sediment is visible in a sample of flush water standing for five minutes.

11. Equipment that is not to be subjected to the pressure test shall be either disconnected from the tank or isolated by blinds or other means during the test. Valves may be used provided that the valve is suitable for the proposed test procedure.

12. All instrument sensors and gages installed in the tank or into thru-wall tank connections shall be included in the hydrostatic test.

13. Connections and joints found to be defective shall be repaired and retested. If a tank defect is identified, the Contractor shall provide the services of a factory-authorized representative to perform the necessary repairs to ensure that 100% watertight integrity and the structural integrity of the tank is restored. If repairs to the tank are necessary, a complete engineers report, attesting to the integrity of the tank repair, affirming conformance with this specification and validating the terms of the Warranty, shall be provided by the Contractor and Tank Manufacturer.

14. Retesting of lines after repairs shall be done at pressures originally specified for the test.

C. Hydrostatic Tank Testing

1. The test pressure shall be that pressure obtained with the tank 100% full, but in no case shall not exceed 10 psig. The test shall be conducted using potable water.

2. Temperature and head adjustments shall be made in accordance with ANSI

B31.3, paragraphs 337.4.1 and 337.4.2. The hydrostatic test shall not be initiated until the tank, interconnecting piping and the test water have reached thermal equilibrium.

3. Interconnecting piping shall be isolated from the tank by closing the isolation valves.

4. Upon attaining thermal equilibrium following filling of the tank with potable water, the water level elevation shall be measured and recorded and the tank shall undergo an initial visual inspection. The tank shall then stand quiescent for 24-hours.

5. Upon completion of the 24-hour static hold period, the tank and connection shall be inspected for leaks and the final water level elevation shall be measured and recorded.

6. If leaks or other defects are identified they shall be evaluated and repaired, and the tank re-tested. If it is determined that the tank cannot be repaired, the Owner shall declare the tank to be unacceptable.

D. Test Reports: The Contractor shall make a record of the test on a "Test Report" form for the tank system tested, which shall consist of the following data:

1. Tank Identification:
2. Date of test:
3. Type of test:
4. Test pressure applied:
5. Time duration of test pressure:
6. Pressure at end of test:
7. Tested by:
8. Comments:

3.11 Field Tests and System Operational Validation

A. The purpose of the system test program shall be to validate the system operation and performance. The Owner will perform checkout and operational tests and provide labor, equipment, and incidentals required for testing. Deficiencies found shall be rectified and work affected by such deficiencies shall be re-tested at the Vendor's expense. The Owner will maintain equipment in proper operational condition during field testing. All chemicals and utilities required for system operation shall be furnished by the Owner.

B. Operational and performance test runs shall be made over the full design load range, or simulated for other conditions. Tests shall continue for specified periods of time to demonstrate that each sub-component, all system controls and the overall system operate as designed. During test runs all necessary adjustments shall be made, controls and motors checked for proper operation, motors checked for overload, and the entire system checked

for abnormal conditions.

C. Operational and performance testing to demonstrate control and operational performance shall be conducted under full load range and cycling conditions and continuous operation to show conformance with these specifications. Tests shall include the following:

1. Hydraulic testing of each subsystem and support systems shall be made, using potable water, to demonstrate proper functioning. Air testing as a substitute for potable water testing is not acceptable.

2. Proper operation of all control panel devices, monitoring and control instruments, chemical metering pumps, distribution pumps, level controls, panels, etc., including all alarms, shall be demonstrated.

D. In the event of controls or equipment malfunction, defects shall be corrected and the test procedures repeated a sufficient number of times to satisfy the Owner that the repairs are permanent and correct, and that system reliability has been demonstrated. The Owner may request additional testing to demonstrate correct operation at no additional cost to the Owner.

E. After test runs have been concluded and systems have been demonstrated to comply with these specifications and are ready for permanent operation, all permanent pipe line strainers and filters shall be cleaned, air filters cleaned or replaced, valve packing adjusted, belt tensions adjusted, drive guards secured in place, lubrication checked and replenished. Items including temporary piping, wiring, and instrument connections shall be removed and openings sealed in a permanent manner as directed. Electrical conduit requiring sealing shall be sealed.

F. Written records shall be kept for each test showing date, system or equipment tested, test method and test results. Test records and certificates of final inspection or approval issued by authorities having jurisdiction shall be submitted to the Owner for each test within 10 working days after test completion.

3.12 Final System Flushing, Disinfection and Analytical Validation

A. Following the completion of the system pressure testing, the entire water storage tank and booster pump station system including the water storage tank, booster pumps, interconnecting piping, fittings and accessories shall be flushed, disinfected and re-flushed.

B. The disinfection treatment must be sufficient to ensure at least 99.9% inactivation of Giardia lamblia cysts and 99.99% inactivation of viruses.

1. The disinfection procedures shall conform to ANSI/AWWA C654, AWWA 652-

02 Disinfection of Water Storage Facilities and AWWA 653-03 Disinfection of Water Treatment Plants. All chemicals used for disinfection shall conform to the requirements of ANSI/NSF Standard 60-1988.

2. The chlorine solution used for disinfection of the well system, treatment system equipment, hydro-pneumatic tanks and associated piping shall be applied such that a chlorine concentration of at least 50 mg/l of available chlorine be available for the entire water depth of the well and throughout the supply and treatment system, into the hydro-pneumatic tanks.

3. The disinfection solution shall remain within the well, filter systems system, storage tank and associated piping system for a minimum of 8 hours.

4. If water supply samples collected following the disinfection procedure demonstrate bacterial contamination, the disinfection procedure shall be repeated.

5. Following the completion of the disinfection procedure, the system shall be flushed to remove the excess chlorine residual, flushing each point of use until the chlorine residual is 0.5 mg/l.

C. Following the completion of the disinfection procedure, the system shall be flushed to remove the excess chlorine residual. A minimum of 2 sets of samples taken at least 24-hours apart, of the raw water supply (Sample Taps ST-1 & ST-2), the water storage tank discharge (Sample Tap ST-4) and the primary distribution service (Sample Tap ST-5) shall be obtained and analyzed for Total Coliform and Heterotrophic Plate Count (HPC). The sampling and analytical protocols shall conform to the requirements of the RI Department of Health and Good Engineering Practice, in accordance with Appendix 1 of the State of Rhode Island Rules and Regulations Pertaining to Public Drinking Water. The results of the bacteriological testing shall be submitted to the Rhode Island Department of Health, on the correct and appropriate reporting forms, for review and approval, prior to the water supply system being placed into service. Individuals performing sampling shall have knowledge of the protocols for collection, storage and preservation of samples as outlined in the respective methods utilized to analyze potable water samples.

D. In addition to the microbiological monitoring presented in Section 3.09 B, the potable water storage tank shall undergo monitoring for Volatile Organic Compounds (VOC's). One (1) sample shall be obtained from sample tap ST-4 and analyzed for volatile organic compounds (VOC's). The results of this sampling shall be submitted to the Rhode Island Department of Health, on the correct and appropriate reporting forms, for review and approval, prior to the water storage tank being placed into service. Individuals performing sampling shall have knowledge of the protocols for collection, storage and preservation of samples as outlined in the respective methods utilized to analyze potable water samples.

3.13 Final System Start-Up

A. Following the successful completion of the system cleaning, flushing, disinfection and pressure testing, the installed system shall be deemed ready for permanent operation.

B. The final system start-up shall be in accordance with the O&M Manual prepared by the Engineer.