

Standard Specifications for the Construction of Sanitary Sewers and Appurtenances

Water Pollution Control Authority



Town of Canton

4 Market Street, Collinsville, Connecticut 06022

Issued for WPCA Review

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
DIVISION 1 - GENERAL REQUIREMENTS		
01110	Introduction to Standard Specifications	01110-1 to 01110-4
01140	Work Requirements and Restrictions	01140-1 to 01140-2
01310	Coordination	01310-1 to 01310-1
01321	Color Audio/Video Tape Documentation Survey	01321-1 to 01321-3
01325	Scheduling of Construction	01325-1 to 01325-4
01330	Submittal Procedures.....	01330-1 to 01330-5
01420	Reference Standards.....	01420-1 to 01420-7
01450	Quality Control	01450-1 to 01450-3
01510	Temporary Utilities	01510-1 to 01510-3
01520	Construction Facilities.....	01520-1 to 01520-3
01550	Traffic Regulation.....	01550-1 to 01550-2
01570	Temporary Controls	01570-1 to 01570-4
01600	Control of Materials and Equipment.....	01600-1 to 01600-3
01720	Field Engineering.....	01720-1 to 01720-2
01725	Preservation and Restoration of Project Features.....	01725-1 to 01725-3
01760	Protecting Installed Construction	01760-1 to 01760-2
01770A	Pipeline Closeout Procedures.....	01770A-1 to 01770A-2
01770B	Pump Station Closeout Procedures	01770B-1 to 01770B-5
DIVISION 2 - SITE WORK		
02090	Controlled Blasting	02090-1 to 02090-7
02210	Subsurface Investigation.....	02210-1 to 02210-2
02230	Clearing & Grubbing	02230-1 to 02230-2
02240	Dewatering.....	02240-1 to 02240-4
02280	Pipeline and Underground Structure Abandonment ...	02280-1 to 02280-2
02281	Abandonment of Subsurface Disposal Systems	02281-1 to 02281-3
02315	Excavation, Backfill and Compaction	02315-1 to 02315-9
02317	Underground Warning Tape	02317-1 to 02317-2
02318	Tracer Wire Pipe Location System.....	02318-1 to 02318-4
02320	Borrow Materials.....	02320-1 to 02320-8
02370	Erosion and Sedimentation Control	02370-1 to 02370-2
02410	Rock Excavation.....	02410-1 to 02410-2
02445	Pipe Sleeve System	02245-1 to 02445-2
02503	Testing of Sanitary Sewer Systems.....	02503-1 to 02503-8
02511	Pre-Insulated Piping	02511-1 to 02511-6
02514	Ductile Iron (DI) Pipe and Fittings.....	02514-1 to 02514-12
02515	Polyvinyl Chloride (PVC) Pipe and Fittings	02515-1 to 02515-8
02518	Valves.....	02518-1 to 02518-4
02530	Precast Manholes and Structures.....	02530-1 to 02530-10
02534	Sanitary Sewer Service Reconnection.....	02534-1 to 02534-2
02535	Breaking Into Existing Structures.....	02535-1 to 02535-3
02740	Bituminous Concrete Pavement and Curb Repair	02740-1 to 02740-12
02760	Pavement Markings.....	02760-1 to 02760-2
02770	Granite Curbing	02770-1 to 02770-3

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
02775	Portland Cement Concrete Sidewalks	02775-1 to 02775-3
02820	Chain Link Fences and Gates	02820-1 to 02820-6
02920	Lawns and Grasses.....	02920-1 to 02920-3
02958	Television Inspection of Pipelines.....	02958-1 to 02958-5
 DIVISION 3 – CONCRETE		
03310	Cast-in-Place Concrete	03310-1 to 03310-13
 DIVISION 9 - FINISHES		
09900	Painting	09900-1 to 09900-9
 DIVISION 11 - EQUIPMENT		
11000	Equipment - General	11000-1 to 11000-5
11240	Chemical Feed and Storage System	11240-1 to 11240-9
11306	Pumping System Components	11306-1 to 11306-6
11307	Sewage Grinder Pump System	11307-1 to 11307-11
 DIVISION 15 - MECHANICAL		
15050	Piping - General	15050-1 to 15050-5
15060	Hangers and Supports.....	15060-1 to 15060-6
15075	Mechanical Identification.....	15075-1 to 15075-7
15080	Mechanical Insulation	15080-1 to 15080-5
15101	Ductile Iron Pipe and Fittings	15101-1 to 15101-3
15103	Copper Pipe and Fittings	15103-1 to 15103-3
15110	Valves.....	15110-1 to 15110-7
15125	Meters & Gauges	15125-1 to 15125-2
15140	Domestic Water Piping	15140-1 to 15140-10
15150	Sanitary Waste and Vent Piping.....	15150-1 to 15150-8
 DIVISION 16 – ELECTRICAL		
16050	Basic Electrical Requirements.....	16050-1 to 16050-5
16060	Grounding and Bonding	16060-1 to 16060-3
16070	Electrical Hangers and Supports	16070-1 to 16070-2
16075	Electrical Identification	16075-1 to 16075-3
16080	Electrical Testing	16080-1 to 16080-4
16131	Conduit.....	16131-1 to 16131-5

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SECTION 01110

INTRODUCTION TO STANDARD SPECIFICATIONS

PART 1 GENERAL

1.1 INTRODUCTION

- A. The following standard specifications for the construction of sanitary sewer systems have been adopted by the WPCA to govern and regulate sewer construction activities within the Town of Canton. Persons and entities performing sewer work should become familiar with the requirements. All requirements set forth herein shall be followed. These standard specifications will be enforced and interpreted by the WPCA and/or its Technical Consultant.
- B. These standard specifications shall be construed as the minimum requirements of the WPCA. Although the standards are intended to apply for all situations expected, there will be aspects of construction activities that require further interpretation by the WPCA or its Technical Consultant.
- C. All standard specifications and quality standards, which are made a portion of these specifications by reference, shall be the latest edition and revision thereof.
- D. Any discrepancies found between these Standard Specifications and the approved Drawings, or other applicable Codes and Regulations shall be immediately reported to the WPCA and its Technical Consultant. The WPCA and its Technical Consultant shall have the sole authority for interpreting such discrepancies, and providing a clarification to the Contractor with the final decision as to the applicable solution.
- E. Aspects of the standard specifications may be amended or superceded by the WPCA and its Technical Consultant at any time.

1.2 SECTION INCLUDES

- A. The Town of Canton WPCA standard specifications include guidelines associated with, but not limited to the following:
 - 1. Construction of:
 - a. gravity sanitary sewers.
 - b. low pressure sanitary sewers.
 - c. individual sanitary sewer services within the right-of-way.
 - d. sewage pumping stations.
 - e. sewage force mains.
 - 2. Bituminous concrete pavement repair and overlay.
 - 3. Restoration of other items within the project limits disturbed by construction activities.

1.3 SUMMARY

- A. All sanitary sewer projects to be constructed within the Town of Canton shall be completed in accordance with the following:

Town of Canton WPCA

1. Plans, details, and specifications approved by the WPCA
2. Town of Canton WPCA Standard Documents for the Construction of Sanitary Sewer Systems
 - a. Sewer Ordinance
 - b. Design Standards
 - c. Standard Specifications (Refer to Table of Contents)
 - d. Standard Details
 - 1) No. 001 – Standard 48-Inch Precast Concrete Sanitary Sewer Manhole
 - 2) No. 002 – Standard 60-Inch Precast Concrete Sanitary Sewer Manhole
 - 3) No. 003 – Interior Manhole Chimney
 - 4) No. 004 – “Dog House” Manhole Base
 - 5) No. 005 – Guidelines for Construction of Standard Manhole Inverts
 - 6) No. 006 – Standard Manhole Frame and Cover
 - 7) No. 007 – Watertight Manhole Frame and Cover
 - 8) No. 008 – Gravity Sewer Test Mandrel
 - 9) No. 009 – Gravity Sanitary Sewer Service Lateral
 - 10) No. 010 – Gravity Sanitary Sewer Service Lateral with Cleanout
 - 11) No. 011 – Low Pressure Sewer Service Connection to Gravity Sewer Service Lateral
 - 12) No. 012 – Cast-In-Place Gravity Sewer Service Chimney
 - 13) No. 013 – Precast Gravity Sewer Service Chimney
 - 14) No. 014 – PVC / Ductile Iron Gravity Sanitary Sewer Main / Service Trench
 - 15) No. 015 – PVC (Mainline & Service) Low Pressure Sewer & Ductile Iron Force Main Trench
 - 16) No. 016 – Concrete Encasement for Gravity Sewer
 - 17) No. 017 – Pipe Support Utility Crossing
 - 18) No. 018 – Common Gravity Sewer and Force Main Trench
 - 19) No. 019 – Impervious Trench Interrupters / Dams
 - 20) No. 020 – Low Pressure Sanitary Sewer Service Lateral

Town of Canton WPCA

- 21) No. 021 – Sanitary Sewer Force Main Concrete Thrust Blocks for Horizontal Bends
- 22) No. 022 - Sanitary Sewer Force Main Concrete Thrust Blocks for Vertical Bends
- 23) No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
- 24) No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
- 25) No. 025 – Low Pressure Sewer Junction Cleanout Structure
- 26) No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
- 27) No. 027 – Sewage Grinder Pump
- 28) No. 028 – Sewage Grinder Pump Electrical Wiring Diagram
- 29) No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
- 30) No. 030 – Force Main In-Line Cleanout Structure
- 31) No. 031 – Temporary Trench Surface Repairs
- 32) No. 032 – Permanent Trench Surface Repairs
- 33) No. 033 – Grease Trap
- 34) No. 034 – Gasoline and Sand Trap
- 35) No. 035 – Concrete Sewer Cradle
- 36) No. 036 – Concrete Pier Pipe Support
- 37) No. 037 – Force Main Tracer Wire
- 38) No. 038 – Hay Bales and Siltation Fence

1.4 GENERAL

- A. No materials, labor or equipment shall be furnished by the WPCA.
- B. Obtain all local permits and licenses necessary for the contemplated Work.
- C. Comply with the requirements of all permits issued for all portions of the Work.
- D. All Work shall be completed within the project schedule as set forth in the Sanitary Sewer Construction Agreement or Sanitary Sewer Lateral Construction Agreement, whichever is applicable.

1.5 OBSERVATION OF CONSTRUCTION ACTIVITIES

- A. All work shall be inspected by the WPCA or its Technical Consultant, who shall have the authority to halt construction when activities are not being performed in accordance with the above documents.

PART 2 PRODUCTS – Not Applicable

PART 3 EXECUTION

3.1 CONNECTION TO EXISTING SEWERS

- A. Flow of any kind into the existing sewerage system shall not be allowed until the sewer has been satisfactorily completed and accepted for use by the WPCA.

END OF SECTION

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SECTION 01140

WORK REQUIREMENTS AND RESTRICTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Project Management
 - 2. Work Hours
 - 3. Sequence of Work
 - 4. Coordination
 - 5. Pre-Construction Meeting
 - 6. Project Meetings
- B. Related Sections
 - 1. Section 01325 – Scheduling of Construction
 - 2. Section 01550 – Traffic Regulation

1.2 PROJECT MANAGEMENT

- A. Retain on the Site, a competent, full time Superintendent, satisfactory to the WPCA and its Technical Consultant. The Superintendent shall not be changed, except with the consent of the WPCA and its Technical Consultant and shall be in full charge of the work. All instructions given to this person by the WPCA and its Technical Consultant shall be binding.
- B. The work should be completed in a continuous uninterrupted operation to the maximum extent feasible. Use sufficient personnel and adequate equipment to complete all the necessary work requirements within the period of time required by the Sanitary Sewer Construction Agreement or Sanitary Sewer Lateral Construction Agreement, whichever is applicable.
- C. Reference Section 01325 and any applicable project permits or directions of the WPCA and its Technical Consultant for additional requirements associated with the scheduling and sequencing of Work.

1.3 WORK HOURS

- A. Unless specifically authorized by the WPCA and its Technical Consultant, the Work must be conducted during daylight hours on Monday through Friday, and within the time between 7:00 a.m. and 5:00 p.m. No work is to be done on holidays, Saturdays, Sundays or outside of the work hours described above, without prior written permission of the WPCA and its Technical Consultant.
- B. Any additional restrictions on work hours required by and project permits shall prevail.

Town of Canton WPCA

1.4 SEQUENCE OF WORK

- A. The WPCA and its Technical Consultant reserves the right to request modifications to the proposed sequence of work after review of the Schedule of Operations.

1.5 COORDINATION

- A. Supply the telephone/beeper number of a responsible person who may be contacted during off-hours for emergencies 24 hours a day, seven days a week.
- B. Prepare a contact list of phone numbers for all project personnel. Project list should include the Developer, Contractor, WPCA, its Technical Consultant, and local emergency personnel including police, fire and ambulance.
- C. All utility shutdowns shall be coordinated with the WPCA and its Technical Consultant and the affected utility. No shutdown is to occur without authorization.

1.6 PRE-CONSTRUCTION MEETING

- A. A pre-construction meeting shall be held as outlined in the Sanitary Sewer Construction Agreement or Sanitary Sewer Later Construction Agreement, whichever is applicable.
- B. The Developer, Contractor, WPCA, and its Technical Consultant shall be in attendance.
- C. A draft pre-construction meeting shall be submitted to the WPCA and its Technical Consultant for review at least 7 days prior to the planned meeting date.

1.7 PROJECT MEETINGS

- A. Subject to the WPCA's discretion, project meetings will be held on a weekly basis, or as required.
- B. Scheduling shall be discussed with all parties to be affected by upcoming work.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 01310

COORDINATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Coordination of progress of the work to minimize interference with other utilities.
- B. Related Sections
 - 1. Section 01325 – Scheduling of Construction.

1.2 GENERAL

- A. Pipeline shutdowns as a result of sewer construction activities shall be minimized. In the event that an active pipeline must be temporarily shut off, the Contractor shall submit a request to both the WPCA and its Technical Consultant and the appropriate utility owner at least three days prior to shut down. An existing pipeline shall not be shut down unless authorized by the appropriate utility owner. The Contractor shall notify the utility system customers about any interruption in service at least three days in advance. An existing pipeline shall not be shut off for more than six (6) hours.
- B. The WPCA reserves the right to require rescheduling or reactivation of temporary shutdowns if an emergency occurs, such as a major pipeline break or fire.
- C. A detailed Schedule of Operations shall be submitted by the Contractor for review by the WPCA and its Technical Consultant prior to commencing any work.

1.3 SUBMITTALS

- A. Submit to the WPCA and its Technical Consultant all requests for temporary shutdowns as detailed above.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION - NOT APPLICABLE

END OF SECTION

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SECTION 01321

COLOR AUDIO-VIDEO TAPE DOCUMENTATION SURVEY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. The Contractor shall provide a color audio-video tape documentation survey under this Section for preconstruction conditions.
2. Color video taping of surface features located within the roadway right-of-way and including residential properties up to the house frontage, supported by simultaneous audio description of said features.

1.2 DEFINITIONS

- A. Zone of Influence is defined as any area within the immediate construction site which may be affected by equipment traffic, material stock piles, temporary staging areas including a minimum 200 feet along each side of adjoining streets to the construction site.

1.3 SUBMITTALS

- A. Submit a list identifying all pertinent equipment owned or controlled by the Contractor, which is available to perform the Work.
- B. Submit a list outlining the Contractor's experience in performing the type of work covered by this Contract.
- C. Submit a list of previous projects where the same or similar types of work have been performed.
- D. Submit a sample tape by the electrographer covering a specific sample route. Such sample tape shall cover at least 500 lineal feet and a minimum of 5 minutes surveying time. These tapes will become the property of the WPCA and will be the basis for the overall quality and conformance with the specifications.

1.4 QUALITY ASSURANCE

- A. Personnel shall be fully qualified electrographers actively engaged in color audio-video tape documentation and survey projects.
- B. Taping shall be done during times of good visibility. Written authorization by the WPCA and its Technical Consultant to proceed with video documentation during fall and winter months must be done with consideration of existing seasonal climate conditions. The video Contractor shall not be responsible for the removal of snow, leaves, debris or parked vehicles.

PART 2 PRODUCTS

2.1 FORMAT

- A. Audio videotape shall be 1/2 inch VHS color videocassette. Reprocessed tapes will not be acceptable. Video output from camera(s) used must be capable of producing NTSC-500 lines. Resolution in the Y channel, minimum 500 TV lines at center. Geometric Distortion should not exceed 2% of picture height at any point in picture area.

2.2 TAPE INFORMATION

- A. The audio videotape shall have the potential to convey 1 video track and 1 audio track. The video and audio tracks shall be recorded simultaneously as original live recordings and shall not be copies of other audio or video recordings. These recordings shall consist of a fixed elevation video record of the zone of influence of construction and the commentary of the electrographer making the video record.
- B. Video recordings shall, by electronic means, display continuously and simultaneously generated transparent digital information to include the date and time of recording, the engineering stationing corresponding to the stationing on the Drawings (or as directed otherwise by the WPCA and its Technical Consultant) the name of the street, easement or building being documented, the project name, direction of travel and the viewing side. The date and time shall appear in the upper left hand corner of the picture -- example:

Time 8:35:15

Date 9/20/79

- C. The project name, name of street or easement, house or building number, engineering stationing, direction of travel and viewing side shall appear on the lower half of the screen -- example:

N. on First St. W/E

84+20

PART 3 EXECUTION

3.1 CONSTRUCTION AUDIO-VIDEO PROCEDURES

- A. Audio-video taping shall commence at Station 0+00 and proceed to 100 feet beyond the end of the proposed pipeline route along the pipeline route viewing side to side along the direction of progress.
- B. The average rate of speed in the general direction of the conveyance used during taping shall not exceed 50 feet per minute. Panning and zooming rates shall be controlled sufficiently that playback will produce optimum clarity of the objects being viewed.
- C. Coverage shall include, but not be limited to, the entire roadway pipeline route, existing driveways, sidewalks, curbs, ditches, streets (including condition of paving for full width), intersections, landscaping, trees, culverts, catch basins, head walls, fences, mailboxes, retaining walls, visible utilities and all buildings and structures

Town of Canton WPCA

located within the zone of influence. Of particular concern are existing faults, fractures, defects or other imperfections exhibited by the above-mentioned surface features.

- D. Houses and buildings shall be identified visually by house or building number, when possible, in such manner that the progress of the taping and proposed construction areas may be located by reference to the houses and buildings.
- E. Tapes produced under this Contract will be turned over to the WPCA on an every other day basis so the WPCA and its Technical Consultant may review and monitor quality and progress. Any portion of the tape coverage deemed unacceptable by the WPCA and its Technical Consultant shall be retaped by the videographer.
- F. Tapes (cassettes and cases) shall be properly identified by tape number, location, project name, and become the property of the WPCA. A record of the contents of each tape shall be supplied by a run sheet identifying each segment in the tape by location, i.e., roll number, street or easement viewing, tape counter number, viewing side, starting point, traveling direction and ending point.

END OF SECTION

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SECTION 01325

SCHEDULING OF CONSTRUCTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Network analysis
 - 2. Periodic reports
 - 3. Constraints on sequence of operations
- B. Related Sections
 - 1. Section 01310 – Coordination
 - 2. Section 01550 – Traffic Regulation

1.2 REFERENCES

- A. Associated General Contractors of America - The Use of CPM in Construction

1.3 SUBMITTALS

- A. Submit a network analysis at least 30 days prior to the start of construction activities.
- B. Revised Analyses
 - 1. Within 10 calendar days after receipt of review comments from the WPCA and its Technical Consultant, submit four prints of the network analysis revised in accordance with those comments.
- C. Periodic Reports
 - 1. On the first working day of each month submit four prints of the updated analysis.

1.4 QUALITY ASSURANCE

- A. Perform data preparation, analysis, charting, and updating in accordance with pertinent recommendations contained in current edition of "CPM in Construction" manual of the Associated General Contractors.
- B. The CONTRACTOR shall take the following into consideration in the preparation of the schedule network analysis:
 - 1. Shop drawing submittal and approval time;
 - 2. Delivery times of equipment and materials;
 - 3. Subcontractors' work, availability and abilities of workmen;

Town of Canton WPCA

4. Weather conditions;
5. Seasonal constraints resulting from stormwater flows;
6. Restrictions in operations at the work site;
7. All other items that may affect completion of the Work.

PART 2 PRODUCTS

2.1 NETWORK ANALYSIS

A. Diagram

1. Graphically show the order and interdependence of all activities necessary to complete the Work. Show the sequence in which each such activity is planned. The Contractor and his project field superintendent shall coordinate activities with all subcontractors and materials suppliers whose work is shown on the diagram.
2. Include, but do not necessarily limit indicated activities to:
 - a. Project mobilization;
 - b. Submittal and approval of Shop Drawings;
 - c. Procurement of equipment and critical materials;
 - d. Fabrication of special equipment and material, and its installation and testing;
 - e. Final cleanup;
 - f. Final inspecting and testing; and
 - g. All activities of the WPCA and its Technical Consultant that affect progress and/or affect required dates for completion of all or part of the Work.
3. Show information in such detail that the duration times of activities will range normally from one to 15 calendar days. The selection and number of activities shall be subject to the approval of the WPCA and its Technical Consultant.
4. Show on the diagram, as a minimum for each activity, preceding and following event numbers, description of each activity, and activity duration in calendar days.
5. Submit the diagram on maximum sheet size 36" high by the width required.

2.2 PERIODIC REPORTS

- A. On or about the first working day of every month, the Contractor shall meet with the WPCA and its Technical Consultant and present four copies of a report of operations during the preceding period which shall include the following:

Town of Canton WPCA

- B. Report actual progress by updating the network analysis.
- C. Note on the summary network, or clearly show on a revised issue, the affected portions of the detailed network.
- D. Revise the summary network as necessary for clarity.
- E. State the percentage of the Work actually completed and scheduled as of the report date, and the progress along the critical path in terms of days ahead of or behind the allowable dates.
- F. If the Work is behind schedule, also report progress along other paths with negative slack.
- G. Include a narrative which includes, but is not necessarily limited to:
 - 1. A description of problem areas, anticipated and current;
 - 2. Delaying factors and their impact;
 - 3. An explanation of corrective actions taken or proposed.
- H. All periodic reports shall indicate the date of latest revision.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to all work of this Section, thoroughly study the referenced standard as well as pertinent portions of the Contract Documents.
- B. In the preparation of the schedule, the Contractor shall take into consideration Shop Drawing submittal and approval time, the delivery times of equipment and materials, Subcontractors' work, availability and abilities of workmen, weather conditions, any restrictions in operations at the Work site, and all other items that may affect completion of the Work within the time requirements of the Sanitary Sewer Construction Agreement or Sanitary Sewer Lateral Construction Agreement, whichever is applicable.

3.2 SEQUENCE OF OPERATIONS

- A. The sequence of operations is subject to the following constraints:
 - 1. Contractor shall achieve final completion as specified in the Sanitary Sewer Construction Agreement, or Sanitary Sewer Lateral Construction Agreement whichever is applicable.
 - 2. Conform to the requirements of all project permits.
 - 3. Final pavement overlay activities in "Town Roads" shall not occur until the temporary pavement patch has been in place through a "Winter" season. The Contractor shall maintain the trench pavement repair work until the "Spring" season, or until such a time as the full-width pavement overlay work is completed.

3.3 SPECIAL CONSIDERATIONS

- A. The Contractor shall pay particular attention to potential traffic routing issues as they might occur during construction. Particular care and consideration for the following issues should be considered and planned by the Contractor prior to construction:
 - 1. Traffic detours and construction rerouting.
 - 2. Maintaining residential vehicular traffic.
 - 3. Maintaining access for emergency vehicles and school buses.
 - 4. Timing construction activities such that resident access to homes and places of work remains available.
- B. Other Considerations
 - 1. The Contractor shall inform the WPCA and its Technical Consultant at least two weeks in advance of commencing work under the SSCA or SSLCA.

END OF SECTION

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Product Data
2. Shop Drawings
3. Product Listing and Manufacturers' Qualifications
4. Samples
5. Certificates of Compliance

1.2 SUBMITTALS

A. Product Data

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

B. Shop Drawings

1. Shop drawings as specified in individual work Sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation drawings, schedule information, piece part drawings, actual shopwork manufacturing instructions, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certification, as applicable to the Work.
2. All shop drawings submitted by Suppliers for approval shall be sent directly to the Contractor for preliminary checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials. The Contractor shall be solely responsible for the coordination of submittals for related or interdependent equipment; fragmented submittals will not be accepted for review by the WPCA and its Technical Consultant. The Contractor shall advise the WPCA and its Technical Consultant in writing of any deviations from WPCA requirements.

Town of Canton WPCA

3. Check all shop drawings regarding measurements, size of members, materials, and details to determine if they conform to the intent of the Drawings and Specifications. Drawings found to be inaccurate, not in compliance, or otherwise in error shall be returned to the subcontractors for correction before submission to the WPCA and its Technical Consultant. Drawings that are current shall be marked with the date, name, and approval stamp of the Contractor. The Contractor shall advise the WPCA and its Technical Consultant in writing of any deviations from WPCA requirements.
4. All details on shop drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made by the Contractor and noted on the drawings before being submitted for approval.
5. No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted and approved as conforming to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the work shall then be as shown in and represented by said drawings.
6. Until the necessary approval has been given, the Contractor shall not proceed with any portion of the work, the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which approval is required.
7. The approval of shop and working drawings, etc., will be general only and shall not relieve or in any respect diminish the responsibility of the Contractor for providing materials necessary for proper fitting and construction of the work as required by the Contract and for achieving the specified result and performance.
8. Should the Contractor submit for approval equipment that requires modifications to the structures, piping, layout, etc. detailed on the drawings, he shall also submit for approval detail of the proposed modifications. If such equipment and modifications are approved, the Contractor, shall do all work necessary to make such modifications.

C. Product Listing And Manufacturers Qualifications

1. Within seven calendar days after execution of the Notice to Proceed, submit to the WPCA and its Technical Consultant the names and addresses of the manufacturers and suppliers of all materials and equipment to be incorporated into the Work. Submit prior to the submission of shop drawings, data in sufficient detail to enable the WPCA and its Technical Consultant to determine whether the manufacturer and/or the supplier have the ability to furnish a product meeting the Specifications. Submit such data in a manner similar to that specified for submission of shop and working drawings.

D. Contractor's Responsibilities

1. Review shop drawings, product data, and samples prior to submission and verify and determine:

Town of Canton WPCA

- a. Field measurements
 - b. Conformance with the Specifications. Advise the WPCA and its Technical Consultant in writing of any deviations from the requirements of the Contract documents.
2. Provide submittal identification and information including:

The date of submission and dates of previous submissions, project title, contractor identification, specification section, manufacturer and supplier, identified field dimensions, applicable standards and identification of deviations from WPCA requirements.
 3. Provide a minimum of 6 sets of shop drawings and product data, 4 of which are to be retained by the WPCA and its Technical Consultant.
 4. Apply the Contractor's stamp, initials, or signature certifying that the submission has been thoroughly reviewed for completeness, compliance with WPCA requirements, coordination with adjacent construction and dimensional compatibility. Items submitted without the stamp or are incomplete will be returned without review, for rework and resubmission.
 5. List any deviations from WPCA requirements and product or system limitations that may be detrimental to successful performance of the work.
 6. Provide space for the Technical Consultant's review stamps and comments. The Technical Consultant will review shop drawings for design, general methods of construction and detailing. This review shall not be construed as a complete check nor does it relieve the Contractor from responsibility for any departures or deviations from the WPCA requirements unless he has, in writing, called the Technical Consultant's attention to such deviations at the time of submission.
 7. Submissions shall be accompanied by a transmittal form referencing the project name and applicable specification section. Submittals shall be referenced with consecutive numbering. Resubmittals shall bear the same transmittal number with a sequential letter suffix commencing with "A".
 8. Revise and resubmit submittals as required, identify all changes made since last submittal.

1.3 REVIEW OF SHOP DRAWINGS

- A. Submittals will be returned under one of the following codes:
 1. APP – “Approved” is assigned when there are no notations or comments on the submittal. Equipment or materials may be released for manufacture.
 2. AAN – “Approved as Noted” is assigned when there are notations or comments on the submittal, but the equipment or materials may still be released for manufacture. All notations and comments must be incorporated in the final product.
 3. R&R – “Revise and Resubmit” is assigned when there are extensive notations and comments requiring a resubmittal of the package. It may also be assigned

Town of Canton WPCA

when there is a significant amount of missing material required for the Technical Consultant to perform a complete review.

4. NA – “Not Approved” is assigned when the submittal does not meet the WPCA requirements. The entire package must be resubmitted, revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the WPCA requirements.
5. REV – “Reviewed – No Action Taken” is assigned to submittals that are reviewed but for which there is no approval required by the Technical Consultant. Examples of the type of submittals that receive this stamp include, but are not limited to, design calculations stamped by another P.E. and submittals of the Contractor’s means and methods that have not been expressly specified.

1.4 QUALITY ASSURANCE

A. Certificates Of Compliance

1. Provide sworn certificates from the manufacturer or material supplier that the materials and fabrications provided under the section conform with the pertinent plans, specifications and processing, product testing and inspection of materials are in conformance with all applicable specifications, drawings and/or WPCA standards.
2. Certificates of Compliance shall be submitted in triplicate when requested by the WPCA’s Technical Consultant.
3. Certificates shall be signed by an officer of the Corporation and witnessed by a Notary Public.

1.5 SEQUENCING

A. General Procedures for Submission and Resubmission of Shop Drawings, Product Data, and Samples

1. Coordination
 - a. Prepare and submit documentation in advance of fabrication and product manufacturer, so that the installation will not be delayed, other related work can be properly coordinated, and there is adequate time for review and resubmission, if required.
2. Resubmission
 - a. Make corrections and modifications required by the Technical Consultant and resubmit until approved.
 - b. Clearly identify changes made to shop drawings and product data and indicate other changes that have been made other than those requested by the WPCA’s Technical Consultant.
3. Distribution
 - a. Distribute approved submittal shop drawings and approved submittal product data to the project site and elsewhere as required to

Town of Canton WPCA

communicate the information to suppliers, Contractors, and field personnel.

B. Samples may be retained by the WPCA, as applicable.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 01420

REFERENCE STANDARDS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, or Federal Specifications, comply with requirements of the standard, except when more rigid requirements are specified or are required.
- B. Obtain copies of the most up-to-date standards as outlined herein.
- C. Conform to reference standard by date of current issue.
- D. Applicable codes and standards shall include all Connecticut General Laws, local ordinances, and regulations, utility company regulations, and the applicable requirements of the National and State codes and standards.

1.2 SCHEDULE OF REFERENCES

- AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006
- AABC Associated Air Balance Council
1000 Vermont Avenue, N.W.
Washington, DC 20005
- AASHTO American Association of State Highway and Transportation Officials
444 North Capital Street, N.W.
Washington, DC 20001
- ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219
- ADC Air Diffusion Council
230 North Michigan Avenue
Chicago, IL 60601
- AFBMA Antifriction Bearing Manufacturers Association
1101 Connecticut Avenue N.W. Suite 700
Washington, DC 20036
- AGA American Gas Association
- AGC Associated General Contractors of America
1957 E. Street N.W.
Washington, DC 20006

Town of Canton WPCA

AGMA	American Gear Manufacturers Association 1500 King Street, Suite 201 Alexandria, VA 22314
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AIA	American Institute of Architects 1735 New York Avenue, N.W. Washington, DC 20006
AISC	American Institute of Steel Construction One East Wacker Drive Suite 3100 Chicago, IL 60601
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
AITC	American Institute of Timber Construction 333 W. Hampden Avenue Englewood, CO 80110
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
APA	American Plywood Association Box 11700 Tacoma, WA 98411
API	American Petroleum Institute 1220 L. Street, N.W. Washington, DC 20005
ARI	Air-Conditioning and Refrigeration Institute 1501 Wilson Boulevard Arlington, VA 22209
ASCE	American Society of Civil Engineers 345 E. 47th Street New York, NY 10017

Town of Canton WPCA

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASPA	American Sod Producers Association 4415 West Harrison Street Hillside, IL 60162
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWI	Architectural Woodwork Institute 2310 South Walter Reed Drive Arlington, VA 22206
AWPA	American Wood-Preservers' Association 7735 Old Georgetown Road Bethesda, MD 20014
AWS	American Welding Society 550 LeJeune Road, N.W. Miami, FL 33135
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091
CDA	Copper Development Association 57th Floor, Chrysler Building 405 Lexington Avenue New York, NY 10174
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 50195

Town of Canton WPCA

DHI	Door and Hardware Institute 7711 Old Springhouse Road McLean, VA 22101
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FGMA	Flat Glass Marketing Association 3310 Harrison White Lakes Professional Building Topeka, KS 66611
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 (WRSIS) Washington Navy Yard, Building 197 Washington, DC 20407
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201
JIC	Joint Industrial Council c/o National Machine Tool Builders Association 7901 Westpark Drive McLean, VA 22102
IBR	Institute of Boiler and Radiator Manufacturers aka Hydronics Institute P.O. Box 218 35 Russo Place Berkeley Heights, NJ 07922
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017

Town of Canton WPCA

IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005
MBMA	Metal Building Manufacturer's Association 1230 Keith Building Cleveland, OH 44115
MFMA	Maple Flooring Manufacturers Association 60 Rivere Drive Northbrook, IL 60062
MIL	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NCMA	National Concrete Masonry Association P.O. Box 781 Herndon, VA 22070
NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association 2101 "L" Street, N.W. Washington, DC 20037
NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
NFPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NSWMA	National Solid Wastes Management Association 1730 Rhode Island Avenue, N.W. Washington, DC 20036

Town of Canton WPCA

NWMA	National Woodwork Manufacturers Association 205 W. Touhy Avenue Park Ridge, IL 60068
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
RIS	Redwood Inspection Service One Lombard Street San Francisco, CA 94111
RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau 515 116th Avenue Bellevue, WA 98004
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711
SDI	Steel Door Institute 712 Lakewood Center North 14600 Detroit Avenue Cleveland, OH 44107
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601
SJI	Steel Joist Institute 1205 48th Avenue North, Suite A Myrtle Beach, SC 29577
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213

Town of Canton WPCA

TCA Tile Council of America, Inc.
 Box 326
 Princeton, NJ 08540

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

WCLIB West Coast Lumber Inspection Bureau
 6980 S. W. Varns Road
 Box 23145
 Portland, OR 97223

WWPA Western Wood Products Association
 1500 Yeon Building
 Portland, OR 97204

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

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SECTION 01450

QUALITY CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Testing laboratory services
 - 2. Product test reports
 - 3. Manufacturer's field service
- B. Related Sections
 - 1. Section 02320 – Borrow Materials

1.2 REFERENCES

- A. ASTM E329 - Standard Practice for use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.3 QUALITY ASSURANCE

- A. The testing lab shall be approved by the WPCA and/or its Technical Consultant prior to any sampling or testing of materials or work.
- B. The testing laboratories shall meet the basic requirements of ASTM E329. Laboratories shall be authorized to operate in the state in which the Work is located.
- C. Testing equipment shall be calibrated at maximum 12 month intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants. Upon request, submit copy of certificate of calibration, made by accredited calibration agency.
- D. Testing shall be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.
- E. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.
- F. Comply fully with manufacturer's instructions. Should these instructions conflict with the Specifications, request clarification from the WPCA and its Technical Consultant before proceeding.
- G. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or requirements indicate higher standards or more precise workmanship.

1.4 CONTRACTOR RESPONSIBILITIES

- A. Notify WPCA and its Technical Consultant of time, location and material being sampled.
- B. Obtain and handle sample at the Project Site or at the source of the product to be tested.
- C. Secure and deliver the required number of soil samples to the laboratory as outlined in the appropriate Section or as directed by the WPCA and its Technical Consultant.
- D. Schedule necessary testing laboratory services.

1.5 TESTING LABORATORY SERVICES

- A. Provide qualified personnel promptly on notice.
- B. Perform specified inspections, sampling and testing of materials and methods of construction.
- C. Comply with applicable standards.
- D. Comply with the requirements of Sanitary Sewer Construction Agreement or the Sanitary Sewer Lateral Construction Agreement, whichever is applicable.
- E. Specimens and samples for testing shall be taken by the testing agency personnel. All sampling equipment and the delivery of specimens and samples shall be performed by the testing agency personnel.
- F. Notify the WPCA's Technical Consultant immediately of irregularities or deficiencies of Work that are observed during performance of services.
- G. Submit two copies of reports of inspections and tests, one copy to WPCA, and one copy to the WPCA's Technical Consultant including:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Testing laboratory name and address.
 - 4. Name and signature of inspector.
 - 5. Date of inspection or sampling.
 - 6. Record of temperature and weather.
 - 7. Date of test.
 - 8. Identification of product and Specification Section.
 - 9. Location in Project.
 - 10. Type of inspection or test.
 - 11. Results of tests and inspections regarding compliance with WPCA Requirements.

Town of Canton WPCA

- H. Contractor's coordination of testing laboratory services.
 - 1. Provide testing laboratory persons access to Work and manufacturer's operations.
 - 2. Provide laboratory with representative samples of materials to be tested in required quantities.
 - 3. Furnish labor and facilities:
 - a. To provide access to Work to be tested.
 - b. To facilitate inspections and tests.
 - c. For laboratory's exclusive use for storage and curing of test samples.
 - d. Forms for preparing concrete test beams and cylinders.
 - 4. Notify laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
 - 5. Arrange with laboratory and pay for, additional inspections, samples, and tests required for Contractor's convenience.

1.6 PRODUCT TEST REPORTS

- A. Furnish two copies of product test reports, one copy to WPCA and one copy to WPCA's Technical Consultant.

1.7 MANUFACTURERS' FIELD SERVICE

- A. When required in the Specification sections, require material and equipment suppliers to provide qualified field service and installation personnel to observe site conditions, installation techniques, quality of workmanship, equipment start-up, adjustment, and performance test. Observations are to be reported and incorporated in the Work procedures.

1.8 PAYMENT PROCEDURES

- A. The Contractor is responsible for payment of all tests outlined in the WPCA Requirements.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

NOT APPLICABLE

END OF SECTION

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SECTION 01510

TEMPORARY UTILITIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes description of the Contractor's responsibilities for providing
 1. Temporary electricity
 2. Temporary lighting for construction purposes
 3. Temporary heating, cooling and ventilating
 4. Temporary water service
 5. Temporary fire protection
- B. Related Sections
 1. Section 01520 - Construction Facilities

1.2 QUALITY ASSURANCE

- A. Maintain temporary utilities in proper and safe condition throughout the progress of the Work.

1.3 TEMPORARY ELECTRICITY

- A. Provide a temporary electrical service capable of providing sufficient power throughout the site for both temporary power and temporary lighting for the Work and for all field offices. Temporary electrical service shall consist of all wiring, breakers, breaker boxes, poles, supports and all other materials necessary for a totally operable system.
- B. Make all arrangements with the electric service company including all permits, securities and inspections to obtain the separately metered temporary services.
- C. Furnish and connect the temporary electric service point to the utility and coordinate metering as required.
- D. All connection points and distribution systems shall be in conformance with applicable electrical codes, OSHA, and enforcement agencies having jurisdiction.
- E. Provide a general power distribution system including all wires, cables, supports, protective devices, transformers, motor starters, etc., as required for a complete electrically protected and safe system to handle construction services.
- F. Provide all outlets with circuit breaker protection and comply with ground fault protection requirements of the NEC.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Temporary general lighting system shall provide sufficient artificial light so that all Work may be done in a workmanlike manner within enclosed structures and

Town of Canton WPCA

chambers, where there is not sufficient daylight. A minimum of 300 watts of lamp per each 200 square foot or less of work area shall be provided.

- B. Temporary general lighting system shall consist of wiring, switches, necessary insulated supports, poles, fixtures, receptacles, lamps, guards, cut-outs, fuses, and other materials necessary for a totally operable system.

1.5 TEMPORARY HEATING, COOLING AND VENTILATING

- A. Provide sufficient temporary heating, cooling and ventilating for the interior of all new structures and buildings to assure safe working conditions and that no damage will occur to the Work.
- B. Systems shall be complete, including but not limited to, pumps, radiators, unit heaters, fans, ducts, piping, insulation, thermostat controls and other equipment necessary for a totally operable system.
- C. Temporary heating, cooling and ventilating shall be capable of maintaining a minimum of 60°F and a maximum of 80°F, unless otherwise specified, simultaneously in all areas of construction in buildings and structures and shall be provided at all times when workmen are engaged in construction activity or if needed to protect Work or equipment previously installed.
- D. Temporary heating systems shall be gas or electric, steam hot water or warm air type; or combination thereof. Salamanders or other direct oil or kerosene fired equipment will not be allowed.
- E. Temporary heating, cooling and ventilating systems shall be located so as not to interfere with existing facilities or new construction work.
- F. Prior to operation of permanent equipment for temporary heating, cooling or ventilating purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance and regular replacement of filters and worn or consumed parts.
- G. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity and to prevent accumulation of dust, fumes, vapors or gases.

1.6 TEMPORARY WATER SERVICE

- A. Water for Construction Purposes
 - 1. The contractor is responsible for providing all water required for construction purposes.

1.7 TEMPORARY FIRE PROTECTION

- A. Comply with all applicable fire protection and prevention requirements that may be established by Federal, State or local governmental agencies.
- B. Prohibit smoking in hazardous areas. Post suitable warning signs in areas that are continuously or intermittently hazardous.
- C. Determine the fire protection adequacy of existing facilities related to the Work being performed and have standby fire protection available if needed.

Town of Canton WPCA

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 01520

CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes the Contractor's responsibilities for providing the following:
 - 1. Field office
 - 2. Temporary telephone service
 - 3. Temporary sanitary facilities
 - 4. First aid station
- B. Related Sections
 - 1. Section 01510 – Temporary Utilities

1.2 QUALITY ASSURANCE

- A. Maintain temporary construction facilities in proper and safe condition throughout the progress of the Work.

1.3 FIELD OFFICE

- A. When required by the WPCA as part of a Sanitary Sewer Construction Agreement, provide and maintain for the duration of the Work at a location approved by the WPCA, a separate field office trailer or equivalent, for the exclusive use of the WPCA's Technical Consultant. The plans and construction of the office shall be approved by WPCA's Technical Consultant and shall be not less than 450 square feet.
- B. Trailer shall be equipped with two exterior doors with screens, and at least 3 screened and lockable windows. The trailer shall be weather tight and insulated in the walls, floor and ceiling. Doors shall be equipped with cylinder locks and two keys shall be supplied for use by the WPCA's Technical Consultant.
- C. Each office shall be equipped with the following:
 - 1. 2, flat top, 30" x 60" desks with a minimum of 3 drawers each
 - 2. 3, standard desk arm chairs on rollers
 - 3. 2, desk lamps
 - 4. 1, drafting table at least 48" x 60" with a vinyl lined work surface
 - 5. 1, swivel top drawing stool with padded seat and back
 - 6. 1, drafting table lamp
 - 7. 1, table at least 3 feet wide x 6 feet long with sufficient chairs to seat 6
 - 8. 3, metal four drawer, standard size vertical filing cabinets with lock and keys (all keyed the same)

Town of Canton WPCA

9. 2, 3' wide bookcases or equivalent built in shelf space
 10. 1, locker for survey equipment
 11. 3, drawing racks
 12. 1, 4' x 6' chalkboard and chalk
 13. 1, pencil sharpener - wall mounted
 14. 1, private telephone line and phone. Telephone shall have the features of internal and internal/external conferencing, speed dial, call transfer, auto dial and two-way speaker.
 15. 1, automatic message recorder capable of taking 10 messages minimum, with 1 minute as allowable time for each message. It shall have an "OFF-ON" switch for its operation.
 16. 1, Fax machine, Pitney Bowes, AT&T, or equal with separate, dedicated telephone line for faxing purposes.
 17. 2, interior door mats.
 18. Overhead lighting (75 foot candles minimum)
 19. CO₂ fire extinguisher
 20. 3, large waste baskets, 1 broom, and dust pan
 21. 1, photocopy machine with supplies and a maintenance plan for the duration of the Work, Ricoh FT 4480 or equal.
 22. Temporary Drinking Water
 - a. Provide adequate potable drinking water, so piped or transported as to keep it safe and fresh, and served from single service containers or satisfactory types of sanitary drinking stands or fountains.
 - b. Provide all such facilities and services in strict accordance with existing and governing health regulations.
- D. Thermostatically controlled heating units or central system of adequate capacity to maintain 70°F under all cold weather conditions. Thermostatically controlled refrigerant type air conditioners of adequate capacity to maintain a maximum temperature of not more than 68°F under all hot weather conditions.
- E. Provide paper cups, paper towels, soap, toilet paper and suitable dispensers and holders for each of these items.
- F. Maintain the office during construction of the Work. The cost for operation of the field office shall be the responsibility of Contractor.
- G. Remove all field offices and temporary facilities from the site after the completion of the Work. The premises shall be restored to a condition equivalent to that which existed prior to installation of the facilities.

Town of Canton WPCA

1.4 TEMPORARY TELEPHONE SERVICE

- A. Provide, maintain and pay for cellular telephone service for the WPCA's Technical Consultant at the time of mobilization for the duration of the Work.
- B. Provide, maintain and pay for 2 telephone lines to the field office of the WPCA's Technical Consultant for telephone, and facsimile service at the time of mobilization for the duration of the Work.

1.5 TEMPORARY SANITARY FACILITIES

- A. Provide suitably enclosed chemical or self-contained toilets for the use of the WPCA's Technical Consultant, and separate facilities for the labor force employed on the Work. Toilets shall be located near the Work sites and secluded from observation insofar as possible. Toilets shall be serviced weekly, kept clean and supplied throughout the course of the Work.
- B. Contractor shall enforce proper use of sanitary facilities.
- C. Use of WPCA's sanitary facilities by Contractor is prohibited.

1.6 TEMPORARY FIRST AID FACILITIES

- A. Provide a first aid station at the site.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 01550

TRAFFIC REGULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. General traffic requirements
 - 2. Traffic regulation on narrow and/or dead end streets
 - 3. Traffic officers
- B. Related Sections
 - 1. Section 01140 – Work Requirements and Restrictions
 - 2. Section 01325 – Scheduling of Construction

1.2 REFERENCES

- A. Manual of Uniform Traffic Control Devices, U.S. Department of Transportation
- B. CONN DOT Standards

1.3 GENERAL TRAFFIC REQUIREMENTS

- A. The Contractor is responsible for scheduling and paying for all flaggers and traffic officers in the event they are required.
- B. Arrange construction activity so that all streets shall remain open to at least one-way traffic during periods of actual work, and to unimpeded, two-way traffic during all other periods.
- C. The Contractor shall provide all traffic control signs, including detour signs, meeting the approval of the WPCA and its Technical Consultant, the Canton Police Department and the Connecticut Department of Transportation (where applicable).
- D. Provide a traffic control plan to WPCA's Technical Consultant for approval showing traffic control signs, barrels, cones, traffic officers, including detour signs, meeting the approval of the WPCA and its Technical Consultant and the Canton Police Department, and in accordance with the Manual of Uniform Traffic Control Devices.
- E. Determine the location of each day's work and implement the approved traffic control plan. If the plan requires the use of traffic officers, notify the Police Department.
- F. Hand deliver written notice to individual houses affected by driveway and side road closings or detours a minimum 24 hours in advance. A recommended parking area outside the work limits shall be included in the notice.

Town of Canton WPCA

1.4 WORK ON NARROW AND/OR DEAD END STREETS

- A. To the extent possible, construction activity shall be arranged to allow at least one-way traffic during periods of actual work, and to unimpeded, two-way traffic during all other periods.
- B. Where it is not possible to maintain traffic past the actual construction site, written notices shall be hand delivered by the Contractor to individual houses affected by the road closings a minimum 24 hours in advance. A recommended parking area outside the work limits shall be included in the notice.
- C. The Contractor shall provide for safe passage of pedestrian traffic around and past the actual work site.

1.5 TRAFFIC OFFICERS

- A. Uniformed traffic officers and/or flaggers shall be required at locations deemed necessary by the WPCA and its Technical Consultant, working in conjunction with the Canton Police and Fire Departments, for the protection of the public.
- B. The Police Chief or his representative, in consultation with WPCA's Technical Consultant, will determine the number of officers required for the work.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 01570

TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes description of the Contractor's responsibility for providing:
 - 1. Temporary dust control
 - 2. Drainage and erosion control
 - 3. Haybales and siltation fence
 - 4. Daily backfill and cleanup
- B. Related Sewer Construction Details
 - 1. No. 038 – Haybales & Siltation Fence

1.2 TEMPORARY DUST CONTROL

- A. Exercise particular care to control dust both during and after construction. A mechanical street sweeper shall be used as needed.
- B. Prevent dust from becoming a nuisance or hazard. During construction, excavated material and open or stripped areas are to be properly policed and controlled so as to prevent spreading of the material.
- C. Control dust during and after construction using calcium chloride and/or salt. The Contractor may be directed to employ sprinkling of water in lieu of calcium chloride for dust control.
- D. During and after construction, all paved road and driveway surfaces are to be scraped and broomed free of excavated materials on a daily basis. The surfaces are to be hosed down or otherwise treated to eliminate active or potential dust conditions and the natural road or wearing surface is to be exposed.
- E. Ensure that the existing equipment, facilities, and occupied space adjacent to or nearby areas of the work do not come in contact with dust or debris as a result of concrete demolition, excavation or surface preparation for coatings.
- F. Control dust by the construction of temporary wooden frame/polyethylene sheeting walls and covering enclosures separating adjacent or nearby areas and equipment from the work site.
- G. Submit for approval materials proposed for use for dust control, prior to prosecution of the work.

1.3 DRAINAGE AND EROSION CONTROL

- A. Installed and maintain sediment trapping system.
- B. Discharge surface runoff from any disturbances to the site into silt containment basins. Siltation prevention measures utilizing haybale and geotextile fences for containment shall be taken before discharge to drainage systems.

Town of Canton WPCA

- C. The WPCA and its Technical Consultant shall not be held liable for any fines or penalties resulting from pollutants entering the drainage system of wetlands as a result of the Contractor's operation.

1.4 HAYBALE AND SILTATION FENCE

- A. Perform surface protection, erosion control work and surface restoration along any length of the proposed sanitary sewer that parallels a brook or its surrounding wetlands as shown on the Drawings and specified herein. The major portions of the work include:
 - 1. Place and maintain both haybales and a staked filter fabric siltation fence along the entire length of the proposed construction between the area of construction and the brook or its surrounding wetlands where shown on the Drawings.
 - 2. Control surface water.
 - 3. Provide erosion control, seed and mulch and netting for the surface restoration of areas disturbed during construction activities.
- B. Provide additional work if necessary to control erosion and siltation throughout the duration of construction activities. Work shall be in accordance with the Town of Canton Inland Wetlands & Watercourses Agency (IWWA).

1.5 TRENCH WORK REQUIREMENTS

- A. There shall be no more than 1000 linear feet of untested pipe in the ground at any one time.
- B. There shall be no more than 1000 linear feet of trench in which there are partially completed manholes.
- C. There shall be no more than 400 linear feet of disturbed trench length at any given time.
- D. All of the above requirements shall apply to the total work including each pipe laying crew on the Project.

1.6 DAILY BACKFILL AND CLEANUP

- A. The Contractor shall furnish all sheeting, shoring, and bracing of every kind necessary to properly perform the Work and/or to comply with State and Federal Laws and Regulations.
- B. The Contractor shall furnish and install in a manner satisfactory to the WPCA's Technical Consultant and local police all barricades and warning signs and lights.
- C. The Contractor shall confine his operations to the shortest possible distance and must clean up his work area behind pipelaying operations immediately after completion of backfilling.
- D. At the close of work each day, the Contractor shall backfill all trenches, as necessary, remove all equipment, boxes and other obstructions from the traveled way so that a free flow of traffic can be safely maintained without the necessity of any special police protection. Any requests for deviations from this requirement shall be submitted to the WPCA and its Technical Consultant for consideration. The

Town of Canton WPCA

Contractor shall clean up and remove excess backfill, materials, and refuse, behind pipelaying operations and shall maintain the traveled way and sidewalks in a neat, clean condition at all times.

PART 2 PRODUCTS

2.1 HAYBALES

- A. Bales of hay required for siltation control shall be wire tied bales of the type normally used for siltation or erosion control or construction projects.

2.2 FILTER FABRIC

- A. Filter fabric siltation fencing shall be a woven filter fabric having a weight of at least 2.5 ounces per square yard, a thickness of at least 17 mils, a coefficient of permeability of not less than 0.0009 centimeters per second and allows a water flow rate of a minimum 40 gallons per minute per square yard. The material shall have a high sediment filtration capacity, high slurry flow and minimum clogging characteristics. The material shall be equal to 100x as manufactured by Mirafi, Inc., Charlotte, North Carolina.

2.3 SEED AND MULCH

- A. Seed shall be an erosion seed mix consisting of a mixture of the previous year's crop and shall contain the following mixture by weight with 98% purity:

<u>Seed</u>	<u>% by Mass</u>	<u>% Germination Minimum</u>
Winter Rye	80 minimum	85
Red Fescue (Creeping)	4 minimum	80
Perennial Rye Grass	3 minimum	90
Red Clover	3 minimum	90
Other Crop Grass	0.5 maximum	
Noxious Weed Seed	0.5 maximum	
Inert Matter	1.0 maximum	

- B. Hay mulch shall consist of mowed and properly cured grass, clover or other acceptable plants. No salt hay shall be used.

PART 3 EXECUTION

3.1 HAYBALES

- A. Control of erosion and siltation during the construction is expected to require mulching, haybales, siltation fencing, diversion and control of storm water run-off, ponding areas and similar methods.
- B. Install haybales by anchoring bales butted together to existing ground with at least two (2) stakes per bale. The stake shall be a minimum of 1 inch square cross section and shall be long enough to penetrate 12 inches into the ground. Deteriorated haybales shall be replaced immediately. Remove and dispose of the haybales following the successful growth of vegetation in the areas disturbed by the construction. The removal of the haybales will be at the direction of WPCA's Technical Consultant and/or the Inland Wetlands & Watercoarses Agency (IWWA). On embankment areas and on flat areas adjacent to wetland areas, the haybales shall

be installed continuously between the construction site and the wetland area as directed by WPCA's Technical Consultant.

3.2 SILTATION FENCE

- A. Install a filter fabric siltation fence in addition to the staked haybales, prior to construction and remove after full surface restoration has been achieved. Install the siltation fence parallel and immediately adjacent to the haybales in conformance with the Drawings. Install as follows:
 - 1. Hand shovel excavate a small trench on the upstream side of the desired fence line location.
 - 2. Unroll the siltation fence system, position the post in the back of the trench (downhill side), and hammer the post at least 1½ feet into the ground.
 - 3. Lay the bottom 6 inches of the fabric into the trench to prevent undermining by storm water run-off.
 - 4. Backfill the trench and compact. Compaction is necessary to prevent the run-off from eroding the backfill.
- B. Control surface waters within the construction area through the use of temporary culverts or other means.

3.3 RESTORATION

- A. Restoration of the ground surface in areas that are brush and/or woodlands prior to the start of construction is expected to require machine spreading of existing stripped surface soils (loam and humus), lime, fertilizer, seed and mulch, and jute netting where required by steep slopes.
- B. Salvage existing loam and topsoil and stockpile this material for re-spreading where originally removed. On backfilling, grading shall be returned to preconstruction contours as much as possible and the stockpile of loam shall be spread over areas disturbed during construction activities.
- C. Place approved mulch on seeded areas to help with erosion control. Use jute netting on areas having a slope greater than 3 horizontal to 1 vertical, to anchor the mulch until a satisfactory growth is obtained. If seeding is not possible because of the time of the year, apply mulch and netting to stabilize the area until such time as seed can be sown.
- D. Maintain the restored areas until such time as the Work is accepted by WPCA. Maintenance shall include all grading, refertilizing, reseeding, remulching and/or netting which may be necessary.

END OF SECTION

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SECTION 01600

CONTROL OF MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes description of the Contractor's responsibilities regarding:
 - 1. Products and material
 - 2. Packaging, handling and storage of materials
 - 3. Inspection of off-site work

1.2 QUALITY ASSURANCE

- A. Prior to submitting Shop Drawings, the Contractor together with his Subcontractors shall review all approved Drawings and Specifications, and WPCA requirements with respect to specific system characteristics, applicability of materials and equipment for the intended purposes, sizes, orientation, and interface with other systems, both existing and proposed, and certify that the materials and equipment proposed will perform as specified.
- B. In accordance with the provisions of Section 01330, the Contractor shall submit to the WPCA's Technical Consultant sufficient detailed data to define the product and document conformity to the Specifications. Data shall be submitted on all materials and equipment proposed to be incorporated in the Work for both temporary and permanent application.
- C. Provide sworn certificates as to quality and quantity of materials where specified or requested by the WPCA's Technical Consultant.
- D. Obtain concurrence of WPCA's Technical Consultant prior to processing, fabricating, or delivering material or equipment.
- E. All materials, workmanship, and equipment used in the Work shall correspond to the approved samples and approved submittal data.

1.3 PRODUCTS AND MATERIAL

- A. Use in the Work only new and first quality material, conforming to the requirements of these Specifications and approved by the WPCA and its Technical Consultant. If, after trial, it is found that sources of supply that have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved materials from other approved sources.
- B. Immediately remove defective materials and equipment from the site.

1.4 PACKAGING, HANDLING, AND STORAGE OF MATERIALS

- A. Progressively deliver materials and equipment to the Site so there will be neither delay in progress of the Work nor an accumulation of material that is not to be used within a reasonable time.
- B. All equipment shall be properly stored and protected immediately upon its arrival and all consideration for potentially lengthy storage periods shall be made.
- C. Deliver products to the Site in their manufacturer's original container, with labels intact and legible.
 - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
 - 2. The WPCA and its Technical Consultant may reject as non-complying such material and products that do not bear identification as to the manufacturer, grade, quality, source, and other pertinent information.
- D. Materials and equipment to be incorporated in the Work shall be handled and stored by the manufacturer, fabricator, Supplier, and Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind to the material or equipment.
- E. All materials and equipment to be incorporated in the Work shall be placed so as to not damage any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to the Town or WPCA.
- F. Determine and comply with the manufacturer's recommendations on product storage, handling, and protection. Provide manufacturer's documentation on recommended storage procedures.
- G. The Contractor shall handle, haul, and distribute all materials and all surplus materials on the different portions of the Work, as necessary or required; shall provide suitable and adequate storage room for materials and equipment during the progress of the Work, and be responsible for the protection, loss of, or damage to materials and equipment furnished by Contractor until the final completion and acceptance of the Work.
- H. Familiarize workmen and Subcontractors with hazards associated with materials, equipment, and chemicals specified herein and take all necessary safety precautions.
- I. Areas available on the Site for storage of material and equipment shall be as shown on the Drawings or approved by the WPCA.
- J. Store mechanical equipment subject to corrosive damage by the outdoor atmosphere (covered or not) in a heated, secured, insured commercial warehouse facility. Equip drive motors with thermostatically controlled strip heaters.
- K. Outdoor storage with plastic, canvas, plywood or other cover will not be allowed except for designated items not containing electrical components or bearings.

Town of Canton WPCA

- L. Materials that become damaged or are unfit for the use intended or specified, shall be promptly removed from the Site.
- M. No item judged rusty, corroded or otherwise damaged during storage will be accepted. Any damaged electrical or instrumentation item shall be removed from the Site and replaced by a completely new item in first class condition.
- N. Do not store material or equipment in any wetland or environmentally sensitive area. Stockpile sites shall be level, devoid of mature stands of natural vegetation, and removed from drainage facilities and features, wetlands, and stream corridors.
- O. Provide protective and preventive maintenance during storage consisting of manually exercising equipment where required, inspecting mechanical surfaces for signs of corrosion or other damage, lubricating, applying any coatings as recommended by the equipment manufacturer as necessary for its protection and other precautions as necessary to assure proper protection of equipment stored.
- P. Treat ferrous surfaces not receiving finish coats of paint with rust preventive coating, and protect non-ferrous metal work and devices with suitable wrappings.
- Q. The Contractor shall be fully responsible for loss or damage to stored materials and equipment.

1.5 INSPECTION OF OFFSITE WORK

- A. Work to be performed away from the Site is subject to inspection on behalf of the WPCA or its Technical Consultant during its fabrication, manufacture, testing, or before shipment. Notify WPCA or its Technical Consultant of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the WPCA and its Technical Consultant in ample time so that the necessary arrangements for the inspection can be made.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 01720

FIELD ENGINEERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Field survey and layout for construction activity.
 - 2. Structural design of bracing, shoring, forms, and similar items to be prepared by the Contractor as part of his means and methods of construction.
 - 3. Delineation of property lines at off-street work areas is the responsibility of the Contractor.
 - 4. The Contractor is responsible for permanently pinning the pump station sites and all easements upon completion of all other site work activities.

1.2 SUBMITTALS

- A. Submit the qualifications of the Registered Professional Engineer and the Land Surveyor to be hired to perform various portions of the Work, as applicable.
- B. Provide documentation verifying the accuracy of field engineering work.
- C. Full surveyed record plan information is required upon completion of the construction activities.
- D. Submit a minimum of six (6) copies of final record drawings of field engineering layouts and as-built survey.
- E. When requested by the WPCA and its Technical Consultant, submit certificate signed by registered (licensed) engineer or surveyor certifying that elevations and locations of Work are in conformance with Contract Documents. Explain all deviations.

1.3 RECORDS

- A. Maintain a complete, accurate log of control and survey work as it progresses.

1.4 QUALITY ASSURANCE

- A. Employ a qualified engineer, registered with the State of Connecticut as a Professional Engineer and a competent surveyor, registered with the State of Connecticut as a Professional Land Surveyor, as required for the particular characteristics of the work being performed.
- B. All easements shall be a minimum of thirty (30) feet wide, centered on the sewer pipe (i.e. 15 feet on each side).
- C. No underground utilities shall be installed within the sewer easement, nor shall any permanent above-grade structures be installed within the limits of the sewer easement without written approval from the WPCA.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.1 PROCEDURES

- A. The Contractor's Registered Professional Engineer or Professional Land Surveyor provided shall establish and maintain site bench marks, lines, elevations and reference marks needed during the progress of the Work. Verify such work by instrument or other appropriate means.
- B. The WPCA and its Technical Consultant shall be permitted at all times to check the lines, elevations and reference marks, set by the Contractor. The Contractor shall correct any errors disclosed by such check. Such a check shall not be construed to be an approval of the Contractor's work and shall not relieve or diminish the responsibility of the Contractor for the accurate and satisfactory construction and completion of the entire Work.
- C. Make, check, and be responsible for measurements and dimensions necessary for the proper construction of and the prevention of misfittings in the Work.
- D. Furnish all protective stakes and temporary structures for marking and maintaining points and lines for the building of the Work, and provide such facilities and materials for verifying said lines and points as he may be required by the WPCA and its Technical Consultant.
- E. Revisions to the layout and elevations of the Work as defined by the Contract Documents are subject to approval by the WPCA and its Technical Consultant.
- F. Maintain and prepare final record drawings of field engineering layouts and as-built survey conducted after completion of the Work.
- G. Delineate property lines in the field prior to commencing with grading work at the site(s).
 - 1. The Contractor is responsible for permanently pinning the pump station sites upon completion of all other site work activities.

END OF SECTION

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SECTION 01725

PRESERVATION AND RESTORATION OF PROJECT FEATURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Protection and replacement of trees, shrubs, signs, property markers, fences, and related project features.
2. Taking precautions, providing programs, and taking actions necessary to protect public and private property and facilities from damage.

1.2 DEFINITIONS

A. Underground Structures

1. Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, and manholes, chambers, electrical and signal conduits, tunnels and other existing subsurface work located within or adjacent to the limits of the Work.
2. The Contractor shall be responsible for checking actual locations of water, sewer, gas, electric, telephone, and other buried mainline/service utilities to avoid potential interferences.

B. Surface Structures

1. Surface structures are defined as existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundation or any extension below the surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.1 REPAIR/RESTORATION

- A. Trees, shrubs, and similar items shall not be removed except as approved by the WPCA and its Technical Consultant. If objects not to be removed are damaged or removed, they shall be repaired or replaced to their original condition.
- B. Trees and shrubs on private property, which are removed or damaged by the Contractor shall be replaced in kind.
- C. Signs, fences, property markers, walls, guardrails and other public or private shall be replaced in kind if damaged. Supports and protective devices required shall be provided.

D. Underground and Surface Structures

1. In the event of damage, injury or loss to existing utilities and structures, make all reasonable efforts to facilitate repairs and to mitigate the impact of such events upon the utility or structure owner's normal operations. Restore the existing utility or structure to the condition required by the WPCA of the utility or structure or at least to the condition found immediately prior to the Work. In the event that the utility owner elects to make the repairs, provide all reasonable access and assistance, and reimburse the utility owner for the cost of repairs. If utility service is interrupted due to damage to facilities, alternate facilities shall be provided.
2. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers and curbs which are temporarily removed to facilitate the Work shall be replaced and restored to their original condition.
3. Wherever water, sewer, gas or petroleum mains, electric or telephone lines, cables or other utilities and structures are encountered and may be in any way interfered with, inform the WPCA and its Technical Consultant and the appropriate utility company. Cooperate with the various utility companies in the protection, removal, relocation, and replacement of structures and facilities.
4. Prior to proceeding with any construction, notify the utility and structure owner(s) within the vicinity of the proposed Work.
5. Work affecting water distribution systems, which will take fire hydrants out of service, must be coordinated with Connecticut Water and the local fire department. The Contractor shall be prepared to restore fire flows in the event of an emergency or to provide for temporary fire flow service in accordance with the requirements of the local fire department.
6. Materials used for relocation or replacement of utilities and structures shall be of an equivalent material, type, class, grade and construction as the existing or as approved by the respective owners thereof, unless otherwise shown or specified.
7. When any survey monument or property marker, whether of stone, concrete, wood or metal, is in the line of any trench or other construction work and may have to be removed, notify the WPCA's Technical Consultant in advance of removal. Under no circumstances shall any monument or marker be removed or disturbed by the Contractor or by any of his Subcontractors, employees or agents, without the permission of the WPCA and its Technical Consultant. Monuments or markers removed or disturbed shall be reset by a land surveyor licensed in Connecticut. Should any monuments or markers be destroyed through accident, neglect or as a result of the Work under this Contract, the Contractor shall employ a land surveyor licensed in Connecticut to re-establish the monument or marker.

3.2 PROTECTION

Town of Canton WPCA

- A. The construction of certain portions of the project may require excavation within the root systems of trees. Roots with a diameter of 2 inches or more within the excavation shall not be cut. If necessary, excavation shall be made with small powered equipment or by hand to comply with this requirement. It may be necessary to excavate from more than one direction to avoid damage to the roots.
- B. The trunks of trees that are to remain and are within the swing radius of the excavating machine bucket when fully extended shall be wrapped with burlap and 2 inch by 4 inch protective wood slats (8 inch spacing maximum) wired around the circumference of the trees to protect them from damage.
- C. Tree limbs shall not be cut except upon written approval of the WPCA and the WPCA's Technical Consultant. Tree limbs cut shall be painted with approved forestry paint manufactured specifically for that purpose.
- D. Underground and Surface Structures
 - 1. Sustain in their places and protect from direct or indirect injury underground and surface structures within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure.
 - 2. Pay utility service company charges related to the temporary support of utility poles if required to complete the Work.
 - 3. Assume risks associated with the presence of underground and surface structures within or adjacent to the limits of the Work. The Contractor shall be responsible for damage and expense for direct or indirect injury caused by his Work to any structure. Immediately repair damage caused by the Work to the satisfaction of the WPCA of the damaged structure.

END OF SECTION

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SECTION 01760

PROTECTING INSTALLED CONSTRUCTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private properties and facilities from damage.

1.2 PROTECTION OF UNDERGROUND AND SURFACE STRUCTURES:

- A. Contractor shall sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure.
- B. Contractor shall pay all utility service company charges related to the temporary support of utility poles if required to complete the Work.
- C. Contractor shall assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the limits of the Work. Contractor shall be responsible for all damage and expense for direct or indirect injury caused by his Work to any structure. Contractor shall repair immediately all damage caused by his Work, to the satisfaction of the owner of the damaged structure.
- D. In the event of damage, injury or loss to existing utilities and structures the Contractor shall make all reasonable efforts to facilitate repairs and to mitigate the impact of such events upon the utility or structure. The Contractor shall be responsible for restoring the existing utility or structure to the condition required by the utility or structure or at least to a condition required by the utility or structure or at least to a condition found immediately prior to the Work. In the event the utility owner elects to make the repairs, the Contractor shall provide all reasonable access and assistance and shall reimburse the utility for the cost of repairs. If utility service is interrupted due to damage to facilities, alternate facilities shall be provided by the Contractor.
- E. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers and curbs which are temporarily removed to facilitate installation of the Work shall be replaced and restored to their original condition at Contractor's expense.
- F. Wherever water, sewer, gas or petroleum mains, electric or telephone lines, cables or other utilities and structures are encountered and may be in any way interfered with, the Contractor shall keep the WPCA and its Technical Consultant and the utility service company informed in advance. Contractor shall cooperate with the WPCA and its Technical Consultant and utility service company in the protection, removal, relocation, and replacement of all structures and facilities.
- G. Prior to proceeding with any construction, Contractor shall notify in writing owners of utilities and structures within the vicinity of the proposed Work.

Town of Canton WPCA

- H. Work affecting water distribution systems, which will take fire hydrants out of service, must be coordinated with the local fire department. The Contractor shall be prepared to take whatever measures as are necessary to restore fire flows in the event of an emergency or provide for temporary fire flow service in accordance with the requirements of the local fire department.
- I. All materials used for relocation or replacement of utilities and structures shall be of an equivalent material, type, class, grade and construction as the existing or as approved by the respective owners thereof, unless otherwise shown or specified.
- J. When any survey monument or property marker, whether of stone, concrete, wood or metal, is in the line of any trench or other construction work and may have to be removed, the Contractor shall notify the WPCA and its Technical Consultant in advance of removal. Under no circumstances shall any monument or marker be removed or disturbed by the Contractor or by any of his Subcontractors, employees or agents, without the permission of the WPCA and its Technical Consultant. Monuments or markers removed or disturbed shall be reset by a land surveyor licensed in the State of Connecticut at the Contractor's expense. Should any monuments or markers be destroyed through accident, neglect or as a result of the Work under this Contract, the Contractor shall, at his own expense, employ a land surveyor licensed in the State of Connecticut to re-establish the monument or marker.

1.3 PROTECTION OF INSTALLED PRODUCTS

- A. Provide protection of installed products to prevent damage for subsequent operations. Remove protection facilities when no longer needed, prior to completion.
- B. Provide coverings to protect equipment and materials from damage.
 - 1. Cover projections, wall corners, and jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent work.

PART 2 PRODUCTS - NOT APPLICABLE.

PART 3 EXECUTION - NOT APPLICABLE.

END OF SECTION

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SECTION 01770A

PIPELINE CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Documentation for Completed Work
 - 2. Final Clean-up
- B. Related Sections
 - 1. Section 01321 - Color Audio/Video Tape Documentation Survey
 - 2. Section 01330 - Submittal Procedures
 - 3. Section 01570 - Temporary Controls
 - 4. Section 01720 - Field Engineering
 - 5. Section 01725 - Preservation and Restoration of Project Features

1.2 SEQUENCING

- A. Completion
 - 1. The Contract shall be considered complete only when:
 - a. All provisions of the approved Project have been strictly adhered to.
 - b. The project and premises have been left in good order, including removal of all temporary construction, Contractor-owned and extraneous materials as required.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.1 CLEANING

- A. Where material or debris has washed, flowed or has been placed in existing watercourses, ditches, gutters, drains, pipe, or structures, for work done under the Contract work limits or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the Work, and the ditches, channels, drains, pipes, structures, and watercourses shall, upon completion of the Work, be left in a clean and neat condition.
- B. Restore or replace, when and as directed, any public or private property damaged or removed 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, complete as required all necessary highway or driveway, walk, and landscaping work. Suitable

Town of Canton WPCA

materials, equipment and methods shall be used for such restoration. The restoration of existing property, signs or structures shall be done as promptly as practicable, as work progresses, and shall not be left until the end of the contract period.

END OF SECTION

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SECTION 01770B

PUMP STATION CLOSEOUT PROCEDURES

1.1 SUMMARY

A. Section Includes

1. Documentation required for the transfer of the completed work to the WPCA.

1.2 SUBSTANTIAL COMPLETION

A. Procedure

1. Prior to requesting final inspection and project closeout, the Contractor shall ensure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.
2. Within a reasonable period of time after receipt of the request, the WPCA and its Technical Consultant will inspect the Work to determine the status of completion. If the WPCA and its Technical Consultant does not consider the Work substantially complete, the Contractor shall remedy any deficiencies to be corrected or completed and the Work will be reinspected.

1.3 FINAL COMPLETION AND PROJECT CLOSEOUT DOCUMENTS

- A. As-Built Drawings - Submit as-built drawings to the WPCA's Technical Consultant for review, approval, or comment. The drawings shall show any and all deviations from the original drawings. The drawings shall depict the location of all conduit and devices exterior from the motor control centers, the location of valves, small diameter piping, relocated devices and all field changes. All underground work shall be actively tied in a minimum of two horizontal directions with vertical control. All fittings, bends, valves and other appurtenances shall be shown. Locate all utilities and appurtenances concealed in construction. Provide detail not shown on Contract Documents. Colored pencils or felt tipped pens shall be used to record all revisions to the record set of Drawings. Use the following color code:

1. Process and Mechanical: Red
2. Architectural: Blue
3. Structural: Purple
4. Plumbing: Brown
5. HVAC: Green
6. Electrical: Orange
7. Other: Black

- B. Final as-built documents shall comply with the SSCA or SSLA, whichever applies.

- C. Operation and Maintenance manuals for items listed in pertinent other sections of these Specifications and for other items. Manuals (6 sets submitted to WPCA) shall include:

Town of Canton WPCA

1. The O&M's shall be submitted in three ring binder notebooks. And shall provide the following as a minimum.
 - a. A comprehensive index broken down into sections and sub-sections, etc.
 - b. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.
 - c. Full specifications on each item.
 - d. Detailed service, maintenance and operation instructions for each item supplied.
 - e. System schematic drawings "as Constructed", illustrating all components, piping and electrical connections of the systems.
 - f. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
 - g. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
 - h. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.
 - i. A complete "As Constructed" set of approved shop drawings.
 - j. The format of the O&M manual shall meet the following general requirements:
 - 1) First will be the complete, comprehensive index.
 - 2) Next will be a section with the operating instructions including complete overview of the system.
 - 3) Next will be a section with a complete parts list as described above.
 - 4) Next will be a section that includes all schematic diagrams, wiring diagrams etc. of the "As Constructed System".
 - 5) Next will be product information.
 - k. Section and sub-section, etc. dividers shall be provided for easy reference.
 - l. Each product shall have a separate divider for easy reference.
 - m. Each instrument section shall have data sheets indicating the Tag names (as used on the Drawings), manufacturer, complete model number, complete specifications, and a parameter setup sheet, per tag name. Following the parameter setup sheets will be the manufacturers O&M manual in its entirety.

Town of Canton WPCA

2. Final documentation shall be written specifically for this project, but may include standard and modified standard documentation. Modifications to existing hardware or software manuals shall be made on the respective pages or inserted adjacent to the modified pages. All standard documentation furnished shall have all portions that apply clearly indicated. All portions that do not apply shall be lined out.
3. The manuals shall contain all illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.
4. The requirements for final documentation include the following:
 - a. As-Built documentation shall include all previous submittals, as described in this Specification, updated to reflect the as-built system.
 - b. The maintenance documentation shall describe the detailed preventative and corrective procedures required to keep the System in good operating condition. All hardware maintenance manuals shall make reference to appropriate diagnostics, where applicable, and all necessary timing diagrams shall be included. A maintenance manual or a set of manuals shall be furnished for all delivered hardware, including peripherals. The hardware maintenance documentation shall include, as a minimum, the following information:
 - 1) Operation information – This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.
 - 2) Preventative-maintenance instructions – These instructions shall include all applicable visual examinations, hardware testing and diagnostics routines, and the adjustments necessary for periodic preventative maintenance of the system.
 - 3) Corrective-maintenance instructions – These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction.
 - 4) Parts information – This information shall include the identification of each replaceable or field-repairable module. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross-references between the Contractor's part number and manufacturer's part numbers shall be provided. All PC boards shall be identified by; manufacturer and model

Town of Canton WPCA

number, slot number, part name and configuration (if applicable).

- D. Warranties and bonds for items so listed in pertinent other sections of the Contract Documents.
- E. Keys and keying schedule, where applicable.
- F. Evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:
 - 1. Certificates of Inspection
 - 2. Certificates of Occupancy
- G. Evidence of payment and release of liens.
- H. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.
- I. Equipment start-up reports shall be submitted in duplicate to the Technical Consultant for each piece of equipment installed. The report shall include detailed descriptions of the points inspected, tests, and adjustments made, quantitative results obtained and maintenance suggestions. The report shall certify that the equipment (1) has been satisfactorily installed and conforms to the Contract requirements; (2) is in accurate alignment and free from undue stress; (3) has been operated under full load and operates satisfactorily; and (4) nothing in the installation will render the manufacturer's warranty null and void.
- J. Color charts, legends, instructions, special tools and other requirements specifically requested in Sections of the Specification.

1.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide instruction by qualified manufacturers' representatives in the proper operation, maintenance, adjustment and the safety aspects of the equipment and materials furnished. Specific instruction requirements may be included within the Sections of the Specification.

1.5 FINAL CLEANING & REPAIRS

- A. Complete cleaning prior to final inspection. Cleaning shall include all interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces. Thoroughly wipe clean all ductwork, piping, equipment, devices, and exposed surfaces. Clean debris from lawns, roofs, downspouts and gutters. Sweep paved surfaces and rake lawns and landscaped areas.
- B. Use only cleaning materials that will not create hazards to health or property.
- C. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, for Work done under the Contract work limits or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed during

Town of Canton WPCA

the 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.

- D. On or before the completion of the Work, tear down and remove all temporary buildings and structures, remove all temporary works, tools, and machinery or other construction equipment, remove all rubbish from any grounds which has been occupied and leave the roads and all parts of the premises and adjacent property in a neat and satisfactory condition.
- E. Restore or replace, when and as directed, any public or private property damaged by 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 necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable, as Work progresses, and shall not be left until the end of the contract period.

1.6 COMPLETION

- A. The Contract shall be considered complete only when:
 - 1. All provisions of theSSCA or SSLCA have been strictly adhered to.
 - 2. All damage to adjoining areas caused by the Work has been repaired.
 - 3. The project and premises have been left in good order, including removal of all temporary construction, Contractor-owned and extraneous materials as required.
 - 4. All warranties, Operation and Maintenance Manuals, maintenance instructions, releases, and permits called for in the Contract have been submitted to the WPCA and its Technical Consultant as applicable.
 - 5. All as-built Drawings as required by the Contract Documents have been submitted to the WPCA and its Technical Consultant.
 - 6. All monies owed the WPCA for services performed for the Contractor by WPCA's forces have been paid.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

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SECTION 02090
CONTROLLED BLASTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. The work to be done under this Section includes furnishing all labor, equipment, materials, services, and performing operations required to fragment and excavate materials classified as rock utilizing controlled blasting procedures specified herein such that damage is prevented to adjacent pipes, structures, property and work and such that resulting ground vibrations and air blast overpressures are consistently maintained below the maximum levels specified in this Section.
2. Protecting adjacent businesses, homes and property, workers, WPCA, its Technical Consultant, and the general public from damage or injury due to improper handling of explosives, flyrock, excessive ground vibrations and/or excessive air blast overpressure levels.
3. Furnishing, installing, and implementing an audible warning system to indicate impending blasting and familiarizing workers, the WPCA and its Technical Consultant, and the general public with the system implemented.
4. Conducting a pre-blast condition survey of existing structures near the proposed construction.
5. Conducting blast monitoring of every blast round required to excavate rock during the conduct of construction utilizing the blast monitoring procedures and equipment specified in this Section.

B. Related Sections

1. Section 02315 - Excavation, Backfill, and Compaction
2. Section 02410 - Rock Excavation

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Persons responsible for blasting shall be licensed blasters in the State of Connecticut and shall have had acceptable experience in similar excavations in rock and controlled blasting techniques.
2. The Contractor shall engage the services of a qualified, independent professional engineer, acceptable to the WPCA's Technical Consultant to conduct a pre-blast condition survey of adjacent structures.

Town of Canton WPCA

3. Blast monitoring shall be conducted by an independent qualified Professional Engineer or seismologist trained in the use of a seismograph, and records shall be analyzed and results reported by persons familiar with analyzing and reporting the frequency content of a seismograph record.
- B. Codes, Permits and Regulations:
1. The Contractor shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Connecticut, the Town of Canton, and its Fire Marshall, governing the transportation, storage, handling and use of explosives.
 2. The Contractor shall obtain and pay for all permits and licenses required to complete the work of this Section.
 3. In case of conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulations, or Specifications.
- C. Blasting Limit Criteria:
1. Peak Particle Velocity Limits:
 - a. At the existing structures surrounding the site and at all new structures on site, the maximum Peak Particle Velocity (PPV) shall not exceed the limits indicated on Figure B-1, Appendix B, of the United States Bureau of Mines Report of Investigations, RI 8507, 1980.
 2. Air Blast Overpressure Limit:
 - a. The Contractor shall conduct all blasting activity in such a manner that the peak air blast overpressure measured at the location of the nearest above ground, occupied structure to blasts (considering wind direction) shall not exceed 0.014 psi.
- D. Blast Monitoring:
1. The Contractor shall monitor peak particle velocities and air blast overpressures resulting from each blast.
 2. The WPCA and its Technical Consultant may require additional blast monitoring on a part-time basis.
- E. Blast Monitoring Reports:
1. Following each blast, a Blast Monitoring Report shall be submitted to the WPCA's Technical Consultant within 24 hours of the blast.
- F. Blast Monitoring Instrumentation:
1. All instrumentation proposed for use on the project shall have been calibrated within the previous six (6) months to a standard, which is traceable to the National Bureau of Standards. Characteristics of required instrumentation are listed below:

Town of Canton WPCA

- a. Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial, and perpendicular to the vibration source.
 - b. Measure and display the maximum peak particle velocity component, the associated frequency, and the peak air blast overpressure. These readings must be displayed and be able to be read in the field, immediately after each blast.
 - c. Furnish a permanent time history record on a strip chart (or from computer disk) of particle velocity components, frequency, and air blast overpressure.
- G. The Contractor shall cooperate with the WPCA and its Technical Consultant in permitting observation of the Contractor's drilling and loading procedures, as well as in providing detailed information on blasting operations.
- H. The Contractor shall be completely responsible for all damages resulting from the blasting operations and shall, as a minimum, take whatever measures are necessary to maintain peak air blast overpressure and peak particle velocities within the specified limits. Modifications to blasting and excavation methods required to meet these requirements shall be undertaken.
- I. The Contractor shall coordinate all blasting activities to ensure there are no detrimental effects on new concrete placed on the project.

1.3 SUBMITTALS

A. Advance Submittal:

1. The Contractor shall submit the following information to the WPCA's Technical Consultant at least two (2) weeks prior to commencing drilling and blasting operations. It is the intent of the WPCA's Technical Consultant to respond to the major items in the Contractor's submittal:
 - a. Sequence and schedule of blasting rounds, including the general method of developing the excavation, lift heights, etc.
 - b. Specifics of a typical blast round to be implemented in each of the following areas:
 - 1) At the area where blasting is intended to be started.
 - 2) At the deepest rock cut area.
 - 3) In each area specified, include the following blast round details:
 - (a) Diameter, spacing, burden, depth, and orientation of each blast hole for each round design;
 - (b) Nomenclature and amount (in terms of weight and number of cartridges) of explosives and distribution of charge to be used within each hole, on each delay, and the total for the blast;
 - (c) Nomenclature and type of detonators; delay pattern wiring diagram for the round: type and capacity of firing source, size, type and location of safety switches and lightning gap.

Town of Canton WPCA

- c. Type and location of stemming to be used in holes.
 - d. Calculations of anticipated vibration levels at the nearest adjacent structures.
2. Methods of matting or covering of the blast area in open excavations to prevent flyrock and excessive air blast overpressure.
 3. Written evidence of the licensing, experience and qualifications of the blasters who will be directly responsible for the loading of each shot and for firing it.
 4. Name and qualifications of the person(s) responsible for design and directing the blasting. This submittal shall document by project lists and samples of blasting round design calculations that the person has the required experience in controlling open-cut blast vibrations in blasting rounds of the type required on the project.
 5. Name and qualifications of the independent Professional Engineer responsible for conducting pre-blast condition surveys. This submittal shall document by project, lists and samples of pre-construction surveys that the proposed independent professional engineer has the required experience.
 6. Name and qualifications of the independent Professional Engineer or seismologist responsible for monitoring and reporting blast vibrations.
 7. Details of an audible advance signal system to be employed at the job site as a means of informing workers, the WPCA and its Technical Consultant, and the general public that a blast is about to occur.
 8. Listing of instrumentation that the Contractor proposes to use to monitor vibrations and air blast overpressure levels complete with performance specifications and user's manuals supplied by the manufacturer.
 9. Recent calibration certificate(s) (within previous six (6) months) for the proposed blast monitoring instrumentation. Calibration shall be to a standard traceable to the National Bureau of Standards.
 10. Submit a copy of the blasting permit(s) obtained to conduct blasting on the site.
 11. Pre-blast conditions survey, as described herein.
 12. The Contractor shall ensure that all damage claims will be honored, pursuant to the terms of the insurance policies and/or applicable state law.
- B. Progress Submittal:
1. Within 24 hours following each blast, the Contractor shall submit to the WPCA and its Technical Consultant, a Blast Monitoring Report. Each Blast Monitoring Report shall include all of the following applicable items:
 - a. Sheet 1 of 3, Report of Blast Monitoring, including PPV, frequency, and air overpressure data.
 - b. Sheet 2 of 3, Blast Monitoring Location Plan.

Town of Canton WPCA

- c. Sheet 3 of 3, Blast Round Design Data, including data noted in Section 1.05.A.3.
 - d. Copy of strip chart (or other permanent record of velocity/time waveform) with calibration and monitoring record marked with the date, time and location of the blast as well as the monitoring location.
2. In the event that the Contractor's design round results in ground vibrations and/or air blast overpressures which exceed the blasting limit criteria specified in this Section, the Contractor shall immediately revise the round design appropriately and submit the revised round design to the WPCA's Technical Consultant for review. The Contractor shall allow sufficient time for review by the WPCA's Technical Consultant.
 3. Review by the WPCA's Technical Consultant of blast designs and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy and safety of the blasting, exercising proper supervision and field judgment and producing the results within the blasting limits required by these Specifications.
 4. The Contractor shall report to the WPCA's Technical Consultant in writing all blasting complaints received by the Contractor within 24 hours of receipt. Each blast complaint report shall include the name and address of the complainant, time received, date and time of blast complained about, and a description of the circumstances that led to the complaint.
- C. The time period(s) specified for submittal are the minimum required by the WPCA's Technical Consultant to review, evaluate and respond to the Contractor. If, after review, the WPCA's Technical Consultant requires re-submission for any reason, the specified time period(s) shall commence upon the date of receipt of the re-submittal(s). The Contractor is responsible for scheduling specified submittal and re-submittal so as to prevent delays in the work.

1.4 PRE-BLAST CONDITION SURVEY

- A. Prior to start of earth/rock excavation or blasting work, an independent Professional Engineer shall conduct a pre-blast condition survey of all existing structures and conditions on the site, adjacent to the site, or in the vicinity of the site. This survey shall extend to such structures or conditions as may be affected by the Contractor's construction operations and as described herein.
1. Coordinate activities, issue notices, obtain clearances and provide whatever photographic and secretarial assistance is necessary to accomplish the survey.
 2. Give notice in writing, to the WPCA of the property concerned, tenants of the property and any representative of local authorities required to be present at such survey. Advise in notice the dates on which surveys are to be made so that they may have representatives present during the examination. Provide copies of all notices to the WPCA and its Technical Consultant.
 3. As a minimum, all structures and buildings within 500 feet of anticipated rock blasting shall be given detailed examination.

- B. Observations shall be recorded during the survey of the existing conditions for houses, garages, commercial buildings and other structures, which might be affected by the Work.
 - 1. The survey shall consist of a description of the interior and exterior condition of the various structures examined. Descriptions shall locate any cracks, damage, or other defects existing and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken and made part of the record.
 - 2. The record of each property examined shall be signed by the representatives present and, if practicable, by the owners and tenants of the property, whether or not they are present at the examinations.
- C. Contractor's record of the pre-blast condition survey shall consist of written documentation and photographs of the conditions identified. Prior to start of Work, the Contractor's record shall be submitted to the WPCA's Technical Consultant for review.
- D. Upon receipt of damage complaints, or upon completion of all earth/rock excavation and blasting work, the Contractor shall make a similar examination of any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed. Give notice to all interested parties so that they may be present during the final examination.
 - 1. Records of the final examination shall be signed and distributed the same as the original pre-construction survey.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.1 SAFETY PRECAUTIONS

- A. Clearing the Danger Area Before Blasting:
 - 1. No blasting shall be permitted until all personnel in the danger area have been removed to a place of safety. A loud, audible, warning system, devised and implemented by the Contractor, shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, WPCA, its Technical Consultant, and the general public with the implemented system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared, and guards shall be stationed to prevent entry until the area has been cleared by the blaster following the blast.
- B. Explosives shall be stored, handled and employed in accordance with federal, state, and local regulations.
- C. No explosives, caps, detonators or fuses shall be stored on the site during non-working hours.

Town of Canton WPCA

- D. The Contractor shall be responsible for determining any other safety requirements unique to blasting operations on this particular site so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.
- E. No requirement of, or omission to require, any precautions shall be deemed to limit or impair any responsibility or obligations assumed by the Contractor. The Contractor shall at all times maintain adequate protection to safeguard the public and all persons engaged in the work, and shall take such precautions as will accomplish such end, without undue interference to the public. The Contractor shall be responsible for and pay for any damage to adjacent structures resulting from work executed under this Section.

3.2 GENERAL BLASTING PROCEDURES

- A. Blasting shall be limited to between the hours of 9:00 a.m. and 3:00 p.m., Monday through Friday, unless prior written permission is received from the WPCA, its Technical Consultant, or the Canton Fire Marshall, to blast at other times.
- B. The Contractor shall notify the WPCA's Technical Consultant at least 48 hours before blasting operations are to commence.
- C. The Contractor shall conduct blasting operations such that damage is prevented to adjacent structures, property and work, and such that peak particle velocity and air blast overpressure levels do not exceed the maximum specified limits at the locations specified.

END OF SECTION

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SECTION 02210

SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. The Contractor shall complete all test pit work as shown on the approved Drawings, or as directed by the WPCA or its Technical Consultant, before beginning any pipe installation work on the project.
2. Sub-surface soils investigations at the site, the use of data resulting from that investigation, and the Contractor's responsibility for additional soils investigation.
3. Pipe sub-surface investigations that the Contractor will be required to carry out, in order to properly locate, plan for and/or connect to the various existing pipelines.

B. Related Sections

1. Section 02315 – Excavation, Backfill, and Compaction
2. Section 02320 – Borrow Materials
3. Section 02740 - Bituminous Concrete Pavement and Curb Repair

C. Related Sewer Construction Details

1. No. 031 – Temporary Trench Surface Repairs
2. No. 032 – Permanent Trench Surface Repairs

1.2 REFERENCES

- A. “Call Before You Dig” Program.

1.3 PIPELINE INVESTIGATIONS

- A. During the course of his work, the Contractor must make his own investigations and judgments, and make test excavations to locate the various existing pipes, where they are involved in his work.
- B. This is especially applicable to the locations where connections are to be made to the existing pipes, and where other existing utilities are to be crossed. These excavations will provide the Contractor with the details required for his activities.
- C. The decision to either safely pass under or over the existing pipes shall be made in the field as approved by the WPCA or its Technical Consultant.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.1 INVESTIGATIONS

Town of Canton WPCA

- A. Prior to test pitting operations, delineate the general scope of the excavation or boring on the paved surface of the ground using white paint, or stakes or other suitable white markings on unpaved surfaces and coordinate with the appropriate agencies in accordance with “Call Before You Dig” policies.
- B. No premarking shall be acceptable if such marks can reasonably interfere with traffic or pedestrian control or are misleading to the general public. Premarking shall not be required of any continuous excavation that is over 500 feet in length
- C. Excavate test pits at such locations shown on the Drawings, as are necessary, or required by the WPCA and its Technical Consultant. In general, test pits will be required to locate underground facilities whose location, depth or size are not precisely known and are critical to the construction under this Contract. Excavate test pits of an appropriate size with equipment suitable for the location and character of the pit to be excavated. In accordance with Section 02315, the pits shall be braced, sheeted and dewatered or as otherwise required for safe excavation and examination of the structure or utility to be exposed.
- D. Upon completion of the examination by the WPCA and its Technical Consultant, backfill and compact the test pits in accordance with Section 02315.
- E. Repair paved surfaces in accordance with Section 02740.

END OF SECTION

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SECTION 02230

CLEARING & GRUBBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Clearing and Grubbing
 - 2. Stripping and Stockpiling of Soil and Sod

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 PART 3 EXECUTION

3.1 CONSTRUCTION

- A. Clearing and Grubbing
 - 1. All work shall be limited to the area required to construct the improvements.
 - 2. All clearing and grubbing shall be carried out in accordance with these specifications, and as directed by the WPCA and its Technical Consultant. The intent is to minimize the removal of vegetation with particular care to protect all trees. In residential yard areas, only those trees specifically identified by the WPCA and its Technical Consultant shall be removed.
 - 3. The burning of trees, brush, stumps, etc., will not be permitted. The Contractor shall remove this material at his own expense, and shall provide a satisfactory method of disposal.
 - 4. The stumps of all trees, brush and major roots shall be grubbed and removed in all excavation areas, and under all embankments where the original ground level is within 3½-feet of the subgrade or slope of embankments. All trees, stumps and brush shall be cut off within 6 inches of the ground in embankment areas where the original ground level is more than 3½ feet below the subgrade or slope of embankments.
 - 5. Quality of work must conform with accepted tree trimming practices. All trimming and pruning shall conform to recognized tree surgery practices and particular note should be made that painting with an approved tree dressing or paint will be required on all cuts 2 inches in diameter or larger. The dressing or paint shall be applied no later than two days after the cuts are made. Recognized tree surgery practices include, among many others, the fact that all limbs and branches which require removal and all stubs regardless of age must be cut flush either to a union with the next larger sound limb or branch or flush to the trunk of the tree. The cutting shall be performed by an experienced arborist. Trained tree climbers are required for pruning of tall growth. Care shall be exercised by the Contractor to prevent injury to trees and shrubs designed to be preserved. An injury to limbs, bark or roots of such plants shall be repaired, as directed, or the plants replaced.

Town of Canton WPCA

6. All trees 4" diameter and larger shall be cut in 4' lengths and stockpiled on a site designated by the land owner. Cuttings, brush and trash, shall be disposed of after cutting as soon as practicable and in such a manner as not to detract from the appearance of the area. The property owner shall have the option to keep some or all of the cut/stockpiled cuttings, as opposed to disposal by Contractor.

B. Dutch Elm Wood

1. Dutch Elm diseased wood shall be disposed of in accordance with State of Connecticut and local regulations.
2. Where the work includes the removal of elm trees or the limbs of elm trees, such trees or limbs thereof shall be disposed of immediately after cutting or removal and in such a manner as to prevent the spread of Dutch Elm disease. This shall be accomplished by covering them with earth to a depth of at least 6 inches in areas outside the right-of-way locations where the Contractor has arranged for disposal.
3. Where the work includes the removal and disposal of stumps of elm trees, such stumps shall be completely disposed of immediately after cutting in the manner specified above.

C. Stripping and Stockpiling of Soil and Sod

1. When excavating through existing grass, weed brush or tree-surfaced areas, the existing loam and surface materials shall be stripped and salvaged.
2. The salvage material shall be machine-excavated and stockpiled.
3. This stockpile of salvage material shall be kept separate from the other stockpiles of excavated material.

3.2 PROTECTION

- A. Trees and shrubs that are specifically designated by the WPCA and its Technical Consultant not to be cut, removed, destroyed or trimmed shall be saved from harm and injury. All damage done to trees by the Contractor's operation and all branches of trees extending within the roadway shall be trimmed and painted where cut as directed or as necessary to provide adequate vertical clearance for construction, including selective trimming of such trees as directed.
- B. Use all necessary precautions to prevent injury to other desirable growth in all areas. If the existing ground in the area is disturbed by any of the work or equipment, or if so directed, rough-grade and loam and seed, without additional compensation.

END OF SECTION

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SECTION 02240

DEWATERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. General Dewatering
 - 2. Pipeline Trench Dewatering
- B. Related Sections
 - 1. Related project permits
 - 2. Section 01570 – Temporary Controls
 - 3. Section 02315 - Excavation, Backfill and Compaction
 - 4. Section 02320 - Borrow Material

1.2 SUBMITTALS

- A. Prepare dewatering design for all pipeline trench locations, as required. Design shall include calculations and drawings stamped and signed by a Professional Engineer registered in the State of Connecticut, where applicable and/or required by the WPCA and its Technical Consultant.
- B. Employ the services of a dewatering specialist or firm when well points, deep wells, recharge systems, or equal systems are required. Specialist shall have completed at least 5 successful dewatering projects of equal size and complexity and with equal systems.
- C. Notify the WPCA's Technical Consultant immediately if any settlement or movement is detected of survey points adjacent to excavations being dewatered. If settlement is deemed by the WPCA's Technical Consultant to be related to the dewatering, submit a modified dewatering plan to the WPCA's Technical Consultant within 24 hours. Implement the approved modified plan and repair any damage incurred to the adjacent structure.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide erosion/sedimentation control devices as indicated and specified.
- B. Provide casings, well screens, fittings, pumps, power and other items required for dewatering system.
- C. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the indicated or specified sedimentation ponds or drainage systems.
- D. Provide portable sedimentation basins/tanks when sedimentation ponds are not available.

Town of Canton WPCA

- E. Provide and store auxiliary dewatering equipment, including pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.
- F. Provide non-woven filter fabric where required for underdrain systems.
 - 1. The non-woven filter fabric shall be specifically designed for subsurface drainage applications.
 - 2. The non-woven filter fabric shall meet the following criteria:

	<u>Test Method</u>
a. Grab Tensile Strength - 120 lbs.	ASTM D4632
b. Grab Tensile Elongation - 50%	ASTM D4632
c. Mullen Burst Strength - 240 psi	ASTM D3786
d. Trapezoid Tear Strength - 50 lbs.	ASTM D4533
e. Puncture Resistance - 70 lbs.	ASTM D4833
f. Permittivity – 1.8 sec ⁻¹	ASTM-D4491
g. Water flow rate - 120 gpm/ft ²	ASTM-D4491

PART 3 EXECUTION

3.1 APPLICATION

- A. General Dewatering
 - 1. Provide adequate pumping and drainage facilities to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures, nor cause excessive disturbance of underlying natural ground.
 - 2. Dewatering includes the lowering of the water table, the lowering of hydrostatic pressure, preventing surface water from entering the excavation during construction and disposing of discharge water. Common dewatering methods include sump pumping, deep wells, well points, or combinations of methods.
 - 3. Water from the trenches and excavations shall be disposed of in such a manner as to avoid public nuisance, injury to public health or the environment, damage of public or private property, or damage to public or private property, or damage to the work completed or in progress. Siltation barriers shall be provided.
 - 4. Any damage resulting from the failure of the dewatering operations of Contractor, and any damage resulting from the failure of Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by Contractor under the bid price.
 - 5. Care shall be exercised to see that water does not collect in the bell socket of pipes waiting to be jointed.

Town of Canton WPCA

6. Precautions shall be taken to protect new work from flooding during storms or from other causes. Control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided for drainage. Upon completion of the work, all areas shall be restored by Contractor to the preconstruction conditions.
7. All pipelines or structures not stable against uplift during construction or prior to completion, shall be thoroughly braced or otherwise protected.

B. Pipeline Trench Dewatering

1. Furnish, install, operate and maintain dewatering system in accordance with approved dewatering plan. Locate dewatering system components so that they do not interfere with construction under this or other contracts.
2. Do not excavate until the dewatering system is operational and the excavation may proceed without disturbance to the final subgrade.
3. Unless otherwise specified, continue dewatering uninterrupted until the structures, pipes, and appurtenances to be built there have been completed such that they will not be floated or otherwise damaged by an increase in groundwater elevation.
4. If open pumping from sumps and ditches results in “boils”, loss of fines, or softening of the ground, submit a modified dewatering plan to the WPCA’s Technical Consultant within 48 hours. Implement the approved modified plan and repair any damage incurred under the bid price.
5. Where subgrade materials are unable to meet the subgrade density requirements due to inadequate dewatering techniques, remove and replace the materials in accordance with Section 02320.
6. Install temporary underdrains if required in trenches beneath bottom level of excavation. Provide trenches to accommodate underdrain and surrounding material. Install underdrains below bottom of normal excavation with open joints wrapped in non-woven filter fabric, and entirely surrounded by $\frac{3}{4}$ " crushed stone to prevent the admission of fines into the underdrains. Provide at least 3 inches between bottom of pipe or structure and highest point of underdrain pipe. Fill the space between the underdrain and pipe or structure with $\frac{3}{4}$ " crushed stone in accordance with Section 02320.
7. Dewatering discharge:
 - a. Install and monitor discharge systems as specified.
 - b. Install sand and gravel filters in conjunction with well points and deep wells to prevent the migration of fines from the existing soil during the dewatering operation.
 - c. Transport pumped or drained water without interference to other work, damage to pavement, other surfaces, or property. Discharge pumped water to a sedimentation pond or drainage system.

Town of Canton WPCA

- d. Do not discharge water into any sanitary sewer system.
 - e. The WPCA and/or its Technical Consultant reserves the right to sample discharge water at any time.
8. Install and place erosion/sedimentation control at the point of discharge as indicated or specified in Section 01570.
9. Removal
- a. Do not remove dewatering systems without prior approval from the IWWA and WPCA's Technical Consultant
 - b. Backfill and compact sumps or ditches with gravel borrow or crushed stone in accordance with Section 02315.
 - c. Remove well points and deep wells. Backfill abandoned well holes with cement grout having a water cement ratio of 1 to 1 (by volume).

END OF SECTION

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SECTION 02280

PIPELINE AND UNDERGROUND STRUCTURE ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Abandonment of Pipe
 - 2. Abandonment of Manholes
- B. Related Sections
 - 1. Section 02320 - Borrow Material
 - 2. Section 02281 – Abandonment of Subsurface Disposal Systems
 - 3. Section 03310 – Cast-In-Place Concrete

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.
- B. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- C. Comply with the directions of the WPCA and its Technical Consultant and the requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Gravel borrow shall meet the requirements of Section 02320 - Borrow Material.
- B. Refer to Section 03310 for concrete requirements.

PART 3 EXECUTION

3.1 CONSTRUCTION

- A. Abandon existing pipelines and manholes upon completion of installation and successful testing of the new pipelines, pumping stations, manholes and appurtenances.
- B. Seal gravity pipes that are to be abandoned at each end with a concrete plug not less than 1½ times the pipe diameter long in the barrel of the pipeline. For example, a 10-inch diameter pipe will require that a minimum 15-inch long plug be installed. Typically, this is done at the manhole unless the existing manhole is to be removed. Similarly, open ends of pressure sewers to be abandoned shall be sealed with a concrete plug no less than 1½ times the pipe diameter long in the barrel of the pipeline.

Town of Canton WPCA

- C. Abandonment of manholes shall be done by carefully removing the frames and covers and delivering them to the WPCA's storage yard. Upper portions of the masonry shall be removed to a depth two-feet below the finished grade and the remaining structure shall be completely filled with gravel borrow placed in 6-inch layers and thoroughly compacted. Dispose of masonry materials removed.

3.2 REPAIR AND RESTORATION

- A. Match the surface repair for each manhole abandoned to its immediate surrounding area. Complete this work in accordance with the applicable specification section.

END OF SECTION

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SECTION 02281

ABANDONMENT OF SUBSURFACE DISPOSAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Provide labor, materials, equipment, transportation, and incidentals necessary to complete the work of this Section including, but not limited to, the abandonment of existing subsurface disposal systems including septic tanks, pumping chambers, and cesspools as specified herein. The subsurface disposal systems must be abandoned in accordance with the appropriate State of Connecticut Laws and Regulations, as well as the Farmington Valley Health District.

B. Related Sections

1. Section 02280 – Pipeline and Structure Abandonment
2. Section 02534 – Sanitary Sewer Service Reconnection

C. Related Sewer Construction Details

1. No. 027 – Sewage Grinder Pump
2. No. 028 – Sewage Grinder Pump Electrical Wiring Diagram

PART 2 PRODUCTS

- A. Sand Borrow used in the abandonment of subsurface disposal systems shall be supplied by the Contractor from an off-site borrow source, selected by the Contractor and approved by the WPCA and/or its Technical Consultant. Sand borrow shall consist of clean, inert, hard, durable grains of quartz or other hard, durable, rock, free from loam or clay, surface coatings and deleterious materials. The allowable amount of material passing a No. 200 sieve as determined by ASTM-C117 should not exceed 5% by weight. The material shall consist of rounded grain particles and not contain stones larger than ½” in diameter.
- B. Controlled Density Fill (CDF) used in the abandonment of subsurface disposal systems shall be of the very flowable and excavatable type intended for filling small or far areas that later may need to be removed. The CDF used in this work shall conform to Connecticut Department of Transportation standards.

PART 3 EXECUTION

3.1 SEQUENCE OF WORK

- A. The work of this section shall not commence until the proposed sanitary sewer system is complete, tested, and operational. Written notification must be received from the WPCA that all proposed facilities are ready for operation.
- B. Upon notification from the WPCA, sewage shall be diverted to either the gravity sewer system or grinder pump stations and the existing subsurface disposal systems abandoned.

3.2 ABANDONMENT OF EXISTING SUB-SURFACE DISPOSAL SYSTEM

- A. The existing sewage discharge piping from each building to the existing septic system, pump chamber, leach field and/or cesspool shall be capped and abandoned, or after connection to the gravity or low pressure sewer system has been completed and approved by the WPCA.
- B. All drain connections to the proposed grinder pump stations must be in place and approved by the WPCA prior to abandoning existing subsurface disposal systems.
- C. The existing subsurface disposal system shall be abandoned in accordance with this Section, Connecticut General Laws, and the Farmington Valley Health District. Procedures for abandoning the system shall be as follows:
 - 1. The septic tank shall be excavated and removed from the site, or:
 - 2. The septic tank or cesspool shall be completely pumped of its contents by a licensed hauler, and properly disposed. The interior of the tank or cesspool shall be completely washed to the satisfaction of the WPCA, and the washwater in the tank shall be completely pumped and disposed by a licensed hauler.
 - 3. Holes shall be punched in the top and floor of the septic tank to allow water to drain.
 - 4. The interior of the septic tank, pump chamber and/or cesspool shall be completely filled with clean sand.
 - 5. In confined areas and/or areas determined by the WPCA and its Technical Consultant to be unpractical and/or highly disruptive on the property for puncturing the septic tank and filling with clean sand, the Contractor, may be directed to substitute Controlled Density Fill in order to complete the abandonment.
 - 6. The Contractor may elect to substitute the abovementioned CDF abandonment methods without specific directions to do so in the event it will minimize disruption to property.

Town of Canton WPCA

7. In circumstances where an existing pumping chamber exists, the Contractor shall turn off and disconnect power to the pump, remove all wiring, remove the pump from within the chamber, thoroughly clean the pump and parts, and abandon the chamber, as described above. Abandonment of chambers and disposal of pumps and all parts shall be included as part of subsurface disposal system abandonment costs.
8. For whatever reasons an underground structure (tank, piping, wiring, subsurface disposal system, chamber, cesspool, etc.) cannot be abandoned and is made to be put into service, the Contractor shall provide written notification specifically describing the details.

END OF SECTION

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SECTION 02315

EXCAVATION, BACKFILL, AND COMPACTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Excavation
 - 2. Backfill
 - 3. Compaction
- B. Related Sections
 - 1. Section 02210 – Subsurface Investigations
 - 2. Section 02240 – Dewatering
 - 3. Section 02317 – Underground Warning Tape
 - 4. Section 02318 – Tracer Wire Pipe Location System
 - 5. Section 02320 - Borrow Materials
 - 6. Section 02410 - Rock Excavation
 - 7. Section 02514- Ductile Iron (DI) Pipe and Fittings
 - 8. Section 02515 – Polyvinyl Chloride (PVC) Pipe and Fittings
- C. Related Sewer Construction Details
 - 1. No. 014 – PVC / Ductile Iron Gravity Sanitary Sewer Main / Service Trench
 - 2. No. 015 – PVC (Mainline & Service) Low Pressure Sewer & Ductile Iron Force Main Trench
 - 3. No. 016 – Concrete Encasement for Gravity Sewer
 - 4. No. 017 – Pipe Support Utility Crossing
 - 5. No. 018 – Common Gravity Sewer and Force Main Trench
 - 6. No. 019 – Impervious Trench Interrupters / Dams
 - 7. No. 031 – Temporary Trench Surface Repairs
 - 8. No. 032 – Permanent Trench Surface Repairs
 - 9. No. 035 – Concrete Sewer Cradle
 - 10. No. 036 – Concrete Pier Pipe Support
 - 11. No. 037 – Force Main Tracer Wire

1.2 REFERENCES

- A. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ [600 kN-m/m³]), Annual Book of ASTM Standards - Volume 04.08. - Soil and Rock
- B. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method. Annual Book of ASTM Standards - Volume 04.08 - Soil and Rock
- C. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Annual Book of ASTM Standards - Volume 04.08 - Soil and Rock
- D. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth), Annual Book of ASTM Standards - Volume 04.08. - Soil and Rock
- E. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth), Annual Book of ASTM Standards - Volume 04.08. - Soil and Rock
- F. 29 CFR Part 1926 Subpart P - OSHA Excavation Regulations 1926.560 through 1926.562 including Appendices A through F
- G. State of Connecticut Department of Transportation – Standards for Roads, Bridges and Incidental Construction, Form 816, 2004.

1.3 DEFINITIONS

- A. Definitions applicable to this Section are as follows:
- B. Earth Retention Systems - Any structural system, such as sheeting and bracing or cofferdams, designed to retain in-situ soils in place and prevent the collapse of the sides of an excavation in order to protect employees and adjacent structures.
- C. Benching - A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
- D. Excavation - Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
- E. Protective System - A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include earth retention systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.
- F. Registered Professional Engineer - A person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

- G. Shield System - A structure that is designed to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as “trench boxes” or “trench shields”.
- H. Sloping - A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
- I. Trench - A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m).

1.4 SUBMITTALS

- A. Drawings and calculations for each earth retention system required in the Work. The submittal shall be in sufficient detail to disclose the method of operation for each of the various stages of construction required for the completion of the earth retention systems.
 - 1. The submittal shall be made in a timely manner to afford the WPCA’s Technical Consultant adequate time to review the design before any work is started on the earth retention system. The review of the design by the WPCA’s Technical Consultant shall not relieve the Contractor of any responsibility.
 - 2. The submitted calculations and drawings shall be prepared, signed and stamped by a Registered Professional Engineer.
 - 3. All excavation, trenching, and related earth retention systems shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State of Connecticut requirements. Where conflict between OSHA and State of Connecticut regulations exists, the more stringent requirements shall apply.
- B. Performance data for the compaction equipment to be utilized.
- C. Construction methods that will be utilized for the removal of rock on the project.
- D. Standard Proctor Test (ASTM D698) results and soil classification (ASTM D2487) for all proposed backfill materials at the frequency specified below:
 - 1. For suitable soil materials removed during trench excavation, perform one test for every 1,000 cubic yards of similar soil type. Similarity of soil types will be as determined by the WPCA and its Technical Consultant.
 - 2. For borrow materials; perform tests at frequency specified in Section 02320 - Borrow Materials.

Town of Canton WPCA

- E. Compaction test results (i.e. ASTM D2922 and ASTM D3017 or ASTM D1556) at a frequency of one test for every 100 cubic yards of material backfilled. The WPCA's Technical Consultant will determine the locations and lifts to be tested.
 - 1. The WPCA's Technical Consultant may specify additional compaction testing when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.
 - 2. If all compaction test results within the initial 25% of the total anticipated number of tests indicate compacted field densities equal to or greater than 95% of maximum dry density at optimum moisture content, the Engineer may reduce frequency of compaction testing. In no case will the frequency be reduced to less than one test for every 500 cubic yards of material backfilled.
 - 3. The Contractor is cautioned that compaction testing by nuclear methods may not be effective where trenches are so narrow that trench walls impact the attenuation of the gamma radiation or where oversized particles (i.e. large cobbles or coarse gravels) are present.

1.5 PROJECT CONDITIONS

- A. Notify "Call Before You Dig" prior to commencing excavation activities, and obtain "Call Before You Dig" identification numbers.
- B. Notify utility owners in reasonable advance of the work and request the utility owner to stake out on the ground surface the underground facilities and structures. The Contractor shall notify the WPCA in writing of any refusal or failure to stake out such underground utilities after reasonable notice.
- C. Make explorations and excavations to determine the location of existing underground structures, pipes, house connection services, etc. in accordance with Section 02210.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Fill material is subject to the approval of the WPCA's Technical Consultant and may be either material removed from excavations or borrow from off site. Fill 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.
- B. Satisfactory materials shall include materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, SW, and SP.
- C. Satisfactory materials shall not contain trash, refuse, vegetation, masses of roots, individual roots more than 18 inches long or more than 1/2 inch in diameter, or stones over 6 inches in diameter. Organic matter shall not exceed minor quantities and shall be well distributed.
- D. Satisfactory materials shall not contain frozen materials nor shall backfill be placed on frozen material.
- E. Excavated surface and/or pavement materials such as gravel or trap rock that are salvaged may be used as a sub-grade material. In no case will salvaged materials be substituted for the required gravel base.

2.2 FILTER FABRIC

- A. Filter fabric shall be as specified in Section 01570 (Temporary Controls).

2.3 BOARD INSULATION

- A. Shall be 3" rigid cellular foam board insulation.

2.4 CONTROLLED DENSITY FILL

- A. Controlled density fill for use where required shall be flowable, excavatable and shall require no vibration for placement. Compressive strength at 28 days shall be 30 to 80 psi and the slump shall be 10 to 12 inches.

PART 3 EXECUTION

3.1 GENERAL

- A. The Contractor shall not occupy more than 400 feet of unfinished trench at any given time.

3.2 PREPARATION

- A. Public Safety and Convenience
 1. Take precautions for preventing injuries to persons or damage to property in or about the Work.
 2. Provide safe access for the WPCA and its Technical Consultant at site during construction.
 3. Do not obstruct site drainage, natural watercourses or other provisions made for drainage.

3.3 CONSTRUCTION

- A. Earth Retention Systems
 1. Provide earth retention systems necessary for safety of personnel and protection of the Work, adjacent work, utilities and structures.
 2. Maintain earth retention systems for the duration of the work.
 3. Systems shall be constructed using interlocking corner pieces at the four corners. Running sheet piles by at the corners, in lieu of fabricated corner pieces, will not be allowed.
 4. Drive sheeting ahead of and below the advancing trench excavation to avoid loss of materials from below and from in front of the sheeting.
 5. Sheeting is to be driven to at least the depth specified by the designer of the earth retention system, but no less than 2 feet below the bottom of the excavation.
 6. Remove sheeting, unless designated to be left in place, in a manner that will not endanger the construction or other structures. All voids left or caused by the withdrawal of sheeting shall be backfilled and properly compacted.

Town of Canton WPCA

7. The WPCA's Technical Consultant may order the placement of additional bracing or supports if required for protection of personnel and property.

B. Trench Excavations

1. Rock to be excavated 10 feet beyond all pipelines and structures, except not onto private property.
2. Excavation shall be performed to the lines and grades indicated on the Drawings. Unauthorized over-excavation shall be backfilled in accordance with the provisions of this Section.
3. Excavate trenches with equipment selected to minimize damage to existing utilities or other facilities. Hand excavate as necessary to locate utilities or avoid damage.
 - a. Sawcut the existing pavement in the vicinity of the trench prior to the start of trench excavation in paved areas, so as to prevent damage to the paving outside the requirements of construction.
 - b. Make pipe trenches as narrow as practicable and keep the sides of the trenches undisturbed until backfilling has been completed.
 - c. Provide a clear distance of 12 inches on each side of the pipe. The minimum trench width shall be 24" plus the diameter of the pipe.
 - d. Excavate to a depth of at least 6" below the pipe.
4. If the Contractor damages existing structures, pipes, facilities, wires, or conduit, he shall bear the sole responsibility and costs for repair and/or replacement. The method of repair must be approved by the utility owner, the WPCA and its Technical Consultant.
5. During excavation, material satisfactory for backfill shall be stockpiled in an orderly manner at a distance from the sides of the excavation equal to at least one half the depth of the excavation, but in no case closer than 2 feet.
 - a. Excavated material not required or not suitable for backfill shall be removed from the site.
 - b. Grading shall be performed as necessary to prevent surface water from flowing into the excavation.
 - c. Pile excavated material in a manner that will endanger neither the safety of personnel in the trench nor the Work itself. Avoid obstructing sidewalks and driveways.
 - d. Hydrants under pressure, valve pit covers, valve boxes, manholes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the Work is completed.
6. The trench bottom shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of pipe.
7. Stones greater than 6 inches in any dimension shall be removed from the bottom of the trench to avoid point bearing.

8. Where unsatisfactory material is found at the normal bottom of trench, the Contractor shall remove the unsatisfactory materials to the depth directed by the WPCA's Technical Consultant and properly dispose of the material. Backfill the resulting extra depth of excavation with suitable soil materials and compact in accordance with the provisions of this Section.
9. Refer to Section 02317 (Underground Warning Tape) and Section 02318 (Tracer Wire Pipe Location System) for the appropriate pipe marking systems.

C. Concrete Encasement

1. Concrete encasement 3 feet beyond all walls and structures.
2. Concrete encasement for all gravity pipes less than 5-feet deep.
3. top of pipe at least three feet below any stream crossing bottom.
- 4.

3.4 TRENCH BACKFILL AND COMPACTION

A. General

1. Unless otherwise specified or indicated on the drawings, use suitable material removed during excavation for backfilling trenches. The WPCA's Technical Consultant may require stockpiling, drying, blending and reuse of materials from sources on the Project.
2. Sufficient leveling and compacting equipment shall be provided to do the work of spreading and compacting the material promptly after it has been deposited. When such equipment is inadequate to spread and compact the material properly, the Contractor shall reduce the rate of excavation and placing of the fill or employ additional equipment.
3. When excavated material is specified for backfill and there is an insufficient amount of this material at a particular location on the project due to rejection of a portion thereof:
 - a. If there is an excess of excavated material available at other portions of the project, the Contractor will be required to use the excess material from one portion of the job to make up the deficiency existing on other portions of the project.
 - b. If there is not an excess of excavated material available at other portions of the project, the Contractor will be required to use borrow materials as directed by the WPCA's Technical Consultant.
4. Trench backfilling and compaction methods shall attain 95% of maximum dry density at optimum moisture content as determined in accordance with ASTM D698, Method C.
5. Do not place stone or rock fragment larger than six inches in greatest dimension in the backfill. Do not drop large masses of backfill material into the trench endangering the pipe or adjacent utilities.

Town of Canton WPCA

6. Install pipe in rock excavated trenches on a dense graded stone bedding with a minimum depth of 6 inches. Shape the stone bedding at the pipe bells to provide uniform support. Encase the pipe in the dense graded crushed stone bedding to a grade 6 inches over the top of the pipe and 12 inches on each side of the pipe.
 7. Extend pipe bedding material (and filter fabric if required) to the full width of the trench excavation.
 8. Backfill from the bottom of the trench to the centerline of the pipe with the specified material. This initial backfill is to be placed in layers of no more than 6 inches and thoroughly tamped under and around the pipe. This initial backfilling shall be deposited in the trench for its full width on both sides of the pipe, fittings and appurtenances simultaneously.
 9. Pipe that is less than 6 inches in diameter, and electrical conduit not encased in concrete, shall be backfilled with sand borrow conforming to the requirements of Section 02320. The backfill shall be placed in the trench for its full width and shall extend to 12 inches over the pipe.
 10. Where excavation is made through permanent pavements, curbs, paved driveways or paved sidewalks, or where such structures are undercut by the excavation, place the entire backfill to sub-grade with granular materials and compact in 6 inch layers. Use approved mechanical tampers for the full depth of the trench. If required, the backfill material shall be sprinkled with water before tamping so as to improve compaction.
 11. Place and compact backfill around manholes, vaults, pumping stations, gate boxes or other structures in six inch layers, from a point 1 foot over the pipe. Care shall be exercised to protect and prevent damage to the structures.
 12. Maximum loose lift height for backfilling existing or borrow material shall be 12 inches, unless satisfactory compaction is demonstrated otherwise to the Engineer through field-testing. In no case shall loose lift height for backfilling exceed 3 feet.
 13. Install dams of suitable material where dense graded stone is used for pipe bedding to prevent groundwater from following along the stone bedding. Install dams every 300 feet, a minimum of one between manholes, or as directed by the WPCA's Technical Consultant. Refer to Standard Detail No. 019.
- B. PVC Low Pressure Sewer and PVC/DI Force Main Trenches
1. Refer to Standard Sewer Detail No. 015 – PVC (Mainline & Service) Low Pressure Sewer & Ductile Iron Force Main Trench.
- C. PVC/DI Gravity Sanitary Sewer and Service Trenches
1. Refer to Standard Sewer Detail No. 014 – PVC / Ductile Iron Gravity Sanitary Sewer Main / Service Trench.
- D. Common Gravity Sewer and Force Main Pipe Trench

Town of Canton WPCA

1. Refer to Standard Sewer Detail No. 018 – Common Gravity Sewer & Force Main Trench.
- E. Pipe Support Utility Crossing
1. Refer to Standard Sewer Detail No. 017 – Pipe Support Utility Crossing.
 2. Refer to Standard Sewer Detail No. 036 – Concrete Pier Pipe Support.
 3. Use marking tape of the appropriate type of pipe crossed in accordance with Section 02317, as well as for the sewer pipe being installed.
- F. Concrete Encasement
1. Refer to Standard Sewer Detail No. 016 – Concrete Encasement for Gravity Sewer.

END OF SECTION

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SECTION 02317

UNDERGROUND WARNING TAPE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Underground Warning Tape
- B. Related Sections
 - 1. Section 02318 – Tracer Wire Pipe Location System
- C. Related Sewer Construction Details
 - 1. No. 014 – PVC/DI Gravity Sanitary Sewer Main/Service Trench
 - 2. No. 015 – PVC Low Pressure & Ductile Iron Force Main Sanitary Sewer Main/Service Trench

1.2 SUBMITTALS

- A. Shop Drawing Submittals
 - 1. Product Data

1.3 QUALITY ASSURANCE

- A. The Contractor shall use the appropriate type of underground warning tape for all existing utilities crossed while installing the sanitary sewer.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Metallic warning tape for underground piping shall be polyethylene tape with metallic core for easy detection and location of piping with a metal detector.
- B. Tape shall be colored and printed with the words “PIPELINE BURIED BELOW,” “DRAIN BURIED BELOW,” or “COMMUNICATION LINE BURIED BELOW,” per the nature of the specific pipeline.
- C. Tape shall be 6 inches wide.
- D. Tape shall be as manufactured by Seton Name Plate Corp., New Haven, CT or approved equal.
- E. The warning tape shall be heavy gauge 0.004 inch polyethylene and shall be resistant to acids, alkalis and other soil components. It shall be highly visible in the following color with the associated phrases stamped in black letters and repeated at a maximum interval of 40 inches.

Town of Canton WPCA

<u>Type of Utility</u>		WARNING MESSAGE
Sanitary Sewer	Green	CAUTION - SANITARY SEWER BURIED BELOW
Storm Drain	Green	CAUTION - STORM DRAIN BURIED BELOW
Water	Blue	CAUTION - WATER LINE BURIED BELOW
Electric	Red	CAUTION - ELECTRIC LINE BURIED BELOW
Telephone / Communications	Orange	CAUTION - TELEPHONE LINE BURIED BELOW
Gas	Yellow	CAUTION - GAS LINE BURIED BELOW

- F. The tape shall be of the type specifically manufactured for marking and locating utilities.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All buried pipe and fittings shall be installed with metallic-lined underground warning tape shall be located at a depth as shown on the appropriate Standard Construction Detail.

END OF SECTION

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SECTION 02318

TRACER WIRE PIPE LOCATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Tracer wire pipe location system for use in the following applications:
 - a. Low pressure sanitary sewer main and service piping systems.
 - b. Sanitary sewer force main piping systems.

B. Related Sections

1. Section 02315 – Excavation, Backfill & Compaction
2. Section 02320 – Borrow Materials
3. Section 02514 – Ductile Iron (DI) Pipe and Fittings
4. Section 02515 – Polyvinyl Chloride (PVC) Pipe and Fittings
5. Section 16060 – Grounding and Bonding

C. Related Sewer Construction Details

1. No. 015 – PVC Low Pressure & Ductile Iron Force Main Sanitary Sewer Main/Service Trench
2. No. 037 – Force Main Tracer Wire System

1.2 SYSTEM DESCRIPTION

- A. The tracer wire pipe location system shall be used to allow WPCA staff to carry a radio signal through the tracer wire to locate the buried piping network.

1.3 REFERENCES

- A. 29 CFR Part 1926 Subpart P - OSHA Excavation Regulations 1926.560 through 1926.562 including Appendices A through F.
- B. State of Connecticut Department of Transportation – Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004.
- C. “Call Before You Dig” Program.

1.4 SUBMITTALS

A. Shop Drawing Submittals

1. Submit product data for the following:
 - a. Tracer wire
 - b. Test stations

- c. Splice kits
- d. Grounding system

1.5 QUALITY ASSURANCE

- A. For each system component, the Contractor shall use materials of a single manufacturer for the duration of the Project.

PART 2 PRODUCTS

2.1 MATERIALS

A. Tracer Wire

- 1. Tracer wire shall be AWG #12 solid copper conductor.
- 2. Jacketing material shall be very high molecular weight polyethylene (HMWPE) insulation no less than 5/64" (78 mils) thick.
- 3. The tracer wire shall be of the type specifically manufactured for direct-bury applications for use in locating buried piping systems.
- 4. Tracer wire shall be as manufactured by BMS of Stoughton, MA, or equal.
- 5. The minimum spool length shall be 1,000 feet in length.
- 6. THHN wire shall not be acceptable for use as a substitute for use as tracer wire.
- 7. Tracer wire color shall be green if available. If green is not available, the WPCA's Technical Consultant may approve white as an alternate. No other colors shall be used.

B. Splice Kits

- 1. Splices shall be made with splice kits utilizing a series of rubber pads and vinyl tape to yield a completely insulated and waterproof splice through 1000 Volts. Low voltage splice kits shall be Plyflex Low Voltage Splice Kits, as manufactured by Plymouth Rubber Company, or equal.
- 2. The splice kits shall insulate and seal the conductors for direct-bury and submersible applications.

C. Test Stations

- 1. Each test station shall be non-corrosive, featuring cast iron cover and collar, with easy access for five (5) wire terminals. Units shall also be constructed to accommodate pass through studs.
- 2. Riser shall be 4" diameter plastic pipe shaft of 18" overall length.
- 3. Test stations shall be locking type, Model Glenn-4, as manufactured by Farwest Corrosion Control Company, or equal.

D. Grounding System

1. Ground rods shall be 3/8" diameter, 60" long steel rods uniformly coated with metallicly bonded electrolytic copper.
2. Ground rod clamps shall be high-strength, corrosion-resistant copper alloy.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Install the pipeline in accordance with the requirements of Sections 02514 and 02515.
2. Trench excavation and backfill shall be in accordance with Section 02315.
3. Borrow materials shall be in accordance with Section 02320.
4. The tracer wire shall be located 6" above the pipe crown within the sand layer as outlined in the standard details.
5. The tracer wire pipe location system shall be installed in such a manner as to be able to properly trace all buried force main and low pressure sewer systems

B. Tracer wire

1. The tracer wire shall be tested in accordance with the requirements of ASTM B-1, B-3, B-8, and D-1248
2. At all future pipe stubs, a coil of 20 feet of tracer wire shall be left for future use.

C. Test stations

1. Test stations shall be located outside the edge of the roadway within the right-of-way or the sanitary sewer easement.
2. The maximum spacing between test stations along mainline pipe shall be 500 feet.

D. Splice kits

1. Install splices only in those locations approved by the WPCA's Technical Consultant.
2. No Splice Option
 - a. Install continuous wire loops to each test station without splices.
3. Splice Option
 - a. Use splice kits specified in Part 2 of this Section.

E. Grounding system

1. Install the grounding system in accordance with Section 16060.
2. Install ground rods at tracer wire system terminal points, use clamp to connect tracer wire to ground rod

3.2 TESTING

- A. The tracer wire pipe testing system shall be fully tested prior to acceptance and final approval.

3.3 RECORD INFORMATION

- A. The Contractor is responsible for providing as-built locations for all test stations to the WPCA.

END OF SECTION

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SECTION 02320

BORROW MATERIALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Standard Gravel Borrow
2. Processed Gravel Borrow for Pavement Sub-Base
3. Sand Borrow
4. Stone Borrow
 - a. Crushed Stone Borrow
 - b. Dense Grade Stone Borrow for Pipe Bedding
 - c. Placed Riprap Borrow
 - d. Washed Round Pea Stone
5. Ordinary Borrow
6. Clay for Trench Dams
7. Compaction Equipment

B. Related Sections

1. Section 02315 – Excavation, Backfill, and Compaction
2. Section 02514 – Ductile Iron (DI) Pipe and Fittings
3. Section 02515 – Polyvinyl Chloride (PVC) Pipe and Fittings
4. Section 02530 – Manholes and Structures

C. Related Sewer Construction Details

1. No. 001 – Standard 48-Inch Precast Concrete Sanitary Sewer Manhole
2. No. 002 – Standard 60-Inch Precast Concrete Sanitary Sewer Manhole
3. No. 014 – PVC / Ductile Iron Gravity Sanitary Sewer Main / Service Trench
4. No. 015 – PVC (Mainline & Service) Low Pressure Sewer & Ductile Iron Force Main Trench
5. No. 016 – Concrete Encasement for Gravity Sewer
6. No. 017 – Pipe Support Utility Crossing
7. No. 019 – Impervious Trench Interrupters / Dams

Town of Canton WPCA

8. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
9. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
10. No. 025 – Low Pressure Sewer Junction Cleanout Structure
11. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
12. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
13. No. 030 – Force Main In-Line Cleanout Structure
14. No. 031 – Temporary Trench Surface Repairs
15. No. 032 – Permanent Trench Surface Repairs
16. No. 033 – Grease Trap
17. No. 034 – Gasoline and Sand Trap

1.2 REFERENCES

- A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM C117 - Standard Test Method for Materials Finer than 75 μm (#200) Sieve in Mineral Aggregates by Washing.
- C. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb./ft³).
- D. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
- E. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes.
- F. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- G. ASTM D3017 - Standard Test Method for Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- H. AASHTO – Standard Specification for Transportation Materials and Methods of Sampling and Testing, 1986 Edition as amended.
- I. State of Connecticut Department of Transportation – Standards for Roads, Bridges and Incidental Construction, Form 816, 2004.

1.3 SUBMITTALS

- A. Provide representative samples of borrow materials taken from the source. Tag, label, and package the samples as requested by the Engineer. Provide access to the borrow site for field evaluation and inspection.

Town of Canton WPCA

- B. Provide sieve analysis (ASTM C136) and permeability analysis (ASTM D2434) from certified soils testing laboratory for all borrow materials.
- C. Provide modified proctor analysis (ASTM D1557) from certified soils testing laboratory for all borrow materials.
- D. Provide sieve analysis (ASTM C136) and permeability analysis (ASTM D2434) from certified soils testing laboratory for all sand borrow materials.
- E. The WPCA and its Technical Consultant reserve the right to require more frequent testing than that which is specified above should the borrow characteristics change.
- F. Prior to the start of work, submit to the WPCA's Technical Consultant performance data for all compaction equipment to be utilized.

1.4 QUALITY ASSURANCE

- A. No borrow shall be placed prior to the approval of the WPCA's Technical Consultant.
- B. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.
- C. Use equipment of adequate size, capacity, and quantity to accomplish the work of this Section in a timely manner.
- D. Comply with the directions of the WPCA's Technical Consultant and the requirements of governmental agencies having jurisdiction.

1.5 PROJECT/SITE CONDITIONS

- A. Existing Conditions
 - 1. Contractor is to be aware of any environmental requirements and restrictions and is to comply with strict adherence to them.
 - 2. During hauling operations, all public and private roadway surfaces shall be kept clean and any borrow or other dirt which may be brought upon the surface shall be removed promptly and thoroughly before it becomes compacted by traffic. If necessary, the wheels of all vehicles used for hauling shall be cleaned frequently and kept clean to avoid bringing any dirt upon the paved surfaces.
 - 3. All excavation, hauling and placement of borrow material on site shall be conducted in such a manner so as to insure that no infringement of these specifications shall be violated.

PART 2 PRODUCTS

2.1 STANDARD GRAVEL BORROW

- A. Gravel borrow shall consist of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

Town of Canton WPCA

- B. Gradation requirements for gravel shall be determined by AASHTO-T11 and T27 and shall conform to the following:

Sieve	Percent Passing
1/2 inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10

1. The maximum size of stone in gravel shall be 2 inches.
2. Free draining material shall meet the material requirements of Article M.02.07 of the CT-DOT Form 816.
3. No more than 75% by weight shall pass the No. 40 sieve, and not more than 10% shall pass the No. 200 mesh sieve.

2.2 PROCESSED GRAVEL BORROW FOR PAVEMENT SUBBASE

- A. The compacted processed gravel borrow to be used for pavement sub-base shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.
- B. The processed materials shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.
- C. Pavement sub-base shall conform to the materials requirements of Article 2.02.03 of the CT-DOT Form 816.
- D. Processed aggregate base shall conform to the material requirements of Subarticles M.05.01-1, M.05.01-2, and M.05.01-3 of CT-DOT Form 816 as outlined below:

Sieve Size (Square Openings)	Percent by Weight Passing Through	
	Minimum	Maximum
2 1/2"	100	100
2"	95	100
3/4"	50	75
1/4"	25	45
#40	5	20
#100	2	12

- E. Processed aggregate shall conform to the material requirements of Article M.05.01 of CT-DOT Form 816, except that coarse aggregate shall be broken stone, and fine aggregate shall be stone sand, screenings, or a combination thereof.

2.3 SAND BORROW

- A. Sand borrow material used for this item shall be supplied from an off-site borrow area, subject to Engineer's approval. Testing of the off-site sand borrow shall be at the Contractor's expense.

Town of Canton WPCA

- B. Sand borrow shall consist of clean, inert, hard, durable grains of quartz or other hard, durable, rock, free from loam or clay, surface coatings and deleterious materials. The allowable amount of material passing a No. 200 sieve as determined by ASTM-C117 shall not exceed 10% by weight.
- C. Material shall consist of a clean, non-plastic, granular material conforming to the requirements of a SW, SP or SM under the Unified Soil Classification System (USCS) (ASTM D2487).
- D. The material shall have the characteristics that when placed and compacted, the soil particles will bind together so as to form a solid, stable surface capable of supporting rubber-tired vehicular traffic during wet weather periods as well as extended dry weather periods. The borrow material shall not contain fines to the extent that the surface layer becomes “greasy” when wet.
- E. The material shall not contain stones larger than 3/8 inch in diameter.
- F. Sand borrow materials with up to 10% by weight, passing the #200 sieve shall be acceptable for use in a final cover system provided that all other gradation and permeability requirements are satisfied.

2.4 STONE BORROW

A. General

1. Crushed stone borrow shall consist of one of the following materials:
 - a. Durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quality of thin, flat, elongated or other objectionable pieces. A detrimental quality will be considered as any amount in excess of 15% of the total weight. Thin stones shall be considered to be such stones whose average width exceeds four (4) times their average thickness. Elongated stones shall be considered to be stones whose average length exceeds four (4) times their average width.
 - b. Durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone with a minimum diameter before crushing of 8 inches.
2. The crushed stone shall be reasonably free from clay, loam or deleterious material and not more than 1.0% of satisfactory material passing a No. 200 sieve will be allowed to adhere to the crushed stone.
3. The crushed stone shall conform to the grading requirements shown in the following grading Table.

B. 1" Crushed Stone Borrow

1. The following 1 ½" crushed stone mix is equivalent to "No. 4", as outlined in M.01.01 (Gradation Table) of the CT-DOT Form 816.

Sieve Size	Percent by Weight Passing Through	
	Minimum	Maximum
1 ½"	100	--
1 ¼"	85	100
¾"	10	40
½"	0	8

2. Granular fill shall conform to the material requirements of Article M.02.01 of CT-DOT Form 816.
3. The material shall consist of broken or crushed stone, gravel, and miscellaneous aggregate.
4. Stone gradations shall vary depending on field use and shall be determined by the WPCA's Technical Consultant.

C. Crushed Stone Borrow for Pipe Bedding

1. The following ¾" crushed stone is "No. 6" stone/gravel from Article M.01.01 in CT-DOT Form 816:

Sieve Size	Percent by Weight Passing Through	
	Minimum	Maximum
1"	100	--
¾"	90	100
½"	10	50
3/8 "	0	20
No.4	0	5

D. Placed Riprap Borrow

1. Stone used for placed riprap shall be hard, durable, angular in shape, resistant to weathering and shall meet the gradation requirement specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized by the Engineer. Stone shall be free from overburden, spoil, shale, or organic material and shall meet the gradation requirement as specified.

Size of Stone	Maximum Percent of Total Weight Smaller Than Given Size
400 lb.	100
300 lb.	80
200 lb.	50
*25 lb.	10

2. No more than 5% by weight shall pass a 2" sieve.

Town of Canton WPCA

3. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stones smaller than the specified 10% size and spalls will not be permitted in an amount exceeding 10% by weight of each load.

E. Washed Rounded Stone (Pea Stone)

1. All stone shall be clean material substantially free from any foreign and deleterious material such that not more than 1% passes the #200 sieve. The maximum particle size shall be 5/8".
2. The following pea stone is "No. 67" stone/gravel from Article M.01.01 in CT-DOT Form 816:

Sieve Size	Percent Passing Through by Weight	
	Minimum	Maximum
5/8 "	100	-
1/2"	85	100
3/8"	15	45
No.4	0	15
No.8	0	5

2.5 ORDINARY BORROW

- A. Ordinary borrow shall consist of a material satisfactory to the WPCA's Technical Consultant and not specified as gravel borrow, sand borrow, special borrow material or other particular kind of borrow. This material shall have the physical characteristics of soils designated as type GW, GP, GM, SW, SP or SM, under USCS. It shall have properties such that it may be readily spread and compacted for the formation of embankments. The borrow shall not include rocks with a major dimension greater than 8 inches.
- B. Borrow material shall conform to the requirements of Article 2.02.03 of CT-DOT Form 816.

2.6 CLAY FOR TRENCH DAMS

- A. Impervious clay material to have a coefficient of permeability not to exceed 1×10^{-5} cm/sec.

2.7 COMPACTION EQUIPMENT

- A. Use equipment capable of adequately placing, spreading and compacting materials to the depth specified.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Prior to the placement of borrow material, site preparation shall be completed as required by the Contract Documents, and approved by the WPCA's Technical Consultant.

Town of Canton WPCA

- B. Ensure that all materials are properly stockpiled on site to prevent contamination by other materials.
- C. Borrow material shall be placed over the entire area in uniform lifts and compacted to 95% of maximum dry density.
- D. Stockpiled borrow shall be utilized prior to using off-site borrow.
- E. Gravel borrow shall be used in all locations where a surface treatment has not been specified but requires a firm finish surface.
- F. Processed gravel for pavement sub-base is intended to provide a stable foundation for driveways, sidewalk and roadway repair where a gravel base has been specified.
- G. Borrow shall be used as a replacement for unsuitable materials where poor soil conditions below the normal depth of the trench are encountered during the progress of the work. Extra excavation, and the type of borrow as determined by the WPCA's Technical Consultant, shall be used only in those locations where its use is ordered by WPCA's Technical Consultant. The intent of the borrow is to provide a stable foundation for the pipe as a replacement of unsatisfactory material, not as a aid to dewatering trenches. Its use shall be limited to those areas in which the WPCA's Technical Consultant orders its use in writing.
- H. All borrow shall be placed so as to keep it free of other materials and to prevent segregation.

END OF SECTION

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SECTION 02370

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Description of Contractor's responsibilities regarding:
 - a. Erosion Control Blanket for restoration of sloped areas steeper than 3:1 (H:V)
- B. Related Sections
 - 1. IWWA regulations
 - 2. Section 01570 – Temporary Controls
 - 3. Section 02230 - Site Clearing
 - 4. Section 02315 - Excavation, Backfill and Compaction
 - 5. Section 02920 - Lawns and Grasses

1.2 REFERENCES

- A. ASTM D3786 – Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
- B. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
- C. ASTM D4491 – Standard Test Method for Water Permeability of Geotextiles by Permittivity.
- D. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- E. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

1.3 SUBMITTALS

- A. Submit material specification and Shop Drawings for all materials and equipment furnished under this Section.

PART 2 PRODUCTS

2.1 EROSION CONTROL BLANKET

- A. Shall be SC150BN, as manufactured by North American Green, or approved equal.
- B. Shall be extended term erosion control blanket constructed of 100% biodegradable materials with a 70% agricultural straw and 30% coconut fiber blend matrix, with longevity up to 18 months.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with the manufacturer's written instruction manual.

END OF SECTION

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SECTION 02410

ROCK EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Rock excavation for trenches and structures.
- B. Related Sections
 - 1. Section 02090 – Controlled Blasting
 - 2. Section 02315 – Excavation, Backfill and Compaction

1.2 DESCRIPTION

- A. Removal of boulders greater than one (1) cubic yard in volume is included under this Section of work. Removal of boulders less than one (1) cubic yard in volume is not considered part of this work and is considered a part of the work specified under Section 02315.
- B. Rock excavation shall mean solid ledge rock or solid concrete which in the opinion of the WPCA's Technical Consultant requires for its removal, drilling and blasting, wedging, sledging, firing, or breaking up with power operated hand tools.
- C. Material removed solely with a power-operated excavator or loose, previously blasted ledge, broken stone, weathered rock or glacial till will not be considered rock excavation. Rock excavation shall not include cemented gravel or hardpan.

1.3 SUBMITTALS

- A. Submit construction methods which will be utilized for the removal of rock on the project.
- B. If blasting is required, submit qualifications of professional blasting Consultant per Section 02090.
- C. Prior to beginning any blasting operation, submit a detailed description of the proposed method for blasting.

1.4 QUALITY ASSURANCE

- A. Contractor to excavate rock at least 10 feet beyond the limits of all structures and pipelines, except in those locations where such work would be required on private property.
- B. Rock excavation shall not occur closer than 30 feet from pipe laying activities to prevent damage to previously installed pipelines.

Town of Canton WPCA

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

- A. Refer to the requirements of Section 02090 for blasting requirements.
- B. Minimum excavation and clearance within rock trenches shall be per Section 02315.
- C. Minimum pipe bedding requirements shall be per Section 02315.

END OF SECTION

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SECTION 02445

PIPE SLEEVE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Casing pipe
 - 2. Spacers between casing pipe and carrier pipe
 - 3. Sand fill between casing pipe and carrier pipe
 - 4. Refer to Sections 02514 and 02515 for requirements associated with carrier pipes.
- B. Related Sections
 - 1. Section 02315 - Excavation, Backfilling and Compaction
 - 2. Section 02514 - Ductile Iron (DI) Pipe and Fittings
 - 3. Section 02515 - Polyvinyl Chloride (PVC) Pipe and Fittings

1.2 REFERENCES

- A. ASTM A-53, Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated Welded and seamless
- B. AWWA C-203, AWWA Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied

1.3 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials provided and equipment used under this Section.

1.4 PERMITS

- A. Comply with the following permits requirements:
 - 1. Town of Canton - Inland Wetlands and Watercourses Agency

PART 2 PRODUCTS

2.1 MATERIALS

- A. The casing pipe shall conform to the requirements of ASTM A53, black, Type S, Grade B, Schedule 40. Minimum yield-strength of 35,000 PSI, designed to withstand appropriate earth pressure loading. The steel casing pipe (sleeve) shall conform to the American Railway Engineering Association (AREA) "Specifications For Pipelines Conveying Non-Flammable Substances."
- B. The ends of the sleeve sections shall be beveled for welding and the joints shall be fully welded so as to develop a strength equivalent to the pipe section.

Town of Canton WPCA

- C. Interior and exterior surfaces of the sleeves shall be cleaned, primed, and coated with hot applied coal tar enamel in accordance with AWWA C-203. No bonded wrapped or similar protective device will be allowed.
- D. Each pipe sleeve section shall be supplied with three 2-inch diameter lubrication/grout holes spaced at 120 degrees from the center. Holes shall be threaded; and the casing supplied with threaded brass plugs installed from inside. Plugs shall not protrude beyond the pipe wall to avoid the formation of voids during jacking.
- E. Pipe sleeve ends shall be square and smooth so the jacking loads are evenly distributed around the entire pipe end, such that point loads are minimized when the pipe is jacked. Pipe used for jacking shall be capable of withstanding the jacking forces that will be imposed by the process of installation, as well as the final-in-place loading conditions.
- F. Casing spacers shall be used for placement of the pipe in the sleeve. The spacers shall conform to the standard details for the pipeline sleeve, shown on the drawings.
- G. Sand fill between the sewer and the casing shall be any fine, uniform, granular material that can be conveniently washed or blown down the pipe. The material shall be well drained and shall not have any cementitious properties.
- H. Temporary piping inserted into the sleeve to install the sand fill shall be extracted simultaneously with the filling operation in order to eliminate voids between the casing and the pipe. All temporary piping shall be extracted prior to sealing off the casing ends.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General
 - 1. Line and grade shall be checked regularly in order to install the sleeve at the correct location.
 - 2. Remove and replace any sleeve section damaged during installation.
 - 3. Thoroughly clean the sleeve after installation and prior to final inspection.
 - 4. Lay the carrier pipe inside the sleeve with sufficient slack so that it is not in tension.
 - 5. Seal off the ends of the sleeve with mortared brick bulkheads following final inspection.

END OF SECTION

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SECTION 02503

TESTING OF SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Testing of Gravity Sewer Systems
 - 2. Testing of Grease Traps/Oil-Water Separators
 - 3. Testing of Pressure Sewers (Low Pressure Sewers and Force Mains)
- B. Related Sections
 - 1. Section 02511 – Pre-Insulated Piping
 - 2. Section 02514 – Ductile Iron Pipe and Fittings
 - 3. Section 02515 – Polyvinyl Chloride Pipe and Fittings
 - 4. Section 02530 – Manholes and Catch Basins
 - 5. Section 02958 – Television Inspection of Pipelines
- C. Related Sewer Construction Details
 - 1. No. 008 – Gravity Sewer Test Mandrel
 - 2. No. 033 – Grease Trap/Oil-Water Separator

1.2 REFERENCES

- A. ASTM C1214-92: Standard Practice for Testing Concrete Pipe Sewer Lines by Negative Air Pressure (Vacuum) Test Method
- B. ASTM D2122-90: Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- C. ASTM F1417-92: Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- D. AWWA C600-93: Installation of Ductile Iron Water Mains and their Appurtenances
- E. AWWA C605-94: Underground Installation of Polyvinyl Chloride (PVC) Pressure pipe and Fittings for Water

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.1 TESTING OF GRAVITY SEWER SYSTEMS

- A. All gravity sewers shall be tested as follows:
 - 1. Allowable leakage by low pressure air test;

Town of Canton WPCA

2. Infiltration or exfiltration water test as described herein;
3. Allowable deflection test;
4. Closed circuit television inspection.

B. Low Pressure Air Test

1. After completing backfill of a section of pipe, conduct a Line Acceptance Test using low-pressure air. The test shall be performed according to the specified procedures and under the supervision of the WPCA's Technical Consultant. Testing procedures noted in the following paragraph shall be explicitly followed.
2. Pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
3. After a manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than the time shown for the given diameters and lengths in Table 1 (at the end of this section).
4. Air tests shall cover a 1.0 psig pressure drop; 0.5 psig pressure drop tests are not acceptable.
5. In areas where groundwater is known to exist, install a one-half inch diameter capped pipe nipple, approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple to remove any obstructions, and then connecting clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pressure in pounds per square inch (psig) that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound per square inch and the timing remain the same.)

Town of Canton WPCA

6. The maximum starting test pressure should not exceed 9 psig, regardless of groundwater level above the pipe. If the groundwater level is such that the added pressure would be greater than 5.5 psig (12.7 feet), the pipe section may be tested using a starting pressure of 9 psig.
7. Each pipe nipple installed to measure groundwater levels should be recapped subsequent to the air testing procedure to prevent future infiltration.
8. As an alternative to installing a pipe nipple in a manhole to measure the height of groundwater, the Contractor shall excavate a test pit over the pipe to determine the height of groundwater.

C. Vacuum Test for Manholes - Gravity Sewer Lines

1. After a manhole has been constructed, conduct a Manhole Acceptance Test using the following vacuum test procedure:
 - a. Plug all lift holes with an approved non-shrink grout.
 - b. Plug all pipes entering the manhole, taking care to securely brace the plug from being drawn into the manhole.
 - c. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturers' recommendations.
 - d. Draw a vacuum of 10 inches of mercury and shut off the vacuum pump. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than:

1 min. 0 sec. for 0-ft. to 10-ft. deep manholes

1 min. 15 sec. for 10-ft. to 15-ft. deep manholes

1 min. 30 sec. for 15-ft. to 25-ft. deep manholes
 - e. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout. Retesting shall proceed until a satisfactory test is obtained.

D. Infiltration/Exfiltration Test

1. All gravity type sewers shall be subjected to either an infiltration or an exfiltration test unless otherwise specified. The type of test required will be contingent upon groundwater conditions in the area where lines are to be tested. These tests shall include losses or gains through manholes as well as through pipe walls and joints, as well as through house connection fittings and pipe. No building shall be connected to a newly installed sewer until such time as the sewer has been satisfactorily tested.

Town of Canton WPCA

2. Where lines are installed in areas having a high groundwater level, an infiltration test continuing for at least four (4) hours shall be carried out by the Contractor under the supervision of the WPCA's Technical Consultant. Various sections of the sewer shall be isolated through the use of watertight plugs and the quantity of water entering the pipe during a predetermined time shall be measured. If the conditions are such that groundwater table varies depending on surrounding influence and time of the year or if the table elevation is unknown at the time of testing, the Contractor will be required to excavate test holes as directed by the WPCA's Technical Consultant.
 3. Where lines are installed in relatively dry areas, an exfiltration test shall be imposed on the sewer. This test shall be carried out by isolating various sections of the line through the use of watertight plugs and filling the line with water to a predetermined level. The loss of water in a predetermined time shall be determined by measuring the quantity of water required to refill the line to the original level.
 4. The length of line tested at one time shall be as directed by the WPCA's Technical Consultant and shall be dependent upon the grade of the sewer.
 5. Losses through manholes shall be included in determining the loss in a line. For exfiltration test, manholes will be filled to the bottom of the cone or flat top section and allowed to stabilize before beginning the test. Refilling to reference line may be required before commencing test.
 6. The maximum acceptable loss, through either infiltration or exfiltration, shall not exceed 100 gallons per mile per 24 hours per inch of diameter of the pipe tested. When two (2) or more pipeline sections are tested at the same time, the allowable leakage for the shortest section shall be used as the acceptable loss for the entire length being tested.
- E. Allowable Deflection Test for PVC Pipe - Unless otherwise specified, all PVC Pipe shall be tested for allowable deflection in accordance with the procedure noted below.
1. Pipe deflection measured not less than sixty days (60) after the backfill has been completed as specified shall not exceed five (5.0) percent. Deflection shall be computed by multiplying the amount of deflection (average outside diameter less twice the average wall thickness diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
 2. Deflection shall be measured with a rigid mandrel (Go-No-Go) device cylindrical in shape and constructed with a minimum of nine or ten evenly spaced arms or prongs. Submit drawings of the mandrel with complete dimensions for each diameter of pipe to be tested. Hand pull the mandrel through all sewer and drain lines.
 3. Uncover any section of pipe not passing the mandrel and replace the bedding and backfill to prevent excessive deflection. Retest repaired pipe until acceptable.

Town of Canton WPCA

F. Closed Circuit Television Inspection

1. Closed circuit television inspection of all gravity sanitary sewers mains shall be in accordance with Section 02958.

G. Test Failures

1. In case leakage or deflection exceeds the above specified amount, locate the failures and repair them.
2. Pipelines with shear-type breaks, fishmouths or damaged gaskets, cracked bells or couplings, hairline fractures, or structural damage shall be replaced in kind. Mechanical sleeve couplings, poured concrete collars or similar repairs are not permitted. The use of pressure grouting repair techniques will not be allowed without the written consent of the WPCA's Technical Consultant.
3. After repairs have been made, the line shall be re-tested and the process of repairing and re-testing shall be repeated until results within the above specified limits are obtained.

H. Alignment of Gravity Sewers and Drains

1. Gravity sewers and drains shall be laid accurately to line and grade.
2. After completion of the construction, including backfilling, it must be possible to sight from manhole to manhole THROUGH THE PIPE. This accuracy of laying the pipe can be easily checked as construction progresses.
3. In the event that the completed main fails to meet the requirement for alignment because of horizontal displacement, the Contractor will be allowed to construct intermediate manholes at his own cost. In the event that the completed sewer main fails to meet the requirement for alignment because of vertical displacement, remove and replace the sewer to the proper grades.

3.2 TESTING OF GREASE TRAPS/OIL-WATER SEPARATORS

A. Vacuum Test

1. After a grease trap/oil-water separator has been constructed, conduct a test using the following vacuum test procedure:
 - a. Plug all lift holes with an approved non-shrink grout.
 - b. Plug all pipes entering the structure, taking care to securely brace the plug from being drawn into the manhole.
 - c. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturers' recommendations.
 - d. Draw a vacuum of 10 inches of mercury and shut off the vacuum pump. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The structure shall pass if the time is greater than:

1 min. 0 sec. for 0-ft. to 10-ft. deep structures

1 min. 15 sec. for 10-ft. to 15-ft. deep structures

1 min. 30 sec. for 15-ft. to 25-ft. deep structures

- e. If the structure fails the initial test, necessary repairs shall be made with a non-shrink grout. Retesting shall proceed until a satisfactory test is obtained.

3.3 TESTING OF PRESSURE SEWER SYSTEMS

A. Tests Required on Pressure Systems

1. Low pressure sewers and force mains shall be filled with water and tested after installation is complete.
2. Arrange for and bear the expense of providing all water required for tests. Furnish, install, and remove all temporary plugs, valves, gauges, and connections required for making the tests. Wherever necessary for the stability of the line, install temporary supports, blocking, bracing or ballast.
3. A pressure test and a leakage test are to be run simultaneously. The pressure for these two tests is to be measured at the lowest part of the line and is to be either 100% higher than normal operating pressure or 150 psi if the former exceeds 150 psi. The test is to be conducted for a period of four (4) hours or until such time as the WPCA's Technical Consultant indicates acceptance of the pipeline.
4. On pipelines where the elevation along the route of construction varies substantially, the WPCA's Technical Consultant reserves the right to require the Contractor to valve off and test portions of the line. Also on extensive construction jobs, the WPCA's Technical Consultant reserves the right to require the testing of individual portions of the line as construction proceeds rather than await completion of the entire project in order to undertake a pressure or leakage test.

B. Time for Making a Test

1. No pipeline is to be placed under pressure or subjected to hydrostatic pressure until at least 5 days have elapsed after the concrete thrust blocks have been installed. If high early strength concrete is used in the concrete thrust blocks, the hydrostatic pressure can be applied to the main after 2 days have elapsed from time of construction of the thrust blocks.
2. Rubber jointed pipelines may be subjected to hydrostatic pressure and inspected for leakage at any convenient time after the trench has been partially backfilled. Partial backfilling shall consist of filling along the center of the pipe length and leaving the joint open for inspection.
3. Pipelines using a rubber type joint and on other such pipelines or at such locations as are approved by the WPCA's Technical Consultant, the Contractor will be allowed to complete backfilling, prior to undertaking the leakage and pressure tests. The carrying out of backfilling prior to the conducting of the necessary tests will be at the option of the Contractor with

Town of Canton WPCA

the exception of intersections, driveways, crosswalks and other such locations where holding open the trench will adversely affect the public.

C. Procedure

1. Slowly fill each section of pipeline to be tested with water up to normal operating pressure.
2. Expel all air from the pipeline. Make taps at points of highest elevation in the pipeline in order to completely remove all air.
3. After the line has been placed under normal operating pressure and all air has been expelled, the pressure and leakage test will be started. The pipeline under test is to be raised to the specified pressure. Furnish a pump, pipe connections, gauges and necessary apparatus and connections to the new main. Raise the pressure in the main to the specified test pressure by means of the pump and maintain the specified pressure for a period of four hours or until the WPCA's Technical Consultant indicates that the pipeline is satisfactory.

D. Examination under Pressure

1. Carefully examine all exposed pipes, fittings, valves, and joints during the open-trench test.

Town of Canton WPCA

2. Remove and replace any cracked or defective pipes, fittings, or valves discovered in consequence of this pressure test with sound material in the manner provided under the applicable pipe section and the test shall be repeated until satisfactory to the WPCA's Technical Consultant.

E. Leakage Test

1. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the maximum specified leakage test pressure after the pipe has been filled with water and the air expelled.
2. No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND\sqrt{P}}{3,700}$$

in which L equals the allowable leakage, in gallons per hour; N is the number of joints in the length of the pipeline tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 35 U.S. gal. for pipe with rubber joints per 24 hours per mile of pipe per inch nominal diameter, for pipe in 12-foot lengths evaluated on a pressure basis of 150 psi.)

02503-8

TABLE I
SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

1 Pipe Diameter (in.)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)								
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.	
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	

Uni-Bell PVC Pipe
Association Publication
Uni-B-6-90

END OF SECTION

SECTION 02511

PRE-INSULATED PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. When directed by the WPCA and its Technical Consultant, furnish a complete system of factory-fabricated, pre-insulated ductile iron piping for above and below ground sanitary sewer force main applications.

B. Related Sections

1. Section 02315 – Excavation, Backfill and Compaction
2. Section 02518 – Tracer Wire Pipeline Location System
3. Section 02317 – Underground Warning Tape
4. Section 02503 – Testing of Sanitary Sewer Systems
5. Section 02514 – Ductile Iron Pipe and Fittings
6. Section 02518 – Valves and Hydrants
7. Section 15060 – Hangers and Supports
8. Section 15101 – Ductile Iron Pipe and Fittings

1.2 REFERENCES

A. Pipe and fittings shall conform to the latest edition of the following standards unless otherwise specified:

1. All references outlined in Section 02514 (Ductile Iron Pipe and Fittings) shall apply to this Section.
2. ASTM D638 – Standard Test Method for Tensile Properties of Plastics
3. ASTM D790 – Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
4. ASTM D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
5. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics
6. ASTM D2856 – Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer
7. ANSI/AWWA A21.11/C111 – ANSI Standard for Rubber Gasket Joints for Ductile Iron Pressure Pipe Fittings

8. AWWA C591 – Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
9. ANSI/AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances

1.3 SYSTEM DESCRIPTION

- A. Prefabricated piping systems shall be designed to prevent freezing of the sewage being conveyed in the proposed force mains.
- B. As a minimum, the pre-fabricated, pre-insulated piping systems shall be designed to prevent freezing of the sewage being conveyed for the following operating conditions:
 1. Low Temperature of Sewage in Force Main: 40°F
 2. Low Temperature of Ambient Air : Negative 20°F

1.4 SUBMITTALS

- A. Manufacturer's scale drawings, cuts or catalogs including descriptive literature and complete characteristics and specifications and code requirements. Submit shop drawings for pre-insulated pipe, types of joint, fittings, couplings, lining, coatings, and all other components specified in this Section.
- B. Prior to first shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with ANSI/AWWA standards and as specified herein.
- C. Manufacturers of pipe on the project shall have an established, annually audited and certified, quality control procedure for manufacturing of pipe. Each manufacturer shall be certified by an independent, third party auditor for compliance with all requirements of the AWWA standards. The manufacturer shall submit a current certificate of compliance for the plant facility where the pipe is to be made. Certificate of compliance shall be submitted for each additional year of pipe manufacturing during the duration of the Project. The manufacturer shall not change the manufacturing plant for the pipe without the written authorization of the WPCA's Technical Consultant.

1.5 QUALITY ASSURANCE

- A. All pre-insulated pipe, fittings, insulating materials, and technical support shall be provided by the Pre-Insulated Piping System manufacturer.
- B. All pipe and fittings shall be manufactured in North America.
- C. Pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. In addition, the WPCA reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere.
- D. Use adequate numbers of laborers skilled in performing the work of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. The WPCA's Technical Consultant will inspect the pipe and fittings after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Pipe rejected after delivery, or at any point during the progress of the work, shall be marked for identification and shall immediately be removed from the job site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- 1. The pre-fabricated, pre-insulated piping system shall be:
 - a. "Ferro-Therm DI", as manufactured by Thermacor Process, L.P.; 1670 Hicks Field Road East; Fort Worth, TX 76179-5248; (817) 847-7300;
 - b. "Insul-Tek Ductile Iron", as manufactured by Preinsulated Piping Systems, Inc.;
 - c. "Lo-Temp Hi-Gard" as manufactured by Perma-Pipe, Inc.
 - d. or approved equal.

2.2 MATERIALS

A. Carrier Pipe

- 1. Carrier pipe shall be ductile iron, Class 52, meeting the requirements of this Section as well as those outlined in Section 02514.
- 2. Nominal lengths shall be either eighteen (18) or twenty (20) feet.
- 3. Pipe and fittings shall be coated inside and out with a bitumastic seal coat.
- 4. Joints shall be mechanical joint type in accordance with ANSI/AWWA C111/A21.11.
- 5. Flanges shall be provided at terminations.

B. Insulation

- 1. Insulation shall be polyurethane foam either spray applied or injected with one shot into the annular space between carrier pipe and jacket, and shall be bonded to both.
- 2. Insulation shall be rigid, 90-95% closed cell polyurethane with a 2.0 to 3.0 pounds per cubic foot density per ASTM D-1622 and ASTM D-2856.
- 3. The coefficient of thermal conductivity (K-Factor) of 0.14 to 0.16 BTU/hr. in/sf/°F @ 73°F per ASTM C-518, and also conforming to ASTM C-591.
- 4. Maximum operating temperature shall not exceed 250°F.
- 5. Insulation thickness shall be 3.03-inches, giving the piping system an overall outside diameter of 10.85-inches.

Town of Canton WPCA

6. The unit weight per foot of the pre-insulated piping with HDPE jacket shall not be less than 16.01 pounds.

C. Jacketing Material

1. Outer casing jacketing material shall be high density polyethylene (HDPE). FRP, HDUP, and tape jacket will not be allowed.
2. The thickness of the HDPE jacket is 0.125-inches for 4-inch piping.
3. Black HDPE resin Type III, Grade P34 under ASTM D-1248.
4. Tensile yield strength of 3,300 psi per ASTM D-638.
5. Ultimate elongation of 850% per ASTM D-638.
6. Tangent flexural modulus of 175,000 psi per ASTM D-790.

D. Moisture Barrier End Seals

1. A factory-applied mastic moisture barrier layer shall be sealed to the jacket and carrier pipe. The heat shrinkable end seal shall be as manufactured by Raychem, or equal.
2. End seals shall be certified as having passed 20-foot head pressure test.
3. End seals shall be mastic completely sealing the exposed end of the insulation.
4. Field applied end seals shall be installed at each field cut to the piping before continuing with the installation.

E. Straight Run Joints

1. To be mechanical-joint type straight field joints.
2. Joints may be jacketed with a split sleeve, sealed with a heat shrink sleeve to prevent the ingress of water or debris.

F. Fittings

1. Under all conditions, fittings shall be ductile iron mechanical-joint style fittings insulated with poured in place urethane foam insulation, sealed and jacketed with a HDPE jacketing in the same manner as used on the straight lengths of pipe.
2. The product requirements outlined for mechanical joint ductile iron fittings in Section 02514 shall apply to this Section.

PART 3 EXECUTION

3.1 GENERAL

- A. Deliver, handle, store and install ductile iron pipe in accordance with ANSI/AWWA C600.
- B. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.
- C. Equipment for pipe laying shall be maintained in good operating order.

- D. Job site shall be kept clean of debris and organized to carry out operations in a safe and satisfactory manner.
- E. Prepare the area prior to placement of the pipe in accordance with Section 02315.

3.2 INSTALLATION

- A. Installation of the piping system shall be in accordance with the manufacturer's instructions.
- B. Lay and maintain the pipe at the required lines and grades as shown on the Drawings. Fittings shall be at the required locations with joints centered, and spigots properly fitted. No deviation shall be made from the required line and grade.
- C. Except at locations indicated on the Drawings by the profile, particular care shall be exercised so that no high points are established where air can accumulate.
- D. Mechanical joints shall be made in accordance with Appendix A of ANSI A21.11/AWWA C111 and the manufacturer's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket before assembly. Tighten bolts to the specified torques. Under no conditions shall extension wrenches or an extended handle ratchet wrench be used to secure greater leverage.
- E. Place poured-in-place concrete thrust blocks at all bends (regardless of the angle of deflection or direction), caps, offsets, hydrants, and tees, as well as in locations shown on the Drawings or directed by the WPCA's Technical Consultant. Poured-in-place thrust blocks shall be formed with wood forms; rough earth forms are not acceptable. Protect pipeline materials and fittings from direct adherence of the concrete thrust block by wrapping in plastic, roofing felt, reinforced manila paper or similar material. The thrust block shall not bear directly on the joint and shall not interfere with future adjustments, tightening, or removal of the joint. Thrust blocks shall bear against undisturbed soil at the side or end of the trench and this undisturbed surface shall be carefully cleaned off so as to be vertical. The thrust blocks shall have a minimum horizontal thickness of 2 feet and shall have the minimum bearing area listed on the Drawings, measured perpendicular to the direction of thrust.
- F. Concrete thrust blocks shall be used in conjunction with retainer glands at all tees, bends, offsets, hydrants, caps, and plugs.
- G. Piping shall be tested in accordance with Section 02503 - Testing of Sanitary Sewer Systems.

3.3 FIELD SERVICE

- A. Provide a certified manufacturer's representative or company field service technician. The technician will be available at the job to check unloading, storing, and handling of pipe, joint installation, pressure testing and backfilling techniques. This service shall be provided as part of the project technical services required by the pre-insulated pipe manufacturer.

END OF SECTION

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SECTION 02514

DUCTILE IRON (DI) PIPE & FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Ductile iron pipe and fittings, direct buried or in below grade vaults.

B. Related Sections

1. Section 02315 – Excavation, Backfill and Compaction
2. Section 02317 – Underground Warning Tape
3. Section 02318 – Tracer Wire Pipe Location System
4. Section 02503 – Testing of Sanitary Sewer Systems
5. Section 02511 – Pre-Insulated Piping Systems
6. Section 02515 – PVC Pipe and Fittings
7. Section 09900 – Painting
8. Section 15101 – Ductile Iron Pipe and Fittings

C. Related Sewer Construction Details

1. No. 014 – PVC / Ductile Iron Gravity Sanitary Sewer Main / Service Trench
2. No. 015 – PVC (Mainline & Service) Low Pressure Sewer & Ductile Iron Force Main Trench
3. No. 019 – Impervious Trench Interrupters / Dams
4. No. 021 – Sanitary Sewer Force Main Concrete Thrust Blocks for Horizontal Bends
5. No. 022 - Sanitary Sewer Force Main Concrete Thrust Blocks for Vertical Bends
6. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
7. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
8. No. 025 – Low Pressure Sewer Junction Cleanout Structure
9. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
10. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
11. No. 030 – Force Main In-Line Cleanout Structure

12. No. 037 – Force Main Tracer Wire

1.2 REFERENCES

- A. Pipe and fittings shall conform to the latest edition of the following standards unless otherwise specified:
1. ANSI/AWWA C104/A21.4, Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.
 2. ANSI/AWWA C110/A21.10, Ductile Iron and Grey Iron Fittings 3" through 48" for Water and Other Liquids.
 3. ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
 4. ANSI/AWWA C115/A21.15, Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
 5. ANSI/AWWA C150/A21.50, Thickness Design of Ductile Iron Pipe.
 6. ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast, for Water.
 7. ANSI/AWWA-C153/A21.53, Ductile Iron Compact Fittings Water Service.
 8. ANSI/AWWA C600, Installation of Ductile Iron Water Mains and their Appurtenances.
 9. ANSI/AWWA C800, Underground Service Line Valves and Fittings.
 10. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 11. Ductile Iron Pipe Research Association, "Thrust Restraint Design for Ductile Iron Pipe" (Third Edition).

1.3 SUBMITTALS

- A. Shop Drawings
1. Manufacturer's scale drawings, cuts or catalogs including descriptive literature and complete characteristics and specifications and code requirements. Submit shop drawings for ductile iron pipe, types of joint, fittings, couplings, filling rings, lining and coating.
 2. Additional requirements for restrained joints:
 - a. Pipe layout drawings showing both plan and profile of the proposed pipeline. Include curve and deflection data, invert elevations, grades, joint locations, closure locations, joint openings if any, and other necessary information.
 - b. Locations and type of restrained joints or devices to prevent joint separation.

B. Quality Control Submittals

1. Certificates of Compliance on pipe materials.
2. Prior to first shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.
3. Manufacturers of pipe on the project shall have an established, annually audited and certified, quality control procedure for manufacturing of pipe. Each manufacturer shall be certified by an independent, third party auditor for compliance with all requirements of the AWWA standards. The manufacturer shall submit a current certificate of compliance for the plant facility where the pipe is to be made. Certificate of compliance shall be submitted for each additional year of pipe manufacturing during the duration of the Project. The manufacturer shall not change the plant manufacturing the pipe during the duration of the Project without the written authorization of the WPCA and its Technical Consultant.

1.4 QUALITY ASSURANCE

- A. Pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. In addition, the WPCA reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere.
- B. Ductile iron pipe shall be from a single manufacturer. Fittings shall be from a single manufacturer, not necessarily the pipe manufacturer.
- C. Shop Inspection - Materials are subject to inspection and approval at the plant of the manufacturer. Except where specified otherwise, inspection will be carried out by the WPCA and its Technical Consultant.
- D. The WPCA's Technical Consultant will inspect the pipe and fittings after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Pipe rejected after delivery, or at any point during the progress of the work, shall be marked for identification and shall immediately be removed from the job site.
- E. Pipe shall be laid, jointed and tested under pressure for defects and leakage in the manner hereinafter specified.
- F. All pipe and fittings shall be manufactured in North America.

1.5 PROJECT CONDITIONS

- A. Secure permits and pay fees required to carry out the piping work. The Contractor shall comply with laws, ordinances, codes, rules, and regulations of the local and state authorities having jurisdiction over the Work. Where provisions of the Contract are in conflict with the codes, the code shall govern requirements set forth in this Section and indicated on the Drawings. The Contract Documents shall govern when in excess of the required or minimum regulations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. American Cast Iron Pipe Company
2. Griffin Pipe Products
3. U.S. Pipe
4. or Approved Equal.

2.2 PIPE

- A. Ductile iron pipe shall be designed in accordance with AWWA C150 and shall be manufactured in accordance with AWWA C151. Fittings and other materials referenced in this section shall conform to the latest edition of the references listed in Paragraph 1.2 of this section.
- B. Unless otherwise indicated or specified, direct buried ductile iron pipe shall be Class 52.
- C. Unless otherwise indicated or specified, ductile iron flanged pipe for vault or above ground service, or for installation in buried vaults, shall be Class 53. Flanges shall be 150 pound and shall be faced and drilled after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and shall be installed flush with the end of the pipe. Exposed piping shall be painted in accordance with Section 09900, and shall not be coal-tar coated.
- D. The manufacturer shall provide sufficient gauged pipe sections to the Contractor in accordance with AWWA C151 to ensure the availability of each pipe diameter required on the project.

2.3 PIPE JOINTS

- A. Direct buried ductile iron pipe shall use push-on-joints conforming to ANSI/AWWA C111/A21.11. Mechanical joints conforming to ANSI/ AWWA C111/A21.11 may also be utilized, where shown on the Drawings or approved by the Engineer.
- B. Where shown on the Drawings, restrained joints shall be used and shall be suitable for a 150 psi working pressure and fabricated of heavy section cast iron casting. Gaskets shall meet the material requirements of ANSI/AWWA A21.11/C111 for mechanical joint gaskets. Bolts and nuts as required shall be low carbon steel conforming to ASTM A307, Grade B. Restrained joints for rubber-type push-on joint pipe shall be Lok-Ring Joint by American Cast Iron Pipe Company, TR FLEX by US Pipe and Foundry Co., Snap-Lok by Griffin Pipe Products Co., Megalug Series 1700 by Ebba Iron, or approved equal.

2.4 FITTINGS

- A. Fittings shall be ductile iron or gray iron. Pipe fittings for below ground service shall be mechanical joint, unless noted otherwise on the Drawings or approved by the Engineer.

Town of Canton WPCA

1. Fittings less than or equal to 12 inches in size shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 and shall have a 350 psi pressure rating.
 2. Fittings greater than 12 inches in size shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 and shall have the following pressure ratings:
 - a. Fittings greater than 12 inches and less than or equal to 24 inches - 350 psi
 - b. Fittings greater than 24 inches - 250 psi
- B. Pipe and fittings, except where specified, shall have a bituminous outside coating in accordance with AWWA C151 and C110 or C153, as applicable.
- C. Sewer Force Main Fittings - Pipe and fittings for sewage or sludge service shall have a bituminous coating inside and outside in accordance with AWWA C151 and C110.
- D. Mechanical joint retainer glands shall be installed on all mechanical joints, except where rodding is used. Retainer glands shall be specifically designed to fit standard mechanical joint bells with corrosion resistant, low-alloy T-head bolts conforming to ANSI/AWWA A21.11/C-111 and ANSI/AWWA A21.53/C-153. Retainer glands shall be manufactured of ductile iron conforming to ASTM A536-80 grade 60-42-10. Set screws shall be of hardened ductile iron and require the same torque in all sizes. Steel set-screws are not permitted. These devices shall have a minimum 250 psi pressure rating with a minimum safety factor of 2:1 and shall be EBAA IRON, Inc., series 1100 or approved equal. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual. Concrete thrust blocks are required to be used in conjunction with retainer glands, as specified in Part 3 of this Section.
- E. Couplings and transitional couplings for pipe less than or equal to 12 inches in diameter shall consist of a long body cast iron sleeve and shall have gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant alloy steel such as Cor-Ten steel or an approved equal. Couplings shall be Romac style 510, Dresser style 153, Rockwell type 441, or approved equal. Transition couplings for pipe less than or equal to 12 inches in diameter shall be Dresser Style 162, Rockwell Type 441 or approved equal.
- F. Couplings and transitional couplings for pipe greater than 12 inches in diameter shall consist of a steel sleeve and with gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant alloy steel such as Cor-Ten steel or an approved equal. Couplings shall be Dresser style 38, or approved equal. Transition couplings for pipe greater than 12 inches in diameter shall be Dresser Style 62, or approved equal.
- G. Couplings shall be provided with an epoxy coating.
- H. Solid sleeves shall have long body type (12 inches min.) and mechanical joints with retainer glands.

- I. Anchoring tees shall have main run ends as indicated on the Drawings or as required for the installation. The branch shall have a plain end with an integral gland and rotating mechanical joint gland to provide a restrained connection with the adjacent valve, fitting, etc.

2.5 GASKETS, GLANDS, NUTS, AND BOLTS

- A. Gaskets, glands, nuts, bolts and accessories shall conform to ANSI/AWWA C111/A21.11 or C153/A21.53, as appropriate.
- B. Gaskets shall be of plain tipped rubber, suitable for exposure to the liquid within the pipe.
- C. Lubricants must be suitable for the type of fluid to be carried by the pipeline, and shall be NSF approved for water service, where applicable.
- D. Glands shall be ductile or cast iron.
- E. Bolts shall be high strength alloy.
- F. Requirements for Flanged Joints:
 1. Gaskets for flanged joints shall be full faced rubber, 1/8 inches thick with cloth insertion. Gaskets shall conform to the dimensions of Table A.1 of ANSI/AWWA C115/A21.15. Ring gaskets shall be utilized for joints 14 inches in diameter and larger.
 2. Flanged joints shall be assembled with bolts and nuts, bolt studs with nut on each end, or studs with nuts in tapped flanges. Bolts and nuts shall be of low carbon steel conforming to the chemical and mechanical requirements of ASTM A307, 60,000 psi tensile strength, Grade B. Bolts, nuts and studs shall be cadmium plated.

2.6 TEST CONNECTIONS

- A. Air release, test connections, and blow off locations shall be installed in the piping for pressure testing and disinfection at locations to be determined by the Contractor and the Engineer (there will be no separate payment for this work).
 1. Corporation cocks shall be in accordance with ANSI/AWWA C800 and shall be $\frac{3}{4}$ inch diameter with CC thread on inlet by iron pipe thread flare on outlet as manufactured by Mueller, Ford, McDonald or approved equal.
 2. Copper tubing shall be annealed Type K soft tubing and shall conform to the requirements of ASTM B88.
 3. Upon completion of testing and disinfection, the corporation cock shall be removed and replaced with a brass plug and the copper tubing removed. The brass plug shall be field swabbed for disinfection in accordance with AWWA C651.

PART 3 EXECUTION

3.1 GENERAL

- A. Deliver, handle, store and install ductile iron pipe in accordance with ANSI/AWWA C600.

3.2 DELIVERY, STORAGE AND HANDLING

A. Delivery of Pipe and Fittings

1. Coordinate delivery of pipe and fittings with installation or unload with proper equipment along the line of work outside the trench near as practicable to the point of final placement, facing in the proper direction and properly wedged secure.
2. Unload and handle pipe and fittings with a crane or backhoe of proper capacity outfitted with a steel cable sling, belt sling or other specially designed attachment to protect the pipe coating.

B. Storage of Materials

1. Store pipe in a manner to keep pipe interior free from dirt and foreign matter. Store pipe on stones, wood blocking, or other hard materials. Pipe may be stored on top of each other to the maximum stacking height specified by AWWA C600.
2. Materials subject to corrosion shall be protected in accordance with manufacturer's recommendations.

C. Handling Materials

1. Handle pipe in such a manner so as to prevent damage to the concrete or mortar coating or lining using methods approved by the pipe manufacturer.
2. Pipe damaged during handling will be rejected and shall be replaced at the Contractor's expense.
3. Take every precaution to ensure that no foreign materials enter the pipe during handling.

3.3 DEFECTIVE PIPE

- A. The WPCA reserves the right to reject defective pipe shipped to the job site or stored on the site. The WPCA's Technical Consultant will examine the pipe and determine if the pipe is damaged prior to installation of the pipe in the trench. Defective pipe or fittings will be rejected for use on this project. Defective pipe is classified as follows:

1. Pipe out of round
2. Damaged pipe barrel area
3. Damaged pipe bells or spigots
4. Missing, misplaced or illegible marking and identification

5. Outside pipe diameter shall not exceed allowable tolerance
- B. If defective pipe is discovered after it has been installed, it shall be removed and replaced by the Contractor with sound pipe.

3.4 JOB CONDITIONS

A. Environmental Requirements

1. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.
2. Equipment for pipe laying shall be maintained in good operating order.
3. Job site shall be kept clean of debris and organized to carry out operations in a safe and satisfactory manner.

B. Protection

1. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug. This provision shall apply during the noon hour and overnight, as well as during delays in the pipe laying operations.

C. Work Affecting Existing Pipelines

1. Location of Existing Pipelines:
 - a. Location of existing pipeline shown on the Drawings shall be considered approximate.
 - b. Contractor is responsible for determining the exact location of existing piping to which he shall make connections, or which he may disturb during earth moving operations, or which may be affected by his work in any way.
2. Work on Existing Pipelines:
 - a. Cut pipes as shown or required with machines specifically designed for this work.
 - b. Install temporary plugs to keep out all mud, dirt, water and debris.
 - c. Provide necessary adapters, fittings, pipe and appurtenances required.
 - d. Cut or tap existing mains at the mid span of a pipe barrel. In no case shall a pipe be cut or tapped within 24 inches of a pipe joint.

3.5 CLEANING PIPE AND FITTINGS

- A. Clean and remove foreign matter from each pipe and fitting before placing in the trench. Remove and replace pipe and fittings whose interior has been contaminated with oil, gasoline or kerosene. Should foreign material or contaminants be observed in previously installed pipe, cease work until foreign material or contaminated pipe is decontaminated or removed.

- B. Remove lumps, blisters, and excess coal-tar coating from the bell and spigot ends of each pipe or fitting. The outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and be dry and free from oil and grease before the pipe or fitting is laid.
- C. On ductile iron pipe or fittings, the bell of the pipe and the spigot of the adjacent pipe or fitting shall be wire-brushed and cleaned of rust and dirt. The bell of the pipe or fitting and the spigot of the adjacent pipe shall be lubricated with the joint lubricant furnished with the pipe, and used in accordance with the manufacturer's directions.

3.6 ALIGNMENT AND GRADE

- A. Lay and maintain the pipe at the required lines and grades as shown on the Drawings and as outlined in Section 02320 (Borrow Materials). Fittings shall be at the required locations with joints centered, and spigots properly fitted. No deviation shall be made from the required line and grade, except with the approval of the WPCA's Technical Consultant.
- B. Joint Openings and Deflection:
 - 1. The maximum allowable joint openings and deflection for push-on joint pipe and restrained joint pipe shall be one-half the manufacturer's maximum allowable opening and deflection.
- C. Line or Grade Conflicts with Other Structures
 - 1. Wherever obstructions not shown on the Drawings are encountered during the progress of the Work and interfere to such an extent that an alteration in the Drawing is required, the Engineer will order a deviation from the line and grade at locations where obstructions such as culverts, ducts, wire and/or pipes are encountered. The pipe shall be laid over or under such obstacles with a clearance of 6 inches. In general, the choice of "over" or "under" will be shown on the Drawings, but the WPCA's Technical Consultant reserves the right to make any alterations at the time of construction.
- D. Where underground conditions indicate a change of alignment or grade, such change shall be made only with the written consent of the WPCA's Technical Consultant.
- E. Except at locations indicated on the Drawings by the profile, particular care shall be exercised so that no high points are established where air can accumulate.

3.7 PIPE INSTALLATION

- A. General Requirements
 - 1. The pipe trench shall be prepared in accordance with Section 02315.
 - 2. Keep trenches dewatered while installing pipe until all required pipe joints have been made and the trench has been backfilled above the water table to a point where pipe uplift will not occur when the pipe is empty.

Town of Canton WPCA

3. Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. Pipe and fittings shall be carefully lowered into the trench piece by piece by means of a crane, ropes or other tools or equipment, in such a manner as to prevent damage to pipeline materials and protective coatings and linings. Under no circumstances shall pipeline materials be dropped or dumped into the trench.
4. Carefully inspect pipe and fittings for cleanliness and defects prior to placing them in the trench.
5. Install underground warning tape over the pipe in accordance with Section 02317.
6. Refer to Section 02318 for requirements associated with the tracer wire pipe location system.

B. Laying Pipe

- a. Install pipe with a minimum of 5 feet of cover, unless specifically indicated otherwise on the Drawings or directed by the WPCA and its Technical Consultant.
 - b. Take every precaution to prevent foreign material from entering the pipe while it is being placed in the line. If the pipelaying crew cannot put the pipe into the trench and in place without getting earth into it, the WPCA's Technical Consultant may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag be placed over each end and left there until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.
2. When laying pipe, the spigot end shall be centered in the bell, the pipe forced home and the joint completely assembled. The pipe shall be adjusted to correct line and grade and secured in place with approved backfill material, properly tamped under and around the pipeline.
 3. When laying the pipe, fittings that do not allow a sufficient and uniform space for joints shall be removed and replaced with pipe or fittings of proper dimensions to ensure a uniform space and a satisfactory joint.

C. Cutting Pipe

1. Pipe furnished on the job shall be furnished in full lengths. Cut ductile iron pipe without damage to the pipe or cement lining. The cutting shall be done to leave a smooth end at right angles to the axis of the pipe.
2. Cut ductile iron pipe either by the use of compression-type chain cutters which exert an even continuous force on the wall of the pipe or by power driven abrasive wheels.
3. On ductile iron pipe using rubber joints, the outside edge of the cut end must be tapered back approximately $\frac{1}{4}$ inch at an angle of about 30 degrees so as to provide for the proper assembly of this joint. This beveling of the outside edge of the end of the pipe can be done with a coarse file or portable grinder.

D. Permissible Deflection at Joints

1. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long-radius curves are permitted, the amount of deflection allowed shall not exceed one-half of the manufacturer's maximum allowable joint deflection, and shall be approved by the WPCA's Technical Consultant.
2. In general, radius curves called for on the Drawings or permitted at the time of construction are to be made using full lengths of pipe. The use of short lengths of pipe and extra joint in order to make a smaller radius turn will not be allowed.

3.8 PUSH-ON JOINTS

- A. Push-on joints shall be made in accordance with the manufacturer's instructions. Insert rubber gasket in the groove of the bell end of the pipe. Install gaskets in the pipe after lowering the pipe into the trench for installation. The bell and spigot shall be thoroughly cleaned of dirt and tar blisters in the trench utilizing a wire brush or bristle brush. Apply lubricant per the manufacturer's recommendations utilizing a paint brush. Place a clean rag under the joint to protect the joint from dirt caused by unintentional grounding of the pipe during jointing. Upon completion, remove the rag. Align the plain end of the pipe to be laid and insert in the bell of the pipe to which it is to be joined, and push home with a jack or by other means. After joining the pipe, use a metal feeler to make certain that the rubber gasket is correctly located.
- B. On water pipe and fittings, make provisions for the electrical continuity of the pipeline. Insert two bronze wedges per joint to provide electrical continuity. Place wedges as close to the 3-o'clock and 9 o'clock positions as possible.

3.9 MECHANICAL JOINTS

- A. Mechanical joints shall be made in accordance with Appendix A of ANSI A21.11/AWWA C111 and the manufacturer's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket before assembly. Tighten bolts to the specified torques. Under no conditions shall extension wrenches or an extended handle ratchet wrench be used to secure greater leverage.

3.10 RESTRAINED JOINTS

- A. Restrained joints shall be installed where shown on the Drawings. The joint assemblies shall be made in accordance with the manufacturer's recommendations.

3.11 CONCRETE THRUST BLOCKS

- A. Place poured-in-place concrete thrust blocks at all bends (regardless of the angle of deflection or direction), caps, offsets, hydrants, and tees, as well as in locations shown on the Drawings or directed by the WPCA's Technical Consultant. Poured-in-place thrust blocks shall be formed with wood forms; rough earth forms are not acceptable. Protect pipeline materials and fittings from direct adherence of the concrete thrust block by wrapping in plastic, roofing felt, reinforced manila paper or similar material. The thrust block shall not bear directly on the joint and shall not interfere with future adjustments, tightening, or removal of the joint. Thrust blocks

Town of Canton WPCA

shall bear against undisturbed soil at the side or end of the trench and this undisturbed surface shall be carefully cleaned off so as to be vertical. The thrust blocks shall have a minimum horizontal thickness of 2 feet and shall have the minimum bearing area listed on the Drawings, measured perpendicular to the direction of thrust.

- B. Concrete thrust blocks shall be used in conjunction with retainer glands at all tees, bends, offsets, hydrants, caps, and plugs.

3.12 TESTING

- A. Pipe, fittings and valves installed under this contract shall be tested in accordance with Section 02503, before being placed into service.

END OF SECTION

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SECTION 02515

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Gravity Pipe and Fittings
 - a. Mainline
 - b. Service Laterals
2. Force Main Sewer Pipe
3. Low Pressure Sewer Pipe
 - a. Mainline
 - b. Service Laterals
4. Piping for Grease Traps
5. Sewer / Water Crossings

B. Related Sections

1. Section 02315 - Excavating, Backfilling and Compaction
2. Section 02317 - Underground Warning Tape
3. Section 02318 - Tracer Wire Pipe Location System
4. Section 02320 - Borrow Material
5. Section 02503 - Testing of Sanitary Sewer Systems
6. Section 02514 - Ductile Iron Pipe and Fittings
7. Section 02530 - Manholes and Structures

C. Related Sewer Construction Details

1. No. 003 - Interior Manhole Chimney
2. No. 009 - Gravity Sanitary Sewer Service Lateral
3. No. 010 - Gravity Sanitary Sewer Service Lateral with Cleanout
4. No. 011 - Low Pressure Sewer Service Connection to Gravity Sewer Service Lateral
5. No. 012 - Cast-In-Place Gravity Sewer Service Chimney
6. No. 013 - Precast Gravity Sewer Service Chimney
7. No. 014 - PVC / Ductile Iron Gravity Sanitary Sewer Main / Service Trench

Town of Canton WPCA

8. No. 015 – PVC (Mainline & Service) Low Pressure Sewer & Ductile Iron Force Main Trench
9. No. 019 – Impervious Trench Interrupters / Dams
10. No. 020 – Low Pressure Sanitary Sewer Service Lateral
11. No. 021 – Sanitary Sewer Force Main Concrete Thrust Blocks for Horizontal Bends
12. No. 022 - Sanitary Sewer Force Main Concrete Thrust Blocks for Vertical Bends
13. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
14. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
15. No. 025 – Low Pressure Sewer Junction Cleanout Structure
16. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
17. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
18. No. 030 – Force Main In-Line Cleanout Structure
19. No. 033 – Grease Trap
20. No. 037 – Force Main Tracer Wire

1.2 REFERENCES

- A. ASTM D2241 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- B. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- C. ASTM D3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
- D. ASTM D2444 - Standard Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- E. ASTM D2412 - Standard Test Method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading.
- F. ASTM D3139 - Standard Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- G. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- H. ASTM F679 - Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- I. ASTM D1869 - Standard Specification for Rubber Rings for Asbestos-Cement Pipe.
- J. AWWA A21 - Ductile Iron Pipe and Fittings.

Town of Canton WPCA

- K. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., For Water Distribution.

1.3 SUBMITTALS

- A. Submit specifications and shop drawings for materials and equipment furnished under this Section.
- B. Prior to first shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM Standards specified herein.

1.4 QUALITY ASSURANCE

- A. Each type of PVC pipe and fittings shall be from a single manufacturer.
- B. Inspection of the pipe will also be made by the WPCA's Technical Consultant after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job site.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Gravity Sewer Mainline Pipe
 - 1. Polyvinyl chloride (PVC) pipe shall be of the size indicated on the Drawings or as specified and shall conform to the latest revision of ASTM D3034, Type SDR 35 for diameters less than or equal to 15-inch diameter and ASTM F679 for pipe greater than 15-inch diameter. Standard laying lengths shall not exceed 13.0 feet for main line pipe.
 - 2. Joints shall be elastomeric gasket joints and shall provide a watertight seal. Assembly of joints shall be in accordance with ASTM 3212.
 - 3. The minimum "pipe stiffness" (load divided by change in inside diameter in direction of load application) at 5% deflection shall be at least 46 psi for pipe tested in accordance with ASTM D2412.
 - 4. No shattering or splitting shall be evident when 150 ft.-lbs. and 210 ft.-lbs. is impacted on 4-inch and 6-inch diameter pipe, respectively, in accordance with ASTM Method of Test D2444.
 - 5. Mainline pipe stubs shall be installed to the limits of right-of-way or sanitary sewer easements.
 - 6. Pipe lengths and fittings to be used on the project shall be clearly marked on the outside in bold type with the name of the manufacturer, pipe size, pipe material, pipe class, and ASTM designation.
- B. Gravity Sewer Service Laterals
 - a. Gravity pipe house connections, wyes, and tees are to be laid in the run of the sewer line. The wyes and tees shall be the same material as the main line and shall conform in material, joints, and class with the line into which they are to be laid.

Town of Canton WPCA

- b. Eighth and sixteenth bends and end plugs are to be of the same material and class or strength designation as the pipe for the house connection.
- c. Unless noted on the Drawings, house service piping shall be 6-inch diameter and shall be of the same material as the main line PVC pipe.
2. Joints shall be elastomeric gasket joints and shall provide a watertight seal. Assembly of joints shall be in accordance with ASTM 3212.
3. The minimum "pipe stiffness" (load divided by change in inside diameter in direction of load application) at 5% deflection shall be at least 46 psi for pipe tested in accordance with ASTM D2412.
4. No shattering or splitting shall be evident when 150 ft.-lbs. and 210 ft.-lbs. is impacted on 4-inch and 6-inch diameter pipe, respectively, in accordance with ASTM Method of Test D2444.
5. Service lateral pipe stubs shall be installed to the limits of right-of-way or sanitary sewer easements.
6. Pipe lengths and fittings to be used on the project shall be clearly marked on the outside in bold type with the name of the manufacturer, pipe size, pipe material, pipe class, and ASTM designation.
7. If connecting to an existing main, test pits are required to verify type and size of mainline pipe. The WPCA's Technical Consultant will dictate the type of connection to be used by the Contractor.
8. Services to be laid at 2% minimum slope unless directed otherwise by the WPCA or its Technical Consultant.
9. The Contractor shall use ductile iron by PVC transition couplings when transitioning from ductile iron mainline pipe to PVC sewer service laterals.
10. Use plastic mechanical gripper plus at all cleanouts on sanitary sewer laterals.
11. Cleanouts shall be installed every 100-feet, and shall be 3" below grade with cast iron curb boxes in accordance with Section 02518. Cleanouts shall incorporate the use of wyes only. Tees are not acceptable. Use cleanouts only in those locations as directed by the WPCA's Technical Consultant. 4" cleanout adapters and plastic mechanical gripper plugs shall be installed inside the 26" high top flange valve box top and cover reading "SEWER".
12. 4" x 4" pressure treated wood marker posts shall be used at the end of service stubs. Marker posts shall be left 6" below grade unless otherwise directed by the WPCA or its Technical Consultant.
13. Plug the bell end of a PVC pipe section at the end of sewer service lateral stubs for future connection.
14. Gravity Sewer Lateral Chimneys
 - a. General
 - 1) Pipe and fittings shall be 6-inch diameter and be of the same material as the main line PVC pipe.

Town of Canton WPCA

- b. Cast-In-Place Type
 - 1) Used only in those locations approved by the WPCA or its Technical Consultant.
 - 2) To be installed in a minimum of two pours; concrete arch first, then the vertical y-branch.
 - 3) Refer to Sewer Construction Detail No. 012 – Cast-In-Place Gravity Sewer Service Chimney.
 - 4) Refer to Section 03310 for cast-in-place concrete requirements.
- c. Precast Type
 - 1) Precast sewer service chimneys can be used upon approval by the WPCA's Technical Consultant, in lieu of poured-in-place chimney installations.
 - 2) Consisting of arch base, riser(s) and cap section sections, each bolted together with neoprene gaskets in between.
 - 3) SDR 35 to be cast into the cap section for connection to the vertical PVC SDR 35 pipe nipple and service connection.
 - 4) Shall be Arrow Concrete Products, Precast Chimney unit, or equal.

C. Force Main Pressure Pipe

- 1. Polyvinyl chloride (PVC) pressure pipe shall be of the size indicated on the Drawings and shall conform to the requirements of the AWWA C900 Standards for PVC C900 DR 18 Pressure Pipe for Water with cast iron pipe equivalent outside diameters. Joints shall use elastomeric gaskets and be in accordance with ASTM D3139. Gaskets shall conform to ASTM F477.
- 2. The standard laying length shall not exceed 20 feet. The minimum "pipe stiffness" (load divided by change in inside diameter in direction of load application) at 5% deflection shall be at least 46 psi for pipe tested in accordance with ASTM Specifications D2412.
- 3. Bends shall be constructed of ductile iron in accordance with AWWA A21.10 and A21.53, with mechanical joint ends.
- 4. Pipe and fittings shall be clearly marked on the outside indicating the name of the manufacturer, nominal diameter, and the ASTM or AWWA designation or both for the DR18 Polyvinyl Chloride Pressure Pipe.
- 5. Poured-in-place concrete thrust blocks bearing against undisturbed soil shall be placed behind all bends, tees, end caps, and offsets.

D. Low Pressure Sewer Pipe

- 1. Mainline Pipe
 - a. Polyvinyl Chloride (PVC) pipe for low pressure sewers shall be of the same size indicated on the Drawings and shall be PVC, Type 1120,

Town of Canton WPCA

ASTM 2241, Class 200 (SDR-21). Joints shall use elastomeric gaskets conforming to ASTM D1869. Connections to tees, brass fittings and end caps shall be made using solvent welded joints.

- b. The standard laying length shall not exceed 20 feet. Pipe and fittings shall be clearly marked on the outside indicating the name of the manufacturer, ASTM designation and the nominal diameter.
- c. The minimum diameter of low pressure sewer pipe shall be 1 ½”.

2. House Connections and Valves

- a. Low pressure sewer connections from each sewage grinder pump station shall be PVC, Type 1120, ASTM D2241, Class 200 (SDR-21). Joints shall use elastomeric gaskets conforming to ASTM D1869. The piping shall be connected to the 1 ¼ -inch pump station discharge fitting using a 1 ¼ -inch to 1½ -inch increaser.
- b. The standard laying length shall not exceed 20 feet. Pipe and fittings shall be clearly marked on the outside indicating the name of the manufacturer, ASTM designation and the nominal diameter.
- c. Valves to be located approximately 1 to 3 feet into the limits of the right-of-way or sewer easement. Not on private property.
- d. Pressure treated wood 4” x 4” posts shall be used as end-of-service markers.
- e. Install a 8” x 8” x 16” precast concrete block at the backside of the mainline tee.
- f. Install a 4” x 8” x 16” precast concrete block beneath the curb stop and check valve assembly.
- g. Install a 4” x 8” x 16” precast block at the end of the service until mainline testing is complete
- h. Service connections to the low-pressure sewer shall use tees. Tees shall be of the same class and size as the mainline pipe for the location to be installed and shall have a branch of 1½ -inch in size. Use elastomeric joints. An end cap, suitable for withstanding line test pressure shall be supplied and installed.
- i. Curb stops shall be threaded bronze ball valves and shall open left. Curb stops shall not be stop/waste-type. Valves shall be Red Head Model B2230, Mueller, Ford or approved equal.
- j. Each curb stop shall be provided with its own extension type cast iron 3-inch road box and lid assembly. The lid shall have the word “sewer” imprinted on it. Box extensions for deep installations shall also be provided as required. A total of four (4) tee handle wrench operators suitable to operate the curb stops installed shall be provided.
- k. Each service connection shall have a check valve installed on the upstream side of the curb stop. The check valve shall have a PVC

Town of Canton WPCA

body, an internal flapper type suitable for direct burial and threaded connections.

E. Plastic Piping for Grease Traps

1. Plastic piping shall be Schedule 80 PVC for use in conjunction with grease traps.

2.2 SEWER / WATER CROSSINGS

- A. Maintain at least 10-foot horizontal separation and 18" vertical separation.
- B. At water crossings, use Class 52 ductile iron pipe in accordance with Section 02514.
- C. Use solid sleeve couplings and center a full length of DI pipe at the water main crossing.

PART 3 EXECUTION

3.1 HANDLING PIPE AND FITTINGS

- A. Install a 6" thick minimum layer of ¾" crushed stone pipe bedding.
- B. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe. Pipe or fittings shall not be dropped. Examine pipe and fittings before installing, and no piece shall be installed that is found to be defective.
- C. If any defective pipe is discovered after it has been installed, remove and replace it with a sound pipe in a satisfactory manner. Thoroughly clean pipe and fittings before installing, keep clean until they are used in the work, and conform to the lines, grades and dimensions required when installed.
- D. Pipe ends requiring cutting shall be cut square without damage to the remaining pipe. Bevel cut pipe ends 1/8-inch at approximately 30 degrees to provide proper assembly of the joint. Beveling can be done with a coarse file or portable grinder.
- E. Support stored pipe from below at not more than 3-foot intervals to prevent deformation. Do not stack pipe higher than 6 feet. Store pipe and fittings in a manner that will keep them at ambient outdoor temperatures. Provide temporary shading as required to meet this requirement. Simply covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

3.2 INSTALLATION

- A. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16 inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
- B. Install piping and fittings true to alignment and grade. If necessary, each length of pipe shall be cleaned out before installation.
- C. Excavation, trenching and backfilling procedures shall be in accordance with Section 02315.

Town of Canton WPCA

- D. The Contractor shall maintain a five foot minimum depth of cover for gravity sewer pipes. If the WPCA allows shallower installation, the gravity sewer shall be concrete encased.
- E. All sections of PVC sewer pipe shall be air and deflection tested in accordance with Section 02503.
- F. Crushed stone bedding for the pipe shall be in accordance with Section 02320.
- G. Install PVC pipe on a bed of crushed stone with a minimum depth of 6 inches. The crushed stone shall completely encase the pipe and cover the pipe to a grade 6 inches over the top of the pipe to a minimum width of 12 inches on each side of the pipe. Bell holes shall be made in a dense graded stone such that the pipe shall be uniformly supported throughout the entire length of the barrel section.
- H. Deflections in Pipe Alignment.
 - 1. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory making of the joint, and shall be approved by the WPCA's Technical Consultant.
 - 2. Prior to deflecting the pipeline, the spigot of the pipeline should be marked flush with the bell end to assure that the spigot is not withdrawn excessively as the result of the deflection. After the pipe is deflected, an adequate depth of jointing material must remain on the side where the spigot is away from home and an adequate width of caulking space must remain on the opposite side of the pipe at the face of the bell.
 - 3. The maximum deflection recommended by the manufacturer when using any pipe system must be observed when deflecting a pipeline.
 - 4. The maximum pipe deflection to be $\frac{1}{2}$ the maximum allowable deflection as stated the pipe manufacturer.
 - 5. In general, all radius curves called for on the Drawings or permitted at the time of construction are to be made using full lengths of pipe. The use of short lengths of pipe and extra joint in order to make a smaller radius turn will not be allowed without the written approval of the WPCA's Technical Consultant.
- I. Unsuitable Laying Conditions
 - 1. No pipe is to be laid in water, in an unsuitable trench or during unsuitable weather conditions.

END OF SECTION

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SECTION 02518

VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Buried Gate Valves
2. Hand-Wheel Operated Gate Valves
3. Sewage Combination Valves
4. Valve Boxes
5. Yard Hydrants

B. Related Sections

1. Section 02514 – Ductile Iron (DI) Pipe and Fittings
2. Section 11306 – Pumping System Components

C. Related Sewer Construction Details

1. No. 010 – Gravity Sanitary Sewer Service Lateral with Cleanout
2. No. 011 – Low Pressure Sewer Service Connection to Gravity Sewer Service Lateral
3. No. 020 – Low Pressure Sanitary Sewer Service Lateral
4. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
5. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
6. No. 025 – Low Pressure Sewer Junction Cleanout Structure
7. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
8. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
9. No. 030 – Force Main In-Line Cleanout Structure

1.2 REFERENCES

- A. AWWA C-111 Standard for Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
- B. AWWA C-509 Resilient-Seated Gate Valves for Water Supply Services.

1.3 SUBMITTALS

- A. Complete Shop drawings of all valves and hydrants shall be submitted to the WPCA's Technical Consultant for review.

1.4 QUALIFICATIONS

- A. All valves and hydrants shall be products of well-established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible, all equipment of the same type shall be from one manufacturer.
2. All valves and appurtenances shall have the name of the manufacturer, flow directional arrows, and the working pressure for which they are designed cast in raised letter upon some appropriate part of the body.
3. All buried valves shall open left (counter clockwise).

2.2 GATE VALVES

- A. All gate valves shall be rated for 150 psi operating pressure and shall conform to AWWA C-509, for Resilient Seated Gate Valves. The sealing wedge shall be ductile iron, fully encapsulated in synthetic rubber, except for the guide and wedge nut areas; which rubber shall be molded and bonded in place without the use of mechanical fasteners, screws, etc. The seating surface shall be specially designed so as to provide a smooth waterway, without depressions or cavities, which might trap debris and interfere with tight closures. Stem shall be sealed with double, O-rings which can be changed under full pressure, with the gate valve open. Valve body and bonnet shall be coated, inside and outside, with fusion-bonded epoxy coating conforming to AWWA C-550.
- B. All gate valves shall be set vertically, nut-operated, opening to the left (counter clockwise), non-rising stem and suitable for direct burial with "O" ring stem seals.
- C. All gate valves shall have Mechanical joint ends complying with ANSI/AWWA C111/A21.11-85 and retainer-type glands.
- D. Gate valves shall be as manufactured by U.S. Pipe (A.P. Smith), Mueller, American Darling, or approved equal.

2.3 SEWAGE COMBINATION VALVES

- A. Sewage combination valves shall be furnished and installed at the locations shown on the plans.

Town of Canton WPCA

- B. Shall automatically function to release large amounts of air found in pipelines during filling, and to allow air to enter the pipeline in the event it is drained. Upon completion of each, the valve shall automatically re-seat tightly.
- C. The compound lever allows air in and out, depending on conditions.
- D. Single body construction.
- E. Valve shall have a cast iron body, stainless steel float, rubber-viton seat, and composition cover gasket. Float, stem, and plug to be stainless steel.
- F. The overall height and width of the valve, complete with backflush assembly, shall be no more than 26-inches and 12-inches, respectively.
- G. The standard screwed end shall be provided at the inlet.
- H. The backflush assembly shall include a 5-foot fabric-reinforced nitrile hose, bronze shut-off valves, and galvanized quick connects. Inlet and outlet shutoff valves to also be provided.
- I. Acceptable manufacturers include:
 - 1. Golden-Anderson (Model 2SAV).
 - 2. Flomatic Corporation (Universal Sewer Valve – Sewair Combo – Model 6650).
 - 3. APCO Valve & Primer Corporation (Model 443).
 - 4. Crispin (Universal Sewer Valve –Model US3621)
 - 5. Val-Matic (Wastewater Combination Air Valve – Model 801ABW)
- J. There shall be no spilling or spurting at pressures equal to or less than 20 psi.
- K. Exterior to be painted with universal metal primer.
- L. Sewage combination valves to be installed in the air release structures, along with inlet and blow-off valves with a single body and double orifice. The inlet shall be 2" NPT and the outlet and blow off connections shall be 1" NPT. The small orifice shall be 7/32" in diameter and rated for a maximum working pressure of 150 psi.
- M. Provide an interior epoxy coating for corrosion protection for sewage installations.

2.4 VALVE BOXES

- A. Each buried valve shall be accompanied by a valve box of the adjustable type of heavy pattern, constructed of cast iron and provided with a 6" cast iron cover.
- B. Valve boxes shall be round, 2-piece, sliding type. The upper section of each box shall have a flange on top having sufficient bearing area to prevent settling. The bottom of the lower section shall be belled to enclose the operating nut of the valve. The barrel shall be 5½" O.D. minimum. Boxes shall be of lengths consistent with pipe depths. Boxes shall be adjustable, with a lap of at least 6" when in the most extended position. Covers shall be slotted for easy removal. Covers for valve boxes on water mains shall have the word "SEWER" cast in the top and weigh at least 13 pounds. Valve boxes shall be coated with coal-tar pitch enamel or other approved coating. Valve boxes shall be suitable for the size valve on which they are

Town of Canton WPCA

used and shall weigh at least 110 pounds with cover. The upper sections shall be 26" and weigh at least 65 pounds. The length of the lower section shall be adequate for trench adjustment, no top or mid-section adapters.

- C. Valve boxes shall be North American made by Buffalo Type Curb Box 95-E, or The Tyler Corporation (Series 6855), Bibby Laperle, or approved equal.

2.5 YARD HYDRANTS

- A. Yard hydrants shall be 2 inch compression type, non-freezing hydrants fitted with 2 inch I.P.S. bottom inlet, 1-1/2 inch hose connection, 4-1/2 foot bury depth, hand wheel operated.
- B. Yard hydrants shall be 2 inch compression type, non-freezing hydrants fitted with 1-1/2 inch I.P.S. bottom inlet, 3/4 inch hose connection, 5-1/2 foot bury depth, lever-operated.
- C. Acceptable manufacturers are Simmons, Mifab, Boshart Industries, Woodford, Murdock, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Valves and hydrants, either existing or new, will be operated only by WPCF staff.

3.2 INSPECTION AND TESTING

- A. Valves shall be inspected and tested in conjunction with the pipelines in which they are installed in accordance with Section 02503 regarding testing to the extent reasonably possible.

3.3 YARD HYDRANTS

- A. Install hydrants with a precast thrust block behind it surrounded with gravel. Provide a pocket of crushed stone (minimum 5 cubic feet) shall be placed around the base of the hydrant.
- B. Furnish any and all adapters, unions, tees, and reducers, required for each hydrant connection.
- C. Smear all threaded portions of joints with mastic.
- D. Provide 18 inch by 18 inch by 3 inch concrete splash pads at each yard hydrant outlet location.

END OF SECTION

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SECTION 02530

PRECAST MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Precast concrete manholes for gravity sewer mains
2. Precast concrete structures used in conjunction with low pressure sewers
3. Precast concrete structures used in conjunction with force mains
4. Standard cast iron manhole frames and covers
5. Watertight cast iron manhole frames and covers
6. Flat slab manhole tops
7. Dog-house manhole base sections
8. Interior manhole chimneys
 - a. Cast-in-place type
 - b. Pre-cast type
9. Exterior damp-proofing
10. Protective interior PVC manhole liner
11. Grease Traps
12. Oil/Water Separators

B. Related Sections

1. Section 02315 – Excavation, Backfill, and Compaction
2. Section 02320 – Borrow Materials
3. Section 02503 – Testing of Sanitary Sewer Systems
4. Section 02514 – Ductile Iron (DI) Pipe and Fittings
5. Section 02515 – Polyvinyl Chloride (PVC) Pipe and Fittings
6. Section 02518 – Valves
7. Division 15 - Mechanical

C. Related Sewer Construction Details

1. No. 001 – Standard 48-Inch Precast Concrete Sanitary Sewer Manhole
2. No. 002 – Standard 60-Inch Precast Concrete Sanitary Sewer Manhole
3. No. 003 – Interior Manhole Chimney

Town of Canton WPCA

4. No. 004 – “Dog House” Manhole Base
5. No. 005 – Guidelines for Construction of Standard Manhole Inverts
6. No. 006 – Standard Manhole Frame and Cover
7. No. 007 – Watertight Manhole Frame and Cover
8. No. 013 – Precast Gravity Sewer Service Chimney
9. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
10. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
11. No. 025 – Low Pressure Sewer Junction Cleanout Structure
12. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
13. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
14. No. 030 – Force Main In-Line Cleanout Structure
15. No. 033 – Grease Trap
16. No. 034 – Gasoline and Sand Trap

1.2 REFERENCES

- A. ASTM C32 - Standard Specification for Sewer and Manhole Brick (made from clay or shale).
- B. ASTM A48 – Standard Specification for Gray Iron Castings.
- C. ASTM C150 – Standard Specification for Portland Cement.
- D. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
- E. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
- F. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Piping Using Rubber Gaskets.
- G. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- H. ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.3 SUBMITTALS

- A. Submit shop drawings, showing details of construction, reinforcing, joints, pipe connections to structures, manhole rungs, manhole frames and covers and interior manhole chimneys.
- B. Submit weights of manhole frames and covers.

1.4 QUALITY ASSURANCE

- A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the WPCA and its Technical Consultant. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places, and the materials shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. Materials that have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced.
- B. At the time of inspection, the materials will be carefully examined for compliance with the latest ASTM designation specified and these Specifications, and with the approved manufacturer's drawings. Manhole sections shall be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections in manhole sections may be repaired, subject to the approval of the WPCA's Technical Consultant, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the WPCA's Technical Consultant.
- D. Personnel shall have confined space entry training for the work to be performed.
- E. For structures placed within the limits of the 100-year floodplain, use watertight frames and covers.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE MANHOLES AND STRUCTURES

- A. Miscellaneous
 - 1. This section shall apply to gravity sewer manholes, structures used in conjunction with low pressure sewers, structures used in conjunction with force mains, grease traps, oil/water separators, flat slab top manholes, and "dog house" manhole base sections.
 - 2. All low pressure sewer and force main structures shall have a 12" diameter by 4" deep sump, centered beneath the manhole opening.
 - 3. Grease traps shall meet the requirements of the State of Connecticut Draft General Permit for the Discharge of Wastewater Associated with Food Preparation Establishments, as well as the requirements of the Farmington Valley Health District requirements. Installation shall include proper trapping and venting as outlined in Division 15.
 - 4. Oil/water separators shall also be properly vented, meeting the requirements of the Division 15 specifications.

Town of Canton WPCA

5. Flat slab manhole tops and “dog house” manhole base sections shall only be used when authorized by the WPCA or its Technical Consultant.
6. Cast-in-place concrete manholes are not acceptable.

2.2 PRECAST CONCRETE MANHOLE SECTIONS

- A. Precast concrete barrel sections and transition top sections, shall conform to Specifications for Precast Reinforced Concrete Manhole Sections, ASTM C478 and meet the following requirements:
 1. The wall thickness shall not be less than 5 inches for 48-inch diameter reinforced barrel sections, 6 inches for 60-inch diameter reinforced barrel sections and 7 inches for 72-inch diameter reinforced barrel sections.
 2. Top sections shall be eccentric (with 3-foot top opening dimension) except that flat top sections shall be used where shallow cover requires a top section less than 4 feet as shown on the Drawings.
 3. Barrel sections shall have tongue and groove joints.
 4. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.
 5. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of H-20 loading plus the weight of the soil above at 120 pcf.
 6. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on each precast section.
 7. Precast concrete bases shall be monolithically constructed. The thickness of the bottom slab of the precast bases shall not be less than the barrel sections or top slab whichever is greater. Precast concrete bases shall be constructed with a minimum 6-inch extended base.
 8. Pre-formed cored opening knock out panels for piping shall be provided in precast sections at the locations shown on the Drawings. They shall be integrally cast with the section, 2½ inches thick and shall be sized as shown on the Drawings. There shall be no steel reinforcing in knock out panels.
 9. The side wall height of the base section shall be a minimum of 12 inches above the top of the pipe coming into the manholes.

2.3 BRICK MASONRY

- A. Bricks shall be good, sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture. Underburned or salmon brick will not be acceptable and only whole brick shall be used unless otherwise permitted. In case bricks are rejected by WPCA’s Technical Consultant, they shall be immediately removed from the site of the work and satisfactory bricks substituted therefore.
 1. Bricks for the channels and shelves shall comply with the latest specifications of ASTM C32 for Sewer Brick, Grade SM.

2. Bricks for building up and leveling manhole frames shall conform to ASTM C32 Grade MS.
 3. Poured concrete inverts will not be allowed.
- B. Mortar used in the brickwork shall be composed of one part Type II portland cement conforming to ASTM C150 to two parts sand to which a small amount of hydrated lime not to exceed 10 lbs. to each bag of cement shall be added.
- C. Sand used shall be washed, cleaned, screened, sharp and well graded as to different sizes and with no grain larger than will pass a No. 4 sieve. It shall be free from vegetable matter, loam, organic or other materials of such nature or of such quantity as to render it unsatisfactory.
- D. Hydrated lime shall conform to ASTM C207.

2.4 JOINTING PRECAST MANHOLE SECTIONS

- A. Tongue and groove joints of precast manhole sections shall be sealed with a preformed flexible joint sealant. The preformed flexible joint sealant shall conform to ASTM C990.

2.5 MANHOLE RUNGS

- A. Manhole rungs shall be steel reinforced, copolymer, polypropylene plastic, drop front design, 14 inches wide with an abrasive step surface.
- B. Aluminum manhole rungs are not acceptable.
- C. Manhole rungs shall conform to OSHA requirements.
- D. Typical vertical spacing shall be 12" on center.
- E. The lowest step shall be 18" above the shelf.
- F. The top step shall be a maximum of 20" below the top of the frame and cover.

2.6 PIPE CONNECTIONS

- A. Pipe connections shall be accomplished in the following ways:
1. For all pipe types except PVC, fill tapered hole around pipe with non-shrink waterproof grout, such as Hallemite, Waterplug, Embeco, or equal, after the pipe has been set into the structure.
 2. For PVC pipe connections, a flexible pipe-to-structure connector shall be used.
 - a. The flexible connectors shall be designed to provide a positive seal between the connector and the structure wall and between the connector and the pipe.
 - b. The flexible boot shall be manufactured of EPDM synthetic rubber in accordance with ASTM C443 and C923 and shall be 3/8 inch thick or greater.
 - c. The external bands shall be made entirely of 304 series non-magnetic stainless steel.

Town of Canton WPCA

- d. The flexible connectors shall be provided with a wedge-type or toggle-type expander to secure the pipe in the structure opening.
- e. The flexible connectors shall meet the following criteria, in accordance with ASTM C923:
 - 1) Shall not leak when subjected to a head pressure of 10 psi for 10 minutes.
 - 2) Shall have the ability to deflect 7 degrees in any direction without leakage under the head pressure conditions described above.
 - 3) Shall not leak when subject to a load of 150 lbs./in. pipe diameter and the head pressure conditions described above.

2.7 STANDARD MANHOLE FRAMES AND COVERS

- A. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended.
- B. Manhole covers and frame seats shall be machined to a true surface.
- C. Castings shall be thoroughly cleaned and subject to hammer inspection.
- D. Cast iron shall conform to ASTM A48, Class 30B.
- E. Standard manhole frames and covers shall be Metropolitan District Commission (MDC) type, with a cover weight of not less than 160 pounds, and a frame weight of not less than 460 pounds.
- F. Standard manhole frames and covers shall be non-vented.
- G. LeBaron Foundry, Inc. Model #LJ105, Campbell Foundry Co. Pattern No. 1221 5012, Neenah Foundry Company Model R-1697, or equal.
- H. Before shipment from the foundry, castings shall be given one coat of coal tar pitch varnish, which shall present a casting that is smooth and tough, but not brittle.
- I. Manhole covers shall read the word "SEWER".

2.8 WATERTIGHT MANHOLE FRAMES AND COVERS

- A. Watertight manhole frames and covers shall be used only where directed by the WPCA or its Technical Consultant.
- B. Units shall be Metropolitan District Commission (MDC) watertight manhole frames and covers.
- C. LeBaron Foundry, Inc. Catalog No. LJ113 shall be used for frame and cover, with Model LJ114 used as the inset.
- D. Bolted and gasketed type watertight frames and covers will not be accepted.

2.9 INTERIOR MANHOLE CHIMNEYS

- A. For interior chimneys less involving pipe less than or equal to 12" diameter, use 60" manholes. For pipe greater than 12" diameter, use 72" diameter manholes. For manholes with two interior chimneys of 12" diameter or less, use a 72" diameter manhole.
- B. Interior manhole drops shall utilize Inside Drop System by Reliner/Duran, Inc. Secure with stainless steel fasteners.
- C. Riser pipe and fittings shall be the same type and diameter as the mainline pipe. For installations where the mainline pipe is less than 6" diameter, use 6" minimum pipe size.
- D. Exterior manhole chimneys shall not be permitted under any conditions.
- E. Manhole chimneys shall be inside type, constructed in only those locations approved by the WPCA's Technical Consultant.
- F. Pipe straps for interior manhole chimneys shall be constructed of ¼" by 1.25" aluminum alloy 6061-T6. Anchor bolts shall be 3/8" stainless steel. A minimum of 2 anchor bolts shall be provided for each strap, with a minimum of two straps per drop, or spaced no further apart than 2-feet on center.

2.10 EXTERIOR DAMP-PROOFING

- A. All manholes and below grade structures shall received exterior damp-proofing.
- B. Damp-proofing coating shall be an asphalt compound specially made to adhere to below grade concrete structures.
- C. The damp-proofing shall be Hydrocide 648 by Sonneborn Building Products, Dehydratine 4 by Tamms Industries, RIW Marine Liquid by Toch Brothers, or approved equal.

2.11 PROTECTIVE INTERIOR PVC MANHOLE LINER

- A. The interior of all precast concrete gravity sewer manholes shall be fitted with a plant installed embedded PVC liner for protection against hydrogen sulfide and corrosion attacks.
- B. Liner panels shall be a 0.065-inch minimum and a combination of standing ribs and mechanical dovetails shall be used to secure the liner panels to the wall of the structure. Liner panels shall be formed to the correct radius to assure a true diameter match between joined sections; additionally, a minimum return of 0.50 inches into the joint shall afford protection between precast sections when assembled.
- C. The plant installed PVC protective liner shall be Dura Plate 100 as manufactured by A-Lok Products Inc., Tullytown, Pennsylvania, or approved equal.
- D. Visual inspection of the liner shall be made after demolding and any cuts or tears shall be repaired prior to shipping. The concrete producer shall take all necessary precautions to prevent damage due to casting, demolding, and delivery.
- E. After the structure is assembled in place, care shall be given to properly plug all lift pin holes with non-shrink grout.

- F. Pipe penetrations through the lined wall shall receive a minimum 0.125 inches of cementitious epoxy corrosion resistant mortar. The mortar shall be hand applied to all unlined exposed areas within the openings and shall overlap the liner wall a minimum of 1.50 inches. The cementitious epoxy mortar material shall be Sikadur 45 EpoCem, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation

1. Place all manholes and structures on a minimum 6” thick layer of crushed stone bedding.
2. Manholes shall be constructed to the dimensions shown on the Drawings and as specified in these Specifications. All work shall be protected against flooding and flotation.
3. Precast concrete barrel sections shall be set so as to be vertical and with sections in true alignment with a ¼-inch maximum tolerance to be allowed. The joints of precast concrete barrel sections shall be sealed with the preformed flexible joint sealant used in sufficient quantity to fill 75% of the joint cavity. The outside and inside joint shall be filled with non-shrink mortar and finished flush with the adjoining surfaces. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. The precast sections shall be installed in a manner that will result in a watertight joint.
4. Holes in the concrete barrel sections required for handling or other purposes shall be plugged with a non-shrink grout or non-shrink grout in combination with concrete or rubber plugs, and finished flush on the inside.

B. Pipe Connections

1. General
 - a. Pipe stubs for future extensions shall be connected to the structures as shown on the drawings and the stub end closed by a suitable watertight plug.
2. Flexible Pipe-to-Structure Connectors
 - a. The flexible pipe-to-structure connectors shall be used for PVC pipe.
 - b. The flexible connectors shall be installed in accordance with the manufacturer’s recommendations.
3. Miscellaneous
 - a. Half pipe lengths shall be installed on each side of manhole or structure.
 - b. The minimum invert drop across each gravity sewer manhole shall be 0.1 feet for similar sized pipes. For different sized pipes, install pipes crown to crown.
4. Grouting

Town of Canton WPCA

- a. All pipe types except PVC shall be grouted into place in the existing structure using non-shrink, water-proof grout.
- b. Rubber plugs shall be used at all lifting holes.
- c. The inside and outside faces of the structures shall be grouted at all joints.
- d. After the new pipe has been set in place, completely fill the hole around the new pipe with non-shrink, water-proof grout.
- e. In addition, place a 6-inch thick concrete encasement a total of 12 inches in length around the pipe stub adjacent to the wall of the structure. Concrete shall have a 28-day compressive strength of 3,000 psi.

C. Manhole Rung Installation

1. Steel reinforced copolymer polypropylene plastic steps shall be press fitted by hand driven hammer into preformed holes in cured precast sections, on 12-inch centers, by the manufacturer that casts the precast sections.

D. Brickwork

1. Mortar shall be mixed only in such quantity as may be required for immediate use and shall be used before the initial set has taken place. Mortar shall not be retained for more than one and one-half hours and shall be constantly worked over with a hoe or shovel until used. Anti-freeze mixtures will not be allowed in the mortar. No masonry shall be laid when the outside temperature is below 40°F unless provisions are made to protect the mortar, bricks, and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material. The final decision as to the adequacy of protection against freezing shall be made by the WPCA's Technical Consultant.
2. Channels and shelves shall be constructed of brick as shown on the Drawings. The brick channels shall be constructed to a height of $\frac{2}{3}$ the diameter of the pipe. The top of the shelf shall be set at the elevation of the crown of the highest pipe and shall be sloped 1-inch per foot to drain toward the flow through channel. Brick surfaces exposed to sewage flow shall be constructed with the nominal 2-inch x 8-inch face exposed (i.e., bricks on edge).
3. The manhole floor shall be 4" below the pipe invert to allow construction of the brick manhole invert.

Town of Canton WPCA

4. Manhole covers and frames and catchbasin frames and grates shall be set in a full mortar bed and red sewer bricks, a maximum of 12 inches thick for conical tops and 6 inches thick for flat top sections, and shall be utilized to assure frame and cover are set to the existing grade. The manhole frames and covers and catchbasin frames and grates shall be reset to final grade prior to placement of final paving. The outside of the frame shall also be fully grouted to prevent leakage into the manhole.
5. In easements, the final grade of the frame and cover shall be left approximately 6 to 12 inches above finish grade.

E. Damp-proofing

1. Outer surfaces of precast manholes shall be given two coats of bituminous dampproofing at the rate of 30-60 sq. ft. per gallon in accordance with manufacturer's instructions.
2. Where shown on the plans, the interior of manholes shall be given similar protective coatings.

3.2 LEAKAGE TEST

- A. Sewer manholes shall be leak tested in conjunction with the pipeline in accordance with Section 02503

3.3 CLEANING

- A. New manholes shall be thoroughly cleaned of silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

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SECTION 02534

SANITARY SEWER SERVICE RECONNECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Connecting new sanitary sewer service pipe to existing sanitary sewer service pipe.
 - 2. Investigation work required to locate the existing sewer services.
- B. Related Sections
 - 1. Section 02210 – Subsurface Investigation
 - 2. Section 02315 – Excavation, Backfilling and Compaction
 - 3. Section 02515 - Polyvinyl Chloride (PVC) Pipe and Fittings
 - 4. Section 02958 – Television Inspection of Pipelines

1.2 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials furnished under this section.
- B. Submit the pipe repair methods proposed.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Straight pipe, adapters and fittings are to be of a type and class equivalent to the lateral pipe. Pipe materials shall conform to Section 02515.
- B. Couplings and transitional couplings shall consist of a steel sleeve with gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant alloy steel such as Cor-Ten steel or an approved equal. Couplings shall be Dresser style, or approved equal.
- C. Fernco style couplings are not acceptable.

PART 3 EXECUTION

3.1 SERVICE INVESTIGATIONS

- A. If the location of the existing sewer service at the property line is unknown, identify the service location by one or more of the following methods, with approval of the WPCA and its Technical Consultant:
 - 1. Insert a transmitter into the service pipe through a clean-out or other access point inside the building that sends a signal to a receiver at the ground surface. Mark out the service location from the main line sewer to the property line using marking paint, stakes, or other means.

Town of Canton WPCA

2. Dig test pits to locate existing sewer services. If necessary, break into existing building connection pipes to determine the source of flow in the pipe. Repair the broken pipe until such time as connection to the new sewer is completed. Supply all materials needed to completely repair all pipes broken. Excavation and backfill shall be carried out in accordance with Section 02315.
 3. Perform smoke testing, dye water testing, or other investigation methods to determine the location, source, and type of flow in certain pipes within the project area.
 4. Television inspect the sewer segments highlighted on the Drawings, in accordance with Section 02958, in order to identify the location of the existing sewer services along the main sewer line.
- B. Supply all materials to completely repair all pipes broken.
 - C. Provide written notification to each property owner at least 24 hours prior to the reconnection of the house service so that the owner may make arrangements to suspend use of the service during reconnection.

3.2 INSTALLATION

- A. Perform pipeline installation in accordance with Section 02515.
- B. Complete service reconnection work on the day on which it was started.
- C. Control and/or divert flow using portable pumps, plugs, etc. during this work, as required to prevent the discharge of wastewater flow to the ground surface and to prevent flow backups into buildings.
- D. After the section of pipeline has been satisfactorily tested and when the WPCA or its Technical Consultant informs the Contractor that the system is ready for operation, reconnect all service connections to the new sewer.

END OF SECTION

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SECTION 02535

BREAKING INTO EXISTING STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Breaking through the walls and inverts of existing manholes and structures.
2. Connecting the new pipes to the existing structures.
3. Ancillary work associated with making the new connections to the existing structures.

B. Related Sections

1. Section 02514 – Ductile Iron (DI) Pipe and Fittings
2. Section 02515 – Polyvinyl Chloride (PVC) Pipe and Fittings
3. Section 02530 – Manholes and Structures
4. Section 03310 – Cast-In-Place Concrete

C. Related Sewer Construction Details

1. No. 004 - “Dog House” Manhole Base

1.2 REFERENCES

- A. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Piping Using Rubber Gaskets.
- B. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.3 SUBMITTALS

- A. Submit shop drawings showing pipe connection details.

1.4 QUALITY ASSURANCE

- A. Personnel shall have confined space entry training as appropriate for the work to be performed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Flexible Pipe-to-Structure Connectors

1. The flexible connectors shall be designed to provide a positive seal between the connector and the structure wall and between the connector and the pipe.

2. The flexible boot shall be manufactured of EPDM synthetic rubber in accordance with ASTM C443 and C923 and shall be 3/8 inch thick or greater.
3. The external bands shall be made entirely of 304 series non-magnetic stainless steel.
4. The flexible connectors shall be provided with a wedge-type or toggle-type expander to secure the pipe in the structure opening.
5. The flexible connectors shall meet the following criteria, in accordance with ASTM C923:
 - a. Shall not leak when subjected to a head pressure of 10 psi for 10 minutes.
 - b. Shall have the ability to deflect 7 degrees in any direction without leakage under the head pressure conditions described above.
 - c. Shall not leak when subject to a load of 150 lbs./in. pipe diameter and the head pressure conditions described above.

B. Grout

1. Non-shrink, water-proof type.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Core drill into existing structures in such a fashion as to make an opening of suitable size to accommodate the connecting pipe without excessive damage to the existing structure.
2. For manholes, break out and rebuild existing inverts as required to provide an adequate base under the new channels being installed, and shaped to provide smooth continuous hydraulic flow through the manhole.
3. Rebuild and tightly close existing manhole walls and inverts, catchbasin, and structure walls to provide an integral, water-tight structure around the new pipes.
4. Divert existing sewage flows as required, during the period of construction. No sewage will be permitted to flow directly against concrete or other masonry work until it is at least 48 hours old.
5. Temporary handling of sewage flows may be accomplished by inserting pipes from the inlet to the outlet of the manhole and by using temporary plugs, where appropriate, provided that such pipes do not interfere with satisfactory completion of the work and shaping the inverts, nor cause excessive backing up in existing sewers above the point of diversion. In cases where this type of temporary handling of sewage is not possible, provide the necessary dams, plugs, etc., in convenient manholes, and pump the sewage around the structure under construction. When sewage is pumped or otherwise diverted

Town of Canton WPCA

around a particular structure, it shall be returned to the sewage system at a convenient point. Under no circumstances shall sewage be permitted to run onto the surface of the ground.

B. Flexible Pipe-to-Structure Connectors

1. The flexible pipe-to-structure connectors shall be used for PVC pipe.
2. Install flexible connectors in accordance with the manufacturer's recommendations.

C. Grouting

1. All pipe types except PVC shall be grouted into place in the existing structure using non-shrink, water-proof grout.
2. After the new pipe has been set in place, completely fill the hole around the new pipe with non-shrink, water-proof grout.
3. In addition, place a 6 inch thick concrete encasement a total of 12 inches in length around the pipe stub adjacent to the wall of the structure.

END OF SECTION

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SECTION 02740

BITUMINOUS CONCRETE PAVEMENT AND CURB REPAIR

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Restoration of Bituminous Concrete Town Roads and Access Driveways
 - a. Trench Repair
 - b. Full-Width Overlay
 - 2. Restoration of Bituminous Concrete State Highways
 - a. Lateral (Cross) Trench Repair
 - b. Longitudinal (Mainline) Trench Repair
 - c. Full-Width Overlay
 - 3. Restoration of Bituminous Concrete Sidewalks and Driveways
 - 4. Bituminous Concrete Curb Repairs
- B. Related Sections
 - 1. Section 02315 - Excavation, Backfilling and Compaction
 - 2. Section 02320 - Borrow Material
 - 3. Section 02760 – Pavement Markings
 - 4. Section 02770 – Granite Curbing
 - 5. Section 02775 – Portland Cement Concrete Sidewalks
 - 6. Section 03310 – Cast-in-Place Concrete
- C. Related Sewer Construction Details
 - 1. No. 031 – Temporary Trench Surface Repairs
 - 2. No. 032 – Permanent Trench Surface Repairs

1.2 REFERENCES

- A. State of Connecticut Department of Transportation – Standards for Roads, Bridges and Incidental Construction, Form 816, 2004 (CT-DOT Form 816).
- B. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1990 Edition, as amended.
- C. ASTM D2939 – Standard Test Methods for Emulsified Bitumens Used as Protective Coatings

Town of Canton WPCA

- D. ASTM D446 – Standard Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers
- E. AASHTO M 226
- F. AASHTO T 96 – L.A. Abrasion Test
- G. AASHTO T 195 (Ross Count)
- H. TAI - (The Asphalt Institute) - MS-3 Asphalt Plant Manual.
- I. TAI - (The Asphalt Institute) - MS-8 Asphalt Paving Manual.

1.3 SUBMITTALS

- A. Product information and mix design for each mix specified under this Section.
- B. Certificate indicating the mix plant conforms to State of Connecticut Department of Transportation “Standard Specifications for Roads, Bridges and Incidental Construction Form 816, 2004.
- C. On-Site Materials Documentation
 - 1. Delivery tickets must include the following information:
 - a. State of Connecticut printed on it.
 - b. Name of producer and identification of plant.
 - c. Date and time of day.
 - d. Type of material.
 - e. Net weight of material.
 - f. Gross weight of truck.
 - g. Project number, purchase order number, and name of Contractor.
 - h. Truck number for specific identification of truck.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Connecticut Department of Transportation “Standard Specifications for Roads, Bridges and Incidental Construction Form 816, 2004.
- B. Mixing Plant: Conform to TAI Manual MS-3, and State of Connecticut Department of Transportation “Standard Specifications for Roads, Bridges and Incidental Construction Form 816, 2004.
- C. Bitumen delivered to a project or to a mix plant must be accompanied by a proper certificate signed by the producer’s authorized representative. Shipments of material not accompanied by a certificate will not be accepted for use in the work.
- D. Obtain materials from same source throughout.

PART 2 PRODUCTS

2.1 MATERIALS

A. General

1. The materials for the bituminous concrete mixture, sources of supply, formula for mix, tack coat, joint seal, mix tolerances, approval of mix formula, and the control of the mixture shall conform to the requirements of Section M.04 of the CT-DOT Form 816.
2. Following is an excerpt table from CT-DOT Form 816 for the various types of bituminous concrete specified in this Section.

TABLE 02740-1					
Percent by Mass Passing Sieve Designation					
Standard Sieves	Class 1	Class 2	Class 3	Class 4	Class 12
#200	3-8	3-8	3-8	0-5	3-10
#50	6-26	8-26	10-30	5-18	10-40
#30	10-32	16-36	20-40		20-60
#8	28-50	40-64	40-70	20-40	60-95
#4	40-65	55-80	65-87	30-55	80-95
1/4"					
3/8"	60-82	90-100	95-100	42-66	98-100
5/8"	70-100	100	100		100
3/4"	90-100			60-80	
1"	100				
2"				100	

B. Dense Graded Pavement Sub-base

1. Dense graded pavement sub-base shall be in accordance with Section 02320.

C. Bituminous Concrete Base Course

1. The bituminous concrete base course shall conform to the material requirements of "Class 4" bituminous pavement, as outlined in Table 02740-1 above, per CT-DOT Form 816, 2004.

D. Bituminous Concrete Binder Course

1. The bituminous concrete binder course shall conform to the material requirements of "Class 1" bituminous pavement, as outlined in Table 02740-1 above, per CT-DOT Form 816, 2004.

E. Bituminous Concrete Top Course

1. The bituminous concrete top course shall conform to the material requirements of "Class 12" bituminous pavement, as outlined in Table 02740-1 above, per CT-DOT Form 816, 2004.

F. Bituminous Concrete Sidewalks and Driveways

1. The bituminous concrete mix used for driveways and sidewalks shall conform to the material requirements of "Class 2" bituminous pavement, as outlined in Table 02740-1 above, per Article M.04 of the CT-DOT Form 816.

Town of Canton WPCA

G. Bituminous Concrete Curbing

1. The bituminous concrete curbing used for driveways and sidewalks shall conform to the material requirements of "Class 3" bituminous pavement, as outlined in Table 02740-1 above, per Article M.04 of the CT-DOT Form 816.

H. Tack Coat

1. Tack coat shall consist of either emulsified asphalt, or cutback asphalt, conforming to the above-referenced Connecticut DOT specifications.

I. Calcium Chloride

1. Calcium chloride shall meet requirements of AASHTO M-144 and shall be spread wherever directed to control dust conditions. The WPCA's Technical Consultant may direct CONTRACTOR to employ sprinkling of water in lieu of calcium chloride for dust control.

J. Excavatable Controlled Density Fill (CDF)

1. CDF shall be as specified in Sections 02315 (Excavation, Backfill, and Compaction) and 02320 (Borrow Materials).

K. Pavement Markings

1. Pavement marking shall be as specified in Section 02760 (Pavement Markings).

L. Paving Equipment

1. Pavers

- a. Pavers shall be of sufficient capacity to provide a uniform spreading operation.
- b. Pavers shall be equipped with a vibratory screed system with heaters or burners.
- c. Pavers shall incorporate adjustable controls for reference grade.

2. Rollers

- a. Rollers shall be self-propelled units, exerting an average contact pressure of 60 to 90 pounds per square inch.

PART 3 EXECUTION

3.1 GENERAL

- A. Prior to the start of trench excavation, saw cut the existing pavement in the vicinity of the trench so as to prevent damage to the paving outside the trench width. All joints shall be saw cut.
- B. Furnish and spread calcium chloride on disturbed surfaces to control dust conditions as directed by the WPCA's Technical Consultant.
- C. In no case will pavement be placed until the gravel base is dry and compacted to at least 95% maximum density at optimum moisture content.

Town of Canton WPCA

- D. The mix shall not be placed on frozen material. No mix shall be placed on wet or damp surfaces.
- E. The mix shall not be placed when the temperature is less than 50°F for a thickness of 1.5 inches or less, or when the temperature is less than 40°F for a thickness greater than 1.5 inches. No mixtures shall be placed when the air temperature is below 40°F, or when the material on which the mixtures are to be placed contains frost or has a surface temperature WPCA's Technical Consultant considers too low.
- F. Loaded trucks shall be tightly covered with waterproof covers acceptable to the WPCA's Technical Consultant.
- G. Install bituminous concrete pavement in accordance with CT-DOT Form 816.
- H. The mix shall be placed at a temperature within 25°F of the approved job mix formula.
- I. Maintain pavement under this Contract during the project warrant period(s) and promptly refill and repave areas that have settled or are otherwise unsatisfactory for traffic, within 24 hours of notice given by WPCA.
- J. All pavement thicknesses referred to herein are compacted thicknesses. Place sufficient mix to ensure that the specified thickness of pavement occurs in all locations.
- K. All manhole frames, catch basin frames and utility boxes are to be set to the grade of the binder course until such time as the top course is placed.
- L. All excavated materials removed for raising of the frames and utility boxes are to be replaced with bituminous concrete pavement (Portland cement concrete is not acceptable). This ring of bituminous concrete pavement shall be filled flush with the surrounding binder course.
- M. The contact surfaces of curbs, castings, and other structures shall be painted with a tack coat prior to placement of paving.
- N. Along curbs, structures and all other places not accessible with a roller, the paving mixture shall be thoroughly compacted with tampers. Such tampers shall not weigh less than 25 pounds and shall have a tamping face no more than 50 square inches in size. The surface of the mixture after compaction shall be smooth and true to the established line and grade.
- O. No vehicular traffic or loads shall be permitted on the newly completed pavement until adequate suitability has been attained and the material has cooled sufficiently to prevent distortion or loss of fines. If the climatic or other conditions warrant it, the period of time before opening to traffic may be extended at the discretion of the WPCA's Technical Consultant.
- P. Existing drainage patterns shall not be altered by the new pavement construction unless otherwise shown on the Drawings or directed by WPCA's Technical Consultant.
- Q. In all cases, the Contractor's operations shall be scheduled so as to interfere as little as possible with traffic.

- R. Pavement markings damaged during the course of the work shall be repaired in accordance with Section 02760.

3.2 RESTORATION OF TOWN ROADS AND ACCESS DRIVEWAYS

A. Trench Repair

1. Upon completion of the pipe trench, backfill as specified in Section 02315 to a depth of 15 inches from the undisturbed surfaces adjacent to the trench excavation.
2. Place at the top, a minimum of 12” processed gravel pavement sub-base. The pavement sub-base shall be placed and compacted in 2 even lifts. Achieve 95% compaction in accordance with AASHTO T-180, Method D.
3. Adjust all municipally-owned utility structures and appurtenances such as manholes, catch basins and gate valve boxes for the finish compacted overlay thickness. The raising of other structures (privately owned utilities) as required to properly complete the final paving work should be completed by the structure owners. It is the responsibility of the Contractor to coordinate all such work and to assure that all structures are properly raised in a timely manner.
4. As soon as possible after the pavement sub-base has been prepared, shaped and compacted, a 3” thick bituminous concrete binder course shall then be placed and compacted so the upper surface is flush with and will provide the proper cross-section with adjacent undisturbed pavement. The 3” binder course shall be placed in two even lifts.
5. Apply joint adhesive to all lateral and longitudinal joints for proper adhesion of the binder course to the existing pavement surfaces.
6. Maintain binder course in a condition suitable for traffic throughout the construction period until the full-width pavement overlay is placed. Defects shall be repaired within 24 hours of notification by filling in any holes that may develop with additional bituminous material to maintain the surface of the trench repair.

B. Full-Width Overlay

1. After a minimum of one full “winter-over” period has elapsed since placement of the trench repair, proceed with the full-width pavement overlay work.
2. The Contractor is responsible for inspecting the condition of all roadways to be overlaid and to plan and provide for the proper preparation of pavement within and outside the limits of the pipe installation work area.

Town of Canton WPCA

3. Prepare the binder course for placement of the top course. The binder course shall be regraded, placing additional bituminous concrete binder course where settling has occurred, repairing the existing surface and replacing broken or damaged sections.
4. Any unstable trench repair and adjacent pavement that has slumped toward the trench or deteriorated due to this construction shall be removed and gravel sub-base reconstructed, and bituminous trench repair replaced with 3" of bituminous concrete binder course.
5. The binder course surface shall be broom cleaned, and shall be in all respects acceptable to the WPCA's Technical Consultant before the final pavement is placed.
6. Adjust all municipally-owned utility structures and appurtenances such as manholes, catch basins and gate valve boxes for the finish compacted overlay thickness. The raising of other structures (privately owned utilities) as required to properly complete the final paving work should be completed by the structure owners. It is the responsibility of the Contractor to coordinate all such work and to assure that all structures are properly raised in a timely manner.
7. The overlay shall cover the full width of existing pavement and enough of paved driveways and intersecting streets to provide smooth transitions to existing surfaces and continuous uninterrupted gutter flow.
8. The overlay shall be "toed-in" to the existing pavement by saw cutting a twelve (12) inch wide by three (3) inch deep groove along the full width of the street for the purpose of tying-in the proposed overlay.
9. Jackhammers shall then be used to properly remove the pavement within the groove.
10. Following preparation of the binder course, apply the tack coat at a rate of not less than 0.10 gallons per square yard. The tack coat shall be heated to a temperature of greater than 160°F and shall not be further diluted. The "toed-in" grooves shall also be properly tack coated to provide adequate adhesion to the existing pavement joints.
11. Immediately after the roadway surface has been prepared, a 1-½" bituminous concrete top course overlay extending the full width of the existing pavement shall then be placed and rolled as specified herein.
12. The finished overlay course shall blend smoothly with all rim elevations of catch basins, manhole covers, gate box covers and any other utilities and shall in no way interfere with or alter the existing surface drainage.
13. The longitudinal joint shall be offset at least 6" from the joint in the course immediately below. The joint in the final coat shall be at the centerline of the lanes.

Town of Canton WPCA

14. Driveway aprons which in the opinion of the WPCA's Technical Consultant are affected by the overlay shall be overlaid in such a manner to maintain current surface drainage along the street gutterline. In no case shall surface drainage from the street be shed onto local driveways.
15. The WPCA's Technical Consultant reserves the right to direct the Contractor to install full-width overlay on undisturbed portions of streets that were damaged in other areas as a result of the construction under this Contract.
16. Any permanent pavement repair that in the opinion of the WPCA's Technical Consultant does not meet this requirement, or that will form puddles 1/16" deep or greater shall be repaired or replaced. The surface coat shall not vary by more than 1/4" when using a 10-foot straight edge.
17. All permanent pavement repair areas shall be repainted to match the original pavement markings. Painting shall be in accordance with Section 02760.

3.3 RESTORATION OF STATE HIGHWAYS

A. General

1. The Contractor is responsible for performing all work in accordance with the permit(s) related to this Section.

B. Lateral (Cross) Trench Repair

1. Adjust all municipally-owned utility structures and appurtenances within the limits of the trench excavation, such as manholes, catch basins and gate valve boxes for the finish compacted overlay thickness. The raising of other structures (privately owned utilities) as required to properly complete the final paving work should be completed by the structure owners. It is the responsibility of the Contractor to coordinate all such work and to assure that all structures are properly raised in a timely manner.
2. The Contractor shall then place Excavatable Controlled Density Fill within the limits of the trench excavation, as outlined in Sections 02315 and 02320, to a point 7 inches below the surface of the existing surrounding undisturbed pavement.
3. The Excavatable Controlled Density Fill shall be allowed to cure 24 hours before continuing with the lateral trench pavement repair. The trench shall be covered with approved steel plates to allow traffic to pass unimpeded. The plates shall be secured in place with pins or other approved methods.
4. After the CDF has cured, the existing pavement shall be cut back a minimum of 12 inches beyond the edges of the trench and excavated and removed to a depth of 7 inches below the surface of the existing pavement. The cut edges of the existing pavement shall be straight and neat utilizing a saw cut only. Cutting with jack hammers will not be allowed.
5. A 4" thick bituminous base binder course shall then be placed and compacted. The 4" base course shall be placed in two even lifts.

Town of Canton WPCA

6. Prepare the base course for placement of the binder course. The base course shall be regraded, placing additional bituminous concrete where settling has occurred, repairing the existing surface and replacing broken or damaged sections at no additional cost to the Owner. The base course surface shall be in all respects acceptable to the Engineer before the binder course is placed. The surface shall then be broom cleaned.
7. Apply joint adhesive to all lateral and longitudinal joints for proper adhesion of the binder course to the existing pavement surfaces. The edges of the existing pavement where the joints are to be formed shall be thoroughly coated with a bitumen emulsion to ensure adhesion between the two pavements.
8. As soon as possible after the pavement base course has been prepared, shaped and compacted, a 3" thick bituminous concrete binder course shall then be placed and compacted so the upper surface is flush with and will provide the proper cross-section with adjacent undisturbed pavement. The 3" binder course shall be placed in two even lifts.
9. Maintain the binder course in a condition suitable for traffic throughout the construction period until the full-width pavement overlay is placed. Defects shall be repaired within 24 hours of notification by filling in any holes that may develop with additional bituminous material to maintain the surface of the trench repair.

C. Longitudinal (Mainline) Trench Repair

1. Upon completion of the pipe trench, backfill as specified in Section 02315 to a depth of 19 inches from the undisturbed surfaces adjacent to the trench excavation.
2. Place at the top, a minimum of 12" processed gravel pavement sub-base. The pavement sub-base shall be placed and compacted in 2 even lifts. Achieve 95% compaction in accordance with AASHTO T-180, Method D.
3. Adjust all municipally-owned utility structures and appurtenances such as manholes, catch basins and gate valve boxes for the finish compacted overlay thickness. The raising of other structures (privately owned utilities) as required to properly complete the final paving work should be completed by the structure owners. It is the responsibility of the Contractor to coordinate all such work and to assure that all structures are properly raised in a timely manner.
4. The existing pavement shall be cut back a minimum of 12 inches beyond the edge of trench and excavated and removed to a depth of 7 inches below the surface of the existing pavement. The cut edges of the existing pavement shall be straight and neat utilizing a saw cut only. Cutting with jack hammers will not be allowed.
5. A 4" thick bituminous base binder course shall then be placed and compacted. The 4" base course shall be placed in two even lifts.

Town of Canton WPCA

6. Prepare the base course for placement of the binder course. The base course shall be regraded, placing additional bituminous concrete where settling has occurred, repairing the existing surface and replacing broken or damaged sections at no additional cost to the Owner. The base course surface shall be in all respects acceptable to the Engineer before the binder course is placed. The surface shall then be broom cleaned.
7. Apply joint adhesive to all lateral and longitudinal joints for proper adhesion of the binder course to the existing pavement surfaces.
8. As soon as possible after the pavement base course has been prepared, shaped and compacted, a 3" thick bituminous concrete binder course shall then be placed and compacted so the upper surface is flush with and will provide the proper cross-section with adjacent undisturbed pavement. The 3" binder course shall be placed in two even lifts.
9. Maintain binder course in a condition suitable for traffic throughout the construction period until the full-width pavement overlay is placed. Defects shall be repaired within 24 hours of notification by filling in any holes that may develop with additional bituminous material to maintain the surface of the trench repair.

D. Full-Width Overlay

1. After a minimum of one full "winter-over" period has elapsed since placement of the trench repair, proceed with the full-width pavement overlay work.
2. The Contractor is responsible for inspecting the condition of all roadways to be overlaid and to plan and provide for the proper preparation of pavement within and outside the limits of the pipe installation work area.
3. Prepare the binder course for placement of the top course. The binder course shall be regraded, placing additional bituminous concrete binder course where settling has occurred, repairing the existing surface and replacing broken or damaged sections.
4. Any unstable trench repair and adjacent pavement that has slumped toward the trench or deteriorated due to this construction shall be removed and gravel sub-base reconstructed, and bituminous trench repair replaced with 4" of bituminous concrete base course and 3" of binder course material.
5. The binder course surface shall be broom cleaned, and shall be in all respects acceptable to the WPCA's Technical Consultant before the final pavement is placed.
6. Adjust all municipally-owned utility structures and appurtenances such as manholes, catch basins and gate valve boxes for the finish compacted overlay thickness. The raising of other structures (privately owned utilities) as required to properly complete the final paving work should be completed by the structure owners. It is the responsibility of the Contractor to coordinate all such work and to assure that all structures are properly raised in a timely manner.

Town of Canton WPCA

7. The overlay shall cover the full width of existing pavement and enough of paved driveways and intersecting streets to provide smooth transitions to existing surfaces and continuous uninterrupted gutter flow.
8. The overlay shall be "toed-in" to the existing pavement by saw cutting a twelve (12) inch wide by three (3) inch deep groove along the full width of the street for the purpose of tying-in the proposed overlay.
9. Jackhammers shall then be used to properly remove the pavement within the groove.
10. Following preparation of the binder course, apply the tack coat at a rate of not less than 0.10 gallons per square yard. The tack coat shall be heated to a temperature of greater than 160°F and shall not be further diluted. The "toed-in" grooves shall also be properly tack coated to provide adequate adhesion to the existing pavement joints.
11. Immediately after the roadway surface has been prepared, a 2 ½" bituminous concrete top course overlay extending the full width of the existing pavement shall then be placed and rolled as specified herein.
12. The finished overlay course shall blend smoothly with all rim elevations of catch basins, manhole covers, gate box covers and any other utilities and shall in no way interfere with or alter the existing surface drainage.
13. The longitudinal joint shall be offset at least 6" from the joint in the course immediately below. The joint in the final coat shall be at the centerline of the lanes.
14. Driveway aprons which in the opinion of the WPCA's Technical Consultant are affected by the overlay shall be overlaid in such a manner to maintain current surface drainage along the street gutterline. In no case shall surface drainage from the street be shed onto local driveways.
15. The WPCA's Technical Consultant reserves the right to direct the Contractor to install full-width overlay on undisturbed portions of streets that were damaged in other areas as a result of the construction under this Contract.
16. Any permanent pavement repair that in the opinion of the WPCA's Technical Consultant does not meet this requirement, or that will form puddles 1/16" deep or greater shall be repaired or replaced. The surface coat shall not vary by more than ¼" when using a 10-foot straight edge.
17. All permanent pavement repair areas shall be repainted to match the original pavement markings. Painting shall be in accordance with Section 02760.

3.4 RESTORATION OF SIDEWALKS AND DRIVEWAYS

- A. Immediately after completing the trench backfill, or in no event later than the end of the work day, the Contractor shall saw cut any damaged edges and place and compact a 12" process gravel pavement sub-base in 2 even lifts to a point 3" below the surrounding area. Achieve 95% compaction in accordance with AASHTO T-180, Method D.

Town of Canton WPCA

- B. All joints shall receive a tack coat prior to placement of the binder course.
- C. A 1 ½" thick binder course shall be installed immediately on the gravel base. This binder course shall be furnished and placed in accordance with CT-DOT Form 816.
- D. Following installation of the binder course, apply the tack coat at a rate of not less than 0.10 gallons per square yard. The tack coat shall be heated to a temperature of greater than 160°F and shall not be further diluted.
- E. Following the tack coat, apply a 1 ½" thick bituminous concrete top course directly over the binder course, bringing the repaired trench surface to its original grade.
- F. Repair shall be neat in appearance, shall blend in with the existing adjoining pavement and shall be acceptable to WPCA's Technical Consultant.

3.5 BITUMINOUS CONCRETE CURB REPAIR

- A. The ends of the existing berm shall be cut with a saw prior to construction of bituminous concrete curb repairs.
- B. Install a 6" thick compacted gravel base below the area of bituminous concrete curb to be repaired.
- C. The bituminous concrete berm shall be machine-laid.
- D. Closure between berms installed hereunder and existing berms shall be uniform, such that they have the same shape and texture as each other.
- E. Construction methods and procedures for bituminous concrete curb shall be in accordance with CT-DOT Form 816.

END OF SECTION

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SECTION 02760

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. New painted pavement markings
 - 2. Replacement of pavement markings disturbed as part of construction activities.
- B. Related Sections
 - 1. Section 02740 - Bituminous Concrete Pavement

1.2 REFERENCES

- A. State of Connecticut Department of Transportation – Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004 (CT-DOT Form 816).
- B. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1986 Edition, as amended.

1.3 SUBMITTALS

- A. Submit material specifications and shop drawings for all materials furnished under this Section.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Waterborne Pavement Marking Paint
 - 1. In accordance with CT-DOT Form 816, pavement marking paint shall conform to the requirements of Article M.07.20 for waterborne pavement marking paint.
 - 2. Paint shall be applied at a rate of 100 to 115 square feet per gallon.
 - 3. Minimum paint thickness shall be 15 mils.
 - 4. The paint shall be capable of being applied to bituminous and portland cement concrete pavements with striping equipment that does not require heating above ambient temperatures.
 - 5. The following additional requirements shall be met:
 - a. The total nonvolatile shall not be less than 70% by weight.
 - b. Pigment shall be 45-55% by weight.
 - c. Weight per gallon shall not be less than 12.5 pounds.
 - d. Drying time to no pickup shall be 15 minutes.

Town of Canton WPCA

B. Reflectorized Glass Beads

1. In accordance with CT-DOT Form 816, glass beads shall conform to the requirements of Article M.07.30
2. Glass beads shall also meet the requirements of AASHTO M247, Type 1.
3. Glass beads shall be applied at a rate of 6 pounds per gallon.

PART 3 EXECUTION

3.1 PREPARATION

- A. All surface dirt within the areas to be painted shall be removed. Large areas of tar, grease or foreign materials may require sand blasting, steam cleaning or power brooming to accomplish complete removal.
- B. Bituminous concrete pavements shall have been in place for 48 hours prior to the application of pavement markings.
- C. Application of markings shall not proceed until final authorization is received from the WPCA and its Technical Consultant.

3.2 INSTALLATION

- A. Painting shall be in accordance with CT-DOT Form 816.
- B. All painting shall be performed in a neat and workmanlike manner.
- C. Lines shall sharp and clear with no feathered edging or fogging.
- D. If for any reason material is spilled or tracked on the pavement or any markings applied by the Contractor, in the judgment of the WPCA's Technical Consultant, are not acceptable, then the Contractor shall remove such material by a method that shall not damage the roadway surface, clean and prepare the surface for a reapplication of markings, and reapply the markings as directed.

3.3 PROTECTION

- A. Precautions shall be taken to prevent tracking by tires of the striping equipment.
- B. No paint or pavement marking material shall be heated above the temperature marked on the container.
- C. Markings shall remain protected until sufficiently dry to bear traffic on roadways that are open to traffic.
- D. Markings shall be protected by traffic cones of not less than 28 inches in height.

END OF SECTION

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SECTION 02770

GRANITE CURBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Installation, repair and replacement of granite curbing.
- B. Related Sections
 - 1. Section 02315 - Excavation, Backfill and Compaction
 - 2. Section 02320 - Borrow Material
 - 3. Section 02740 - Bituminous Concrete Pavement
 - 4. Section 03310 - Cast-In-Place Concrete

1.2 REFERENCES

- A. Connecticut Department of Transportation - Standard Specification for Roads, Bridges and Incidental Construction, Form 816, 2004 (CT-DOT Form 816).
- B. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1986 Edition, as amended.

1.3 SUBMITTALS

- A. Submit shop drawings, including materials, showing dimensions, layouts and details of construction and accessories required.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Granite Curbing
 - 1. Granite curbing shall be hard and durable, fundamentally of light color, of general uniform texture, of smooth splitting appearance, and free from seams or imperfections.
 - 2. No top projections of greater than 1/8 inch shall exist, and no more than 1" projections shall exist on the back and bottom of each section.
 - 3. Vertical Granite Curbing
 - a. Vertical granite curbing shall conform to the requirements of Article M.12.06 of the CT-DOT Form 816.
 - b. Standard laying length shall be 6-feet.
 - 4. Granite Slope Curbing
 - a. Granite slope curbing shall conform to the requirements of Article M.12.07 of the CT-DOT Form 816.

Town of Canton WPCA

b. Standard laying length shall be no less than 2-feet.

B. Mortar

1. Mortar shall conform to the requirements of Article M.11.04 of the CT-DOT Form 816.
2. In general, mortar shall be one part Portland cement and two parts (by volume) dry fine aggregate.
3. Hydrated lime in an amount of less than 4 pounds of lime to each bag of Portland cement may be added if approved by the WPCA's Technical Consultant.

C. Gravel Base

1. The processed gravel base shall conform to the requirements of Article M.02.03 of the CT-DOT Form 816.
2. Gravel base shall be processed gravel sub-base as specified in Section 02320 (Borrow Materials).

D. Concrete Base

1. Concrete fill shall meet the requirements of Section 03310 (Cast-In-Place Concrete).

PART 3 EXECUTION

3.1 INSTALLATION

- A. Excavation shall be made of sufficient depth and width to accommodate the granular base.
- B. The line of the curbing shall be set straight and true for the full depth.
- C. The joints of the stone curbing shall be pointed with mortar for the full depth of the curbing.
- D. At approximately 50-foot intervals, a ½" joint shall not be filled with mortar to be left free for expansion.
- E. Granite edging shall be set on an 8" minimum depth compacted processed gravel base.
- F. The gravel base shall be fine graded and thoroughly compacted with approved mechanical compactors.
- G. Concrete fill shall be placed on the front and back of the granite curbing in lieu of gravel backfill in locations where a sidewalk does not directly abut the back of the curb. In locations where a sidewalk directly abuts the back of the curb, concrete fill is only required on the front side.
- H. All granite edging shall have a 4" reveal from the finished pavement surface, except in the case of transition curbing, and shall be flush with adjacent sidewalks.

Town of Canton WPCA

- I. Where edging is to be set on a radius between 10 feet and 160 feet, the maximum laying length shall be 3 foot. Where edging is to be set on a radius of 10 feet or less, the maximum laying length shall be 1 foot.
- J. The joints of all granite curbing shall be filled with cement mortar and neatly pointed on exposed surfaces. Excess mortar shall be satisfactorily cleaned from the curb.

END OF SECTION

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SECTION 02775

PORTLAND CEMENT CONCRETE SIDEWALKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

Description of Contractor's responsibilities regarding:

1. Sidewalks including wheelchair ramps
2. Driveway Aprons

B. Related Sections

1. Section 02315 - Excavating, Backfill and Compaction
2. Section 02320 - Borrow Material
3. Section 03310 - Cast-in-Place Concrete

1.2 REFERENCES

- A. ACI 301 (American Concrete Institute) - Specifications for Structural Concrete for Buildings.
- B. ACI 304 (American Concrete Institute) - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- D. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- E. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- F. ASTM C33 - Concrete Aggregates.
- G. ASTM C94 - Ready Mix Concrete.
- H. ASTM C150 - Portland Cement
- I. ASTM C260 - Air-Entraining Admixtures for Concrete.
- J. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- K. ASTM C494 - Chemical Admixtures for Concrete.
- L. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- M. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- N. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1986 Edition, as amended.

Town of Canton WPCA

- O. State of Connecticut Department of Transportation – Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials for this work shall conform to the requirements of Article M.03.01 of the CT-DOT Form 816.
- B. Portland cement concrete shall meet the requirements of Section 03310 (Cast-In-Place Concrete).
- C. Premolded expansion joint filler shall meet the requirements of AASHTO Designation M153, Type II.
- D. Welded wire fabric shall meet the requirements of ASTM A185.
- E. Gravel borrow for the sidewalk base shall be in accordance with Section 02320 - Borrow Material.
- F. Sheet membrane curing compounds shall meet the requirements of ASTM C 309.

PART 3 PART 3 EXECUTION

3.1 PREPARATION

- A. Shape the subgrade parallel to the proposed surface and compact thoroughly. The top of the subgrade shall be at an elevation 12" below the elevation of the proposed finished surface for sidewalks and 18" for driveways and aprons. Fill depressions with suitable material and compact again until the surface is smooth and hard.
- B. Install a gravel base on top of the subgrade to a depth of 8" for sidewalks and 12" for driveways and aprons. Fine grade the gravel base and compact thoroughly with approved mechanical tampers.
- C. Place Portland cement panels 4 inches thick for sidewalks and 6 inches thick for driveways and driveway aprons in accurately set, smooth wooden or steel forms of sufficient strength to resist springing out of shape. The gravel base shall be fine graded and recompacted immediately ahead of pouring the concrete. Sidewalks shall match the top of the existing adjacent sidewalk panels.
- D. Completely remove mortar and dirt from forms that have been previously used. The forms shall be well staked and thoroughly graded and set to the established lines with their upper edge conforming to the grade of the finished walk. Oil forms before placing concrete.
- E. Install 1/2" thick premolded expansion joint filler to separate sidewalk panels.

3.2 INSTALLATION

- A. Reinforce the concrete slab with welded wire fabric, 6x6-W4 x W4.
- B. Place concrete to half the desired depth at which point the welded wire fabric shall be placed or raised to the surface. The remaining concrete can then be placed. Care should be exercised to avoid walking in areas with reinforcing.

Town of Canton WPCA

- C. No finish work shall be performed while free water is present. After water sheen has disappeared and concrete has started to stiffen, edging operations, where required, shall be completed. After edging and joining operations, the surface shall be floated. Immediately following floating, the surface shall be steel-troweled. Following troweling, the concrete sidewalk shall be given a broom finish in accordance with Section 03310 - Cast-in-Place Concrete.
- D. Cure the concrete by covering with burlap or other acceptable material that shall be kept moist for at least five (5) days after placing the concrete.
- E. Cure the concrete by the application of a liquid membrane-curing compound as soon as free water has disappeared and the surface cannot be marred. The application should be uniform and without puddles.
- F. After the concrete has cured, apply caulk sealer to expansion joints.

END OF SECTION

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SECTION 02820

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Installation of fence framework, fabric, and accessories
 - 2. Excavation for post bases
 - 3. Concrete foundations for posts and center drop for gates
 - 4. Manual gates and related hardware as shown on the plans and specified herein
 - 5. Other related work

1.2 REFERENCES

- A. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless
- B. ASTM A121 - Specification for Zinc-Coated (Galvanized) Steel Barbed Wire
- C. ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
- D. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- E. ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners
- F. ASTM A392 - Zinc-Coated Steel Chain-Link Fence Fabric
- G. ASTM A428 - Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles
- H. ASTM A491 - Aluminum Coated Fabric Wire
- I. ASTM A569 - Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality
- J. ASTM A585 - Aluminum Coated Steel Barbed Wire
- K. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-dip Process
- L. ASTM A792 - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-dip Process
- M. ASTM A824 - Metallic Coated Steel Marcellled Tension Wire for Use with Chain Link Fence
- N. ASTM B429 - Aluminum-Alloy Extruded Structural Pipe and Tube
- O. ASTM C94 - Ready Mixed Concrete
- P. ASTM F567 - Practice for Installation of Chain Link Fence
- Q. ASTM F668 - Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric

Town of Canton WPCA

- R. ASTM F900 – Industrial and Commercial Swing Gates
- S. ASTM F934 – Standard Colors for Polymer-Coated Chain Link Fence
- T. ASTM F1043 – Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
- U. ASTM F1083 – Pipe, Steel, Hot-dipped Zinc-Coated (Galvanized) Welded, for fence Structures
- V. ASTM F1184 – Industrial and Commercial Horizontal Slide Gates
- W. CLFMI (Chain Link Fence Manufacturers institute) – Product Manual

1.3 SUBMITTALS

- A. Shop drawings showing the plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates and a schedule of components.
- B. Data indicating compliance with these specifications for the fabric, posts, accessories, fittings and hardware.

1.4 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.
- B. Supply material in accordance with CLFMI – Product Manual.
- C. Perform installation in accordance with ASTM F567.
- D. Furnish a 10-year factory warranty against corrosion and rust for the entire fencing system.

1.5 PRODUCT HANDLING

- A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
- B. Packages shall be labeled with the manufacturer's name.
- C. Store fence fabric and accessories in a secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General - Material furnished shall be new and first quality and shall not have been painted. Steel shall be copper bearing, containing not less than 0.2% pure copper. Materials are to be galvanized, then PVC coated – color black.
- B. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F1043 Type A on pipe exterior and interior.
- C. Fabric Wire (Steel): ASTM F668 PVC coated.

- D. Barbed Wire: PVC coated steel strands with galvanized steel barbs; 12-gauge thick wire, 3 strands, 4 points at 3 inches on center.
- E. Concrete: ASTM C94; Air Entrained Portland Cement, 3,500 psi strength at 28 days, 3 inch slump; $\frac{3}{4}$ inch nominal sized coarse aggregate.

2.2 COMPONENTS

- A. Line Posts: 2.5-inch diameter.
- B. Corner and Terminal Posts: 3-inch.
- C. Gate Posts: 3.5-inch diameter.
- D. Top and Brace Rail: 1.66-inch diameter, plain end, sleeve coupled.
- E. Gate Frame: 1.90-inch diameter for welded fabrication.
- F. Fabric: 1.75-inch diamond mesh interwoven wire, 9-gage thick, top salvage twisted tight, bottom selvage twisted tight.
- G. Tension Wire: 6-gage thick steel, single strand, ASTM A824.
- H. Tension Band: steel.
- I. Tension Strap: steel.
- J. Tie Wire: Aluminum alloy steel wire.
- K. Fastener Hardware: ASTM A307

2.3 ACCESSORIES

- A. Caps: Cast steel galvanized, PVC coated; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel, PVC coated.
- C. Extension Arms: Cast steel galvanized, PVC coated, to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.
- D. Gate Hardware: Fork latch with gravity drop, mechanical keepers; 3 gate hinges for each leaf and hardware for padlock. Hinges shall be non lift-off design.

2.4 GATES

- A. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
- B. Fabricate gate frames from 1.9 inch outside diameter pipe weighing 2.72 lbs/l.f. unless note otherwise.
- C. Factory assemble gates.
- D. Gates are to be the same height as the main fence unless noted otherwise.
- E. Conform to requirements specified for PVC coated steel chain link fence except that PVC coated aluminum alloy framing conforming to ASTM B429 may be used.
- F. Design gates for operation by one person.

2.5 SWING GATES

- A. Fabricate gates to permit 180 degree swing.
- B. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

2.6 FINISHES

- A. Components and Fabric: Vinyl coating, black, color in accordance with ASTM F934 over galvanized coating to ASTM A53; ASTM A123; ASTM A153, ASTM A653 for components; ASTM A392 for fabric of 2.0 oz/sq ft galvanizing.
- B. Vinyl Components: color to match fabric.
- C. Hardware: Galvanized to ASTM A153.
- D. Accessories: Same finish as framing, fabric.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fence with posts vertical and components to line and grade shown on Drawings.
- B. Install posts with 6-inch maximum clear opening from end posts to buildings, fences and other structures.
- C. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.
- D. Post holes shall have a plan diameter 12 inches greater than the post diameter and a minimum depth of 42 inches. Holes shall be clean and free of loose soil and debris.
- E. Line Post Footing Depth Below Finish Grade: ASTM F567, 4 feet.
- F. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567, 4 feet.
- G. Set chain link fence posts in air-entrained 3,500 psi, $\frac{3}{4}$ inch concrete. Embed posts a minimum of 3'-0". Concrete shall be placed continuously in one operation and tamped or vibrated for consolidation.
- H. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.
- I. Extend concrete footings 1-inch above grade, and trowel, forming crown to shed water.
- J. Fill gate posts with the above specified concrete prior to the installation of gates.
- K. Where solid rock is encountered line posts shall be set to a minimum depth of 12 inches, and end, corner, gate and intermediate post to a minimum of 18 inches in the solid rock. The hole shall have a minimum width or diameter 1 inch greater than the largest dimension of the post section to be set. After the post is set and plumbed the hole shall be filled with grout consisting of one part Portland cement and one part clean,

Town of Canton WPCA

well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids.

- L. Rails, Bracing, and Fabric - Concrete shall attain 75% of the 28 day strength before rails, tension wires and/or fabric is installed. A minimum of 7 days shall pass before installation of the above items. Fabric shall not be stretched and tensioned or gates hung until the concrete attains full strength. Fabric shall be installed with two inches clear space to finish grade.
- M. Line post spacing shall be a maximum of 10'-0" center to center.
- N. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- O. Corner and terminal posts are to be braced horizontally and diagonally. The braces are to extend over one adjacent panel. Changes in line of 30 degrees or more shall be considered as corners.
- P. Install top rail through line post tops and splice with 6- inch rail sleeves.
- Q. On curves with a radius less than 500 feet the top rail shall be bent true to the curve.
- R. Install center, and bottom brace rail on corner gate leaves.
- S. Install framework, fabric, gates, and accessories in accordance with ASTM F567.
- T. Place fabric on outside of posts and rails.
- U. Install nuts for tension bands and hardware bolts on the side of the fence opposite the fabric.
- V. Stretch fabric between terminal posts or at intervals of 100-feet maximum, whichever is less.
- W. Position bottom of fabric 2-inches above finished grade.
- X. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15-inches on centers.
- Y. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- Z. Install bottom tension wire, stretched taut between terminal posts.
- AA. Install support arms sloped outward and attach barbed wire; tension and secure.
- BB. Support gates from gate posts. Do not attach hinged side of gate from building wall.
- CC. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf, latch, catches, and locking clamp.
- DD. Miscellaneous - Install nuts for tension bands and hardware bolts on the side of the fence opposite the fabric. Repair galvanized coating where damaged using hot-applied repair compound applied in accordance with the manufacturer's recommendations.
- EE. Repair damage to galvanized coating using hot-applied repair compound in accordance with the manufacturer's recommendations.

3.2 ERECTION TOLERANCES

Town of Canton WPCA

- A. Maximum Variation From Plumb: $\frac{1}{4}$ inch in 8 feet.
- B. Maximum Offset From Indicated Position: 1-inch.

END OF SECTION

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SECTION 02920

LAWNS AND GRASSES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Restoration of all vegetated areas disturbed during construction including:
 - a. Lawn areas.
 - b. Grass surfaces.
 - c. Tree belts.
 - d. Easements.
2. Products specified herein include loam, starter fertilizer, lime, and lawn seed.

B. Related Sections

1. Section 01570 – Temporary Controls
2. Section 02230 – Clearing and Grubbing
3. Section 02315 – Excavation, Backfill, and Compaction.
4. Section 02740 – Bituminous Concrete Pavement and Driveway Repair.

1.2 REFERENCES

- A. ASTM D5539 – Standard Specification for Seed Starter Mix

1.3 QUALITY ASSURANCE

- A. Seed shall be placed only between the periods from April 15th to June 1st, and from August 15th to October 1st, unless otherwise approved by the WPCA's Technical Consultant.

1.4 SUBMITTALS

A. Submit the following for approval:

1. Lawn seed mixture including percent by weight of each seed type, and manufacturer/supplier name.
2. Suitable laboratory analysis of the soil to determine the quantity of fertilizer and lime to be applied.
3. Lime and starter fertilizer application rates based on laboratory soil tests.

PART 2 PRODUCTS

2.1 MATERIALS

A. Loam

1. Loam shall consist of fertile, friable, natural topsoil typical of the locality without admixture of subsoil, refuse or other foreign materials and shall be obtained from a well-drained arable site. It shall not be a swampy mulch nor shall it contain excessive quantities of sand or clay. It shall be free of stumps, roots, heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter.
2. The loam shall have an acidity range, such that its pH ranges from 5.5 to 7.6.

B. Starter Fertilizer

1. Starter fertilizer shall bear the manufacturer's name and guaranteed statement of analysis, and shall be applied in accordance with the manufacturer's directions.
2. Shall be Scott's Starter Fertilizer, or equal, with timed nitrogen release to prevent burning.

C. Lime

1. Lime shall be pelletized type for prolonged time release to soil.

D. Lawn Seed

1. Lawn seed shall be a fresh, clean, new crop seed. The weed seed content shall be less than 0.5% by weight. The seed shall contain a high percentage of perennial grasses.
2. Seed shall be Scotts Play Area Mixture, Scotts Pure Premium Sun and Shade Brand (North) Grass Seed Mixture, or equal.

PART 3 EXECUTION

3.1 PREPARATION

- A. In accordance with Section 02230 (Clearing and Grubbing), the Contractor shall salvage all existing loam, which shall be stockpiled at an acceptable on-site location. Under no circumstances shall existing topsoil be removed from the project site for another use by the Contractor.
- B. The ground surface shall be fine graded and raked so as to prepare the surface of the loam for lime, fertilizer and seed.
- C. The Contractor shall perform a laboratory soil test on the proposed loam before placing any lime, fertilizer, or seed. This work shall be in accordance with ASTM D5539 (Standard Specification for Seed Starter Mix).

3.2 APPLICATION

- A. Fertilizer and lime shall be applied to the surface of the ground in accordance with the manufacturers instructions, and based on the results of the certified soils test.

Town of Canton WPCA

- B. The seed shall then be placed using a drop or rotary spreader at the rate recommended by the seed manufacturer for the intended use of the lawn or grass area being restored.
- C. After spreading of the seed, lightly rake the surface to work the seed in. The surface shall then be rolled.

3.3 MAINTENANCE

- A. Maintain loamed and seeded areas by mulching, covering, netting, watering, fencing, etc., until an acceptable stand of vegetation is approved by the WPCA's Technical Consultant.
- B. Suitable signs and barricades should be placed to protect the seeded areas. After the grass has started, all areas and parts of areas that fail to show a uniform stand of grass for any reason whatsoever, shall be reseeded until all areas are covered with a satisfactory growth of grass.

3.4 SPECIAL CONSIDERATIONS

- A. Following the final top course of paving all pavement edges, waterways, sidewalks, berms, etc. shall be brought to grade with loam, fine graded, raked, seeded, and rolled to the satisfaction of the WPCA's Technical Consultant. Whenever possible the final surface of the loam backup shall slope away from the surface edge to allow proper sheeting of runoff. The Contractor shall be solely responsible for protecting, maintaining, and repairing this work until a satisfactory start of healthy grass is established.
- B. Upon removal of the haybales and siltation fence, the Contractor shall loam and seed all disturbed areas.
- C. In locations where the project area passes through existing grass, weed brush or tree-surfaced areas that are not covered by a specific lawn repair item, surface restoration shall be as follows:
 - 1. After completion of backfilling, the existing loam and surface materials, which were salvaged during excavation, shall be returned to the top of the trench.
 - 2. After natural settlement and compaction has taken place, the trench surface shall be harrowed, dragged and raked as necessary to produce a smooth and level surface.
 - 3. The area is then to be sowed with "orchard grass" or "rye grass" or other such materials to hold the soil and produce a growth similar to that existing prior to construction.
 - 4. The cost of repairing the trench surface in this manner shall be included in the trench excavation price.

END OF SECTION

SECTION 02958

TELEVISION INSPECTION OF PIPELINES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Television Inspection of Pipelines

1.2 SUBMITTALS

- A. Manufacturer's product data for the television inspection equipment, including camera, television monitor, carriage, recording device, signal conductor cable, etc.
- B. Information on database/software that will be used to store and review inspection data.
- C. Sample of television inspection log that will be used. Provide a legend for all abbreviations, symbols, codes, etc. used on the logs.
- D. Documentation submittals
 - 1. Two printed copies of the television inspection reports.
 - 2. Two copies of the television inspection video and voice audio recordings saved onto CD-R/WR or DVD-R media.

1.3 QUALITY ASSURANCE

- A. Personnel shall have confined space entry and other training as appropriate for the work to be performed.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. Provide all equipment necessary to complete the video inspections with voice audio recordings, including, but not limited to, inspection studio, television camera, and video capture equipment.
- B. The inspection equipment shall be capable of inspecting a minimum of 2,000 feet of pipe where entry into the pipe can be made from both ends. Where entry can only be made from one end, the equipment shall be capable of inspecting a minimum of 700 feet. The equipment shall be capable of providing a picture of acceptable quality at these maximum lengths, regardless of the vibration caused by normal movement of the camera and the length of the signal conductor cable between the camera and the recording device.
- C. The inspection equipment shall be capable of clearly televising the interior of a six inch diameter pipe and all larger sizes.
- D. The television camera used for the inspection shall be one specifically designed and constructed for such inspection.

Town of Canton WPCA

- E. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe.
- F. The camera shall be waterproof and operative in 100% humidity conditions.
- G. The camera, television monitor, and other components of the video system shall be capable of producing a high quality color image with clear definition of pipe internal features.
- H. A pan and tilt camera shall be used for the television inspection to provide the ability to view into the laterals to determine the accessibility of the lateral by the lateral inspection system (LIS) camera.
- I. The pan and tilt camera shall be capable of 360 degree rotational scan. The tilt arc shall not be less than 225 degrees and the viewing angle shall be a minimum of 300 degrees. The lens position shall be operated remotely. Cameras incorporating mirrors for viewing sides or cameras using exposed rotating heads are not acceptable.
- J. The camera shall be an auto-iris type with remote controlled manual override. The adjustment of focus and iris shall provide a minimum focal range of from 6 inches in front of the camera lens to infinity.
- K. The distance along the pipe in focus from the initial point of observation shall be a minimum of twice the vertical height of the pipe.
- L. The illumination must be such as to allow an even distribution of light, which will produce a clear picture around the pipe perimeter, regardless of diameter and without the loss of contrast, flare out of picture, or shadowing. The lighting system shall also minimize reflective glare and the intensity shall be fully adjustable. The camera lighthouse shall include a high-intensity side viewing lighting system to allow illumination of internal sections of lateral pipe connections.
- M. The television studio shall be insulated against noise and extremes in temperature and shall be large enough for two people for the purpose of viewing the television monitor while the inspection is in progress. The television studio shall be mounted on a mobile vehicle which allows safe and orderly movement of the inspection equipment.
- N. The television monitor screen shall be not less than 17 inches, measured on the diagonal.
- O. The television camera, monitor, and other components of the video system shall be capable of receiving and transmitting a picture having not less than 500 lines of resolution.
- P. The camera shall be mounted on a skid assembly that is able to ride over obstructions and cushion the camera against shock. The skid shall also have guards to keep the camera in line in the event of a turnover due to an obstruction.
- Q. The television inspection equipment shall meet the following criteria:
 - 1. Color: The following colors shall be clearly differentiated: white, yellow, cyan, green, red, blue, and black.

- 2. Linearity: The background grid shall show squares of equal size, without convergence or divergence over the whole picture. The center circle shall appear round and have the correct height and width relationship.
 - 3. Resolution: The live picture shall be displayed on a monitor capable of providing a clear, stable image free of electrical interference with a minimum horizontal resolution not less than 500 lines.
 - 4. Color Consistency: To ensure that the camera shall provide similar results when used with its own illumination source, the lighting shall be fixed in intensity prior to commencing the survey. In order to ensure color consistency, generally no variation in illumination shall take place during the survey.
- R. The monitor display shall incorporate an automatically updated record in feet and tenths of a foot of the distance along the pipe from the cable calibration point to the center point of the camera. Use a suitable metering device which enables the length of the pipe being inspected to be accurately measured to within ± 0.2 feet.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to television inspection, clean pipes.
- B. Reduce flow level in pipe being inspected by bypass pumping or by jetting to meet the requirements described below, unless otherwise agreed to:

Maximum Depth of Flow for Television Inspection	
6 inch to 10 inch pipe	10% of pipe diameter
12 inch to 24 inch pipe	15% of pipe diameter
Greater than 24 inch pipe	20% of pipe diameter

- C. Alternatively, perform television inspection during off-peak hours when flow depths satisfy the above requirements.

3.2 INSPECTION

- A. Move the camera through the pipe at a moderate rate, stopping where necessary to permit proper documentation of all pertinent features/defects. In no case will the television camera be pulled at a speed greater than 30 feet per minute.
- B. Use manual winches, power winches, TV cable, powered rewinds or other devices to move the camera through the pipe that do not obstruct the camera view or interfere with proper documentation of the pipe conditions. All winches shall be stable with either locking or ratcheting drums.
- C. If, during the inspection operation, the television camera will not pass through the entire pipe section from one direction, set up equipment so that the inspection can be performed from the opposite direction, if possible.

Town of Canton WPCA

- D. When manually operated winches are used to pull the television camera through the pipe, use portable radios, telephones or other suitable means of communication between members of the crew located at each end of the pipe section being inspected to insure good communications.
- E. The importance of accurate distance measurements is emphasized. Measurement for location of pipe features/defects shall be by means of a meter device. Marking on the cable or a similar method will not be allowed. Accuracy of the distance meter shall be checked by use of a measuring wheel, tape, or other suitable distance measuring device.
- F. Record the following pipe features/defects, at a minimum, and report them on the inspection logs:
 - 1. Pipe diameter and material of construction.
 - 2. Joint spacing and the location of joints which appear to be damaged, incorrectly installed, shifted, open, or in any way deficient.
 - 3. Location, size and orientation (clock position) of connecting pipes (such as building services in a sewer).
 - 4. Description and location of pipe structural deficiencies such as cracks, breaks, collapses, corrosion/erosion, etc.
 - 5. Description and location of pipe obstructions (such as sediment, roots or grease).
 - 6. Description and location of grade concerns, such as pipe sags, especially in gravity pipes.
 - 7. The locations where infiltration is entering the pipe and an estimated infiltration rate at each location.
- G. Indicate direction of survey and distance to each feature/defect from the beginning of the inspection.
- H. Provide an audio description of each feature/defect observed.
- I. Report on the logs weather conditions, ground conditions, and surface cover.
- J. Repair pipe damaged as a result of the inspections at no cost to the Owner.
- K. Position camera head to reduce risk of picture distortion and along the longitudinal axis of the pipe. In circular pipes, position camera lens centrally, $\pm 10\%$ of the vertical sewer dimension. In non-circular pipes, position camera lens at mid-height and centered horizontally.

3.3 DOCUMENTATION

- A. Television Inspection Logs
 - 1. Prepare television inspection logs describing features/defects identified and their locations.

B. Video Recordings

1. Provide continuous video tape recordings of the inspection view as it appears on the television monitor. The image recorded shall be equal to or better than the quality of the original picture on the television monitor.
2. Provide a visual and voice audio description record of the pipe features/defects observed recorded simultaneously as original live recordings.
3. The audio portion of the recording shall be sufficiently free of electrical interference and background noise to produce an oral report that is clear, complete, and easily discernable. The audio portion of the tape report shall include the location and identification of the pipe section inspected, the direction of travel, a description of the features/defects encountered, and the distance traveled.
4. Provide television inspection video/audio recordings saved onto CD-R/WR or DVD-R media. CDs and DVDs shall be properly identified by video number, location, and project name.
5. Video recordings shall, by electronic means, display continuously and simultaneously generated transparent digital information as described below:
 - a. At the start of each pipe section inspected:
 - 1) Size and length of pipe and pipe material
 - 2) Pipe section reference number
 - 3) Date of inspection
 - 4) Road name/location
 - 5) Direction of inspection (upstream or downstream)
 - 6) Starting time of inspection
 - b. Continuously during the inspection:
 - 1) Automatic update of the camera's position, in feet and tenths of feet from the beginning of the pipe section
 - 2) Upstream and downstream locations (manholes reference numbers for sewers and drains).

END OF SECTION

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SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Concrete Materials
 - 2. Admixtures
 - 3. Concrete Mix
 - 4. Miscellaneous Concrete Materials
- B. Related Sections
 - 1. Section 02315 – Excavation, Backfill, and Compaction
 - 2. Section 02514 – Ductile Iron (DI) Pipe and Fittings
 - 3. Section 02525 – Polyvinyl Chloride (PVC) Pipe and Fittings
- C. Related Sewer Construction Details
 - 1. No. 012 – Cast-In-Place Gravity Sewer Chimney
 - 2. No. 016 – Concrete Encasement for Gravity Sewer
 - 3. No. 021 – Sanitary Sewer Force Main Concrete Thrust Blocks for Horizontal Bends
 - 4. No. 022 – Sanitary Sewer Force Main Concrete Thrust Blocks for Vertical Bends
 - 5. No. 023 – Low Pressure Air Release, Flushing & Cleanout Structure
 - 6. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
 - 7. No. 025 – Low Pressure Sewer Junction Cleanout Structure
 - 8. No. 026 – Low Pressure Sewer Junction Air Release, Flushing & Cleanout Structure
 - 9. No. 029 – Force Main In-Line Air Release, Flushing, and Cleanout Structure
 - 10. No. 030 – Force Main In-Line Cleanout Structure
 - 11. No. 035 – Concrete Sewer Cradle
 - 12. No. 036 – Concrete Pier Pipe Support

1.2 REFERENCES

- A. ACI 301-95 - "Specifications for Structural Concrete for Buildings", (included as part of this specification).

Town of Canton WPCA

- B. ACI 305 - "Hot Weather Concreting".
- C. ACI 306.1-90 - "Standard Specifications for Cold Weather Concreting".
- D. ACI 318-95 - "Building Code Requirements for Reinforced Concrete", American Concrete Institute.
- E. ASTM C33 - "Specification for Concrete Aggregates".
- F. ASTM C42 - "Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete".
- G. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- H. ASTM C131 - "Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine."
- I. ASTM C150 - "Specification for Portland Cement".
- J. ASTM C260 - "Specification for Air-Entraining Admixtures for Concrete".
- K. ASTM C494 - "Specification for Chemical Admixtures for Concrete".
- L. ASTM C535 - "Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine."

1.3 SUBMITTALS

- A. Submit concrete mix proposed for use, indicating design strength, supplier, batch quantities, and constituents. Provide test report copies indicating prior satisfactory performance in accordance with ACI 301.
- B. Provide data and descriptive literature for concrete constituents including admixtures, aggregate tests, bond breaker, bonding agent, and repair grout.
- C. Submit detailed methods proposed for curing and protection of concrete. This submittal shall be made not less than 10 days prior to the placement of any concrete.
- D. Submit a truck load ticket for every concrete delivery. Ticket information shall include batch time and date, weights of all constituents, quantity of admixtures, water added at the batch plant and moisture content of coarse and fine aggregates.
- E. Maintain an accurate daily record of the locations and quantity of concrete placed.

1.4 QUALITY ASSURANCE

- A. Inspection of cast-in-place concrete work, and testing, including slump tests, air content, and standard compression test cylinders may be performed by the WPCA's Technical Consultant. Materials and workmanship may be subjected to inspection and testing in mill, shop and/or field by the WPCA's Technical Consultant. Such inspection and testing shall not relieve Contractor of his responsibility to provide his own inspection, testing, and quality control as necessary to furnish materials and workmanship in accordance with requirements of this Section.
- B. Provide notification prior to the start of any phase of concrete placement work so as to provide the opportunity to inspect the work. Such notification shall be made at least 24 hours in advance of concrete placements and at least 36 hours in advance of other inspections (forms, rebar, etc.).

Town of Canton WPCA

- C. Facilitate inspection and testing by the WPCA's Technical Consultant, and furnish the following:
 - 1. Safe access to the work at all times to make possible proper inspection of work.
 - 2. Full and ample means and assistance for sampling and testing materials and proper facilities for inspection of work in plant and at project site.
 - 3. Covered box large enough to contain twenty-four standard concrete cylinders. At temperatures below 60°F, box shall be electrically heated and thermostatically controlled to maintain inside temperature of 60° to 80°F. Cylinders shall be placed in box immediately after molding and shall be covered with moist burlap until delivery to laboratory, 24 to 72 hours after molding.
 - 4. Access by the WPCA's Technical Consultant to the batch plant supplying the concrete.
- D. Compression tests will typically consist of one set of four cylinders for each test made, cured, and tested by testing laboratories during progress of job. One set of cylinders will typically be taken for every 100 cubic yards of concrete or fraction thereof placed in any one day.
 - 1. One cylinder of each set will be tested for 7-day compressive strength, two cylinders will be tested for 28-day compressive strength. The remaining cylinder will be tested for 56-day compressive strength if either one of the 28-day tests are below the specified strength, otherwise the 56-day test will be eliminated.
 - 2. Specimens will be cured under laboratory conditions. The WPCA's Technical Consultant may require additional cylinders to be cured under field conditions when unusual conditions may tend to reduce concrete strength.
- E. Slump test, to check consistency, will be made from the sample used to mold cylinders. Additional slump tests may be taken of every batch delivered to job site.
- F. Tests for determination of air content will be made as required to verify conformance with the specifications.
- G. Concrete mix shall be redesigned if any of the following criteria are not satisfied:
 - 1. Average 7-day strength of any two tests representing a particular design strength is less than 90 percent of specified 7 day strength or:
 - 2. Average 28-day strength of any two tests representing a particular design strength is less than 100 percent of specified strength.
- H. The average of any three consecutive 28 days strength tests from the same concrete pour representing each class of concrete shall be equal to or greater than specified strength. Not more than 10 percent of strength tests shall have values less than specified strength. No test shall show an average strength (of any one set of cylinders) less than 95 percent of specified strength.
- I. When tests of control specimens fall below these requirements, the WPCA's Technical Consultant may require 56 day cylinder tests or core specimens taken from concrete in questions and tested in accordance with ASTM C42. If these specimens do not meet strength requirements, the WPCA's Technical Consultant has

the right to require additional curing, load tests, strengthening or removal and replacement of those parts of structure which are unacceptable, and in addition, removal of such sound portions of structure as necessary to ensure safety, appearance, and durability of structure.

- J. Any material or workmanship which is rejected, either at the batch plant or at the site, shall be replaced promptly.
- K. Acceptance of work and admixtures at the batch plant shall not prevent final rejection at job site upon arrival or after it has been installed, if work is found to be defective in any way.
- L. In addition to the requirements under paragraph 1.4J, portions of a structure which do not meet requirements of these specifications based on appearance, or for any other aesthetic reason, shall be corrected or removed and replaced as directed by the WPCA's Technical Consultant. .
- M. Work on all new concrete structures shall conform to all requirements of ACI 306.1, Standard Specifications for Cold Weather Concreting by the American Concrete Institute, except as modified herein.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: shall be American-made Portland Cement, free from water soluble salts or alkalies which will cause efflorescence on exposed surfaces. Portland Cement shall be Type II, ASTM C150. Air entraining cements are prohibited.
- B. Normal weight Fine Aggregate: washed, inert, natural sand conforming to ASTM C33 and the following additional requirements.

Sieve	Retained Percent
#4	0 - 5
#16	25 - 40
#50	70 - 87
#100	93 - 97
Fineness Modulus	2.80 (plus/minus 0.20)
Organic	Plate 2 maximum
Silt	2.0 percent maximum
Mortar Strength	100 percent minimum compression ratio
Soundness	5 percent maximum loss, magnesium sulfate, five cycles

- C. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33 and the following additional requirements:

Size	¾ inch, F.M. 6.70 +/- 0.20
Organic	Plate 1 maximum
Silt	1.0 % maximum
Soundness	5% maximum loss, magnesium sulfate, five cycles

Additionally, all coarse aggregates shall not exceed 35% by weight "percentage of wear" as determined by the Los Angeles Abrasion Tests in ASTM C131 and C535.

- D. Water - shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.

2.2 ADMIXTURES

- A. Water-reducing agent:

1. Daracem - 55 W.R. Grace & Co.
2. "Pozzolith 220N" - Master Builders, Inc.
3. "Eucon WR" - Euclid Chemical Co.
4. Or approved equal conforming to ASTM C494 Type A.

Note: Water-reducing agent shall be by same manufacturer as air-entraining agent.

- B. Air-entraining agent:

1. "DAREX AEA" - W.R. Grace & Co.
2. "MB-VR" or "MB-AE" - Master Builders, Inc.
3. "Air-Mix" - Euclid Chemical Co.
4. Or approved equal conforming to ASTM C260.

- C. Admixtures which retard setting of cement in concrete shall not be used without written approval of the WPCA's Technical Consultant. Admixtures causing accelerated setting of cement in concrete shall not be used.

2.3 CONCRETE MIX

- A. Select proportions of ingredients to meet the design strength and materials limits specified and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportioning shall also conform to the requirements in ACI 301 and ACI 318.

- B. The design mix shall be selected based on previous test records for a mix with essentially the same proportions, and meet the following limiting values:

Minimum Allowable 28 day Compressive Strength (psi)	Maximum Allowable Water/Cement Ratio	Total Cementitious Material (Pounds)	
		Min	Max
4000	0.45	611	635

- C. If sufficient test records are not available, (at least 30 consecutive strength tests or two groups of tests totaling at least 30 within the past 12 months), the design mix shall be developed using laboratory trial mixtures in accordance with ACI 301.

- D. All concrete is normal weight with air-dry weight not to exceed 150 lbs. per cubic foot.
- E. All concrete shall contain the approved air-entraining admixture as per manufacturer's written instructions to provide entrained air by volume in the cured concrete between 4.5 and 6.5%.
- F. The approved water-reducing admixture shall be used in all concrete, in accordance with manufacturer's written instructions.

2.4 MISCELLANEOUS MATERIALS

- A. Grout: ready-to-use, non-metallic, non-shrink aggregate product requiring only the addition of water at the job site. Grout shall be as manufactured by Five Star Cement; U.S. Grout Corp.; or an equivalent product by Saverisen Cements Co., Pittsburgh, Pennsylvania. Grout shall be easily workable and shall have no drying shrinkage at any age. Compressive strength of grout (2 inch by 2 inch cubes) shall not be less than 5000 psi at 7 days, and 7500 psi at 28 days.
- B. Bond Breaker:
 - 1. Provide an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.
 - 2. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a non-staining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors, Inc., Silco seal 77, by SCA Construction Supply Division, Superior Concrete Accessories or equal.
- C. Bonding Agent:
 - 1. Provide a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881, Type II. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, NJ, Concessive Liquid (LPL) by Master Builders of Cleveland, OH or equal.
 - 2. Latex bonding agent shall be a non-remulsifiable acrylic-polymer latex conforming to ASTM C1059 Type II.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify cover requirements over all reinforcement.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.
- C. Verify site conditions to insure that full access is available for placement of concrete.

3.2 JOINTS

Town of Canton WPCA

- A. Construction and expansion joints indicated on the approved Drawings are mandatory and shall not be omitted. Construction joints shall conform to the following:
 - 1. Before placing new concrete against concrete already in place and hardened, the surface shall again be cleaned with a jet where practical. The exposed aggregate shall then be mopped with a mortar composed of the same proportions of sand and placed and mopped in place immediately prior to the placing of concrete and shall not have set up or hardened prior to the placing of concrete.
 - 2. Where joints other than those shown are required, they shall be made at such locations as the WPCA's Technical Consultant may allow, and shall in no case impair the structural strength of the structure.
- B. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subject to approval of the WPCA's Technical Consultant.

3.3 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

- A. Concrete shall be ready-mixed, produced by a central batch plant. Hand or site mixing shall not be allowed. Constituents, including admixtures, shall be batched at central batch plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer.
- B. Central plant and rolling stock equipment and methods shall conform with Truck Mixer and Agitator Standard of Truck Mixer Manufacturer's National Ready-Mixed Concrete Association, ASTM C94, ASTM C685, and Contract Documents. Consistency of concrete at time of placement shall be at a 3 inch slump, +/- 1 inch.
- C. Ready mixed concrete shall be transported to site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site shall be within one and one-half hours after cement is first introduced into the aggregates. Concrete with a temperature greater than 90°F. shall be rejected and removed from the site.

During any of the following conditions: high ambient temperature, high concrete temperature, low relative humidity, increased wind velocity, high solar radiation, when the temperature of the concrete is 85°F or above, the time between the introduction of cement to the aggregates and discharge shall not exceed one hour. In addition, when the rate of evaporation on the surface of the concrete is expected to approach 0.2 lb/ft²/hr. (see chart in ACI 305R) special precautions shall be taken against the formation of plastic shrinkage cracking on the surface of the concrete after placement.

During any period when for more than three successive days the average daily outdoor temperature drops below 40°F, the concrete temperature at the time of placement shall be as specified in below:

Least dimension of section, inches.	Minimum temperature of concrete as placed and maintained during the protection period, °F	Maximum gradual decrease in surface temperature during any 24 hours after end of protection, °F
Less than 12	55	50
12 to less than 36	50	40
36 to 72	45	30
Greater than 72	40	20

Central mixed concrete shall be plant mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged.

- D. Retempering of concrete which has partially hardened by mixing with or without additional cement, aggregates, or water will not be permitted.

3.4 PLACING CONCRETE

- A. Remove excess water and foreign matter from forms and excavations. Do not place concrete on frozen soil. Provide adequate protection against frost action during freezing weather.
- B. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcements, and which avoid re-handling. Do not deposit partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and shape to ensure continuous flow in chute. Flat (coal) chutes shall not be used. Chutes shall be of metal or metal lined and uniformly sloped. Slope shall not be less than 25° nor more than 45° from horizontal. Concrete shall be lowered and maintained as near to the surface of deposit as practicable. The chute shall be thoroughly cleaned before and after each use and debris and any water shall be discharged outside of the forms. Concrete shall not be allowed to flow horizontally over distances exceeding 10' or dropped vertically over 6'.
- C. Place concrete in such a manner as to prevent segregation and accumulations of hardened concrete on forms or reinforcement above the grade of concrete being placed.
- D. Thoroughly consolidate each layer of concrete by rodding and vibrating using internal type mechanical vibrator. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normal weight concrete shall operate at speeds of not less than 7,000 vpm and be of suitable capacity. Do not use vibrators to move concrete. Vibration shall be supplemented by spading to remove bubbles and honeycombs adjacent to visible surfaces. At least one vibrator shall be on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting concrete placement.
- E. Deposit concrete continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of

seams and planes of weakness within the section. If a section cannot be placed continuously between planned construction joints, as specified, field joints and additional reinforcement shall be introduced to preserve structural continuity.

- F. Cold joints, particularly in exposed concrete, including "honeycombs", are unacceptable. If they occur in concrete surfaces exposed to view, the WPCA's Technical Consultant may require that entire section in which blemish occurs be removed and replaced with new materials.

3.5 CONCRETE ENCASUREMENT FOR PIPELINES

- A. Backfilling of the pipe trench shall not commence until the WPCA's Technical Consultant approves such actions.
- B. Concrete encasement at stream crossings shall extend to at least 10-feet to either side of the stream.
- C. Concrete encasement at culvert crossings and beneath stone/retaining walls, shall extend at least 3-feet to either side of the structure.
- D. For certain installations, the WPCA's Technical Consultant may require the additional concrete encasement to protect the sewer pipe and surrounding utilities and structures.

3.6 FINISHING OF CAST-IN-PLACE CONCRETE

- A. Upper Horizontal Surfaces
 - 1. All horizontal surfaces not subjected to wear, such as tops of parapets, copings, walls, etc., shall be formed by placing an excess of material in the forms and removing or striking off such excess with a template, forcing the coarse aggregate below the surface of the mortar.
 - 2. All horizontal surfaces shall be attained by striking off excess concrete and in no case shall concrete be added to the tops of walls, etc., once initial set has taken place.
 - 3. The top of such surfaces shall be finished in a manner as required and dictated by the necessary appearance of the part being finished. For covered surfaces, a wood float finish will in most cases be sufficient. Steel troweling may be necessary where concrete is exposed to view and adjacent surfaces have a steel trowel finish. In other cases, a "broom" finish may be required.
- B. Slab Surfaces - In general, all exterior slabs shall have a wood or magnesium trowel non-slip finish. The finish shall be accomplished by a procedure as follows:
 - 1. "Wood Float Finish" - The surface shall be screeded, given a minimum of one steel troweling and shall then be finished with a wood, cork or other float as required to produce the desired finish. In cases where a rough wood float finish is sufficient, the above procedure may be executed, omitting the steel troweling
 - 2. "Broom Finish" - On exterior work such as sidewalks and where else called for, a broom finish shall be used. The finishing shall be accomplished in the following manner. Screeding shall be done and the surface worked up with a

wood float. At a proper time thereafter, the surface shall be steel troweled at least once and more if so directed. Upon completion of troweling, a sufficiently stiff bristled broom shall be drawn lightly across the surface to produce a slightly striated finish. The brooming shall in general be in a direction of 90° to the longitudinal axis of the completed work as in the case of sidewalks and stair treads.

3. For all of the finishing procedures described, the time element is important and something that must be determined during the progress of the work as conditions warrant. Normally, free water on the surface of concrete should not occur. The Contractor shall wait for the concrete surface to dry before starting finishing operations. Do not, under any circumstance, add dry cement to wet areas in order to accelerate drying. All finishing and rubbing required for all parts of the work shall be by competent "Cement Finishers" trained for the work.

C. Formed Surfaces

1. Immediately after the end of the wet cure period, remove form ties and patch all tie-holes, rat holes, and other surface voids with a non-metallic, non-shrink grout, which most nearly matches the color and texture of the concrete surface. All protrusions shall be ground smooth with an approved mechanical grinder.

D. Surfaces Requiring Rub Finish

1. Rubbed finish of surfaces shall be provided on all poured interior and exterior vertical concrete surfaces and the underside of horizontal surfaces exposed to view, including all building and structure surfaces. Rubbing shall include but not be limited to:
 - a. The exterior face of all building foundation walls, platforms and the like, from the top of the walls to 6 inches below grade, the interior faces of all building walls and ceilings, stair risers, retaining walls, stair cheeks, and the like.
2. All surfaces requiring a rubbed finish shall, when completed, shall present a smooth, even textured surface and proper appearance. The WPCA's Technical Consultant shall be the sole judge of the acceptability of a rubbed finish. All cement utilized in rubbing shall be of the same type manufacturer and source as that used in batching the concrete. The following procedure shall be required for all surfaces requiring a rubbed finish.
 - a. Immediately upon removal of the forms, snap all form ties and fill tie holes with non-shrink grout to a point slightly indented from the finished surface. Hand chip all air pockets and laitance covered holes greater than 1/4 inch. A mechanical grinder of a type approved by the WPCA's Technical Consultant shall then be used to remove any form marks, ribs, or bulges, or other protruding surface defects.
 - b. The surface shall then be wetted with clean water and a cement (4 parts), presifted fine sand (5 parts), and water grout shall be evenly

applied utilizing a sponge float filling all exposed voids. The surface shall be rubbed with a burlap bag and allowed to thoroughly dry.

- c. The surface shall again be wetted and the grout reapplied with the sponge float and again rubbed with burlap, removing all excess material.
- d. After the final rubbing is completed, the surface shall be thoroughly drenched and kept wet for a period of 7 days unless otherwise directed by the WPCA's Technical Consultant. No other cement powder, grout or other surface coating will be allowed. Plastering of surfaces requiring a rubbed surface will NOT be tolerated.

3.7 CURING AND PROTECTION

- A. When concrete is placed at or below an ambient air temperature of 40°F. or whenever this temperature or lower values are likely to occur within 48 hours after placement of concrete, cold weather concreting procedures, according to ACI 306.1 and as specified herein, shall be followed. The entire area affected shall be protected by adequate housing or covering, and heating. No salt, chemicals or other foreign materials shall be used in the mix to lower the freezing point of concrete. No oil or kerosene heaters shall be utilized.
- B. No frozen materials shall be used in batching concrete and any ice shall be removed from coming into contact with the concrete.
- C. Protect concrete work against injury from heat, cold, and defacement of any nature during construction operations.
- D. Concrete shall be treated and protected immediately after concreting or cement finishing is completed, to provide continuous moist curing above 50°F. for at least seven days, regardless of ambient air temperatures.
- E. All concrete shall be cured immediately after finishing in accordance with the following requirements:
 - 1. Curing shall be accomplished by a continuous soaking process such as the use of soaker hose or sprinklers, or by use of plastic roll materials to cover the concrete, which shall be thoroughly wetted at least once a day or more often as required in very hot weather. Such plastic shall be placed as soon as possible after finishing of concrete as is proper so that scarring of the surface will not occur. Plastic shall be held in place on the surface of the concrete in such a manner and means as will not allow it to be blown off or otherwise dislodged from the concrete surface. Curing procedures shall be maintained continuously for a period of at least 7 days.
 - 2. All methods of curing shall be subject to approval of the WPCA's Technical Consultant, and each method employed shall be practical and adequate for the curing required. Curing compounds in lieu of wet curing will not be allowed.
- F. Keep permanent temperature records showing date and outside temperature during concreting operations. Thermometer readings shall be taken at start of work in morning, at noon, and again late in afternoon. Locations of concrete placed during such periods shall likewise be recorded in such manner as to show any effect temperatures may have had on construction.

3.8 REMOVAL OF FORMWORK

- A. Forms shall not be removed until concrete has attained sufficient strength to support its own weight, construction loads to be placed thereon and lateral loads, without damage to structure or excessive deflection.
- B. Forms for construction joint bulkheads and keyways may be removed the following day, after the concrete pour. Extreme caution must be used to avoid damage to the concrete surface and keyway.

3.9 REPAIRING OF HARDENED CONCRETE SURFACES

- A. Defective concrete and honeycombed areas shall not be patched unless examined and approval is given by the WPCA's Technical Consultant. After approval, areas involved shall be cut back to a minimum depth of 1 inch from the finished surface, or as otherwise directed, whichever is greater. Edges of areas to be repaired shall be cut square to a minimum depth of 3/4 inch. Feathered edges will not be allowed. Any voids or honeycomb around reinforcing steel shall be chipped away to provide at least 3/4 inch clearance all around to permit proper placement of repair concrete around the steel to the parent, sound concrete.
- B. All exposed surfaces shall be thoroughly cleaned of all mud, paint, grime, scum, laitance, organic matter, detritus, calcareous growth and all other foreign matter by sand and water blasting or other acceptable means. Immediately after cleaning, the surface may be checked by the WPCA's Technical Consultant for proper surface preparation, including fractured concrete or loose aggregate. Any such material shall be removed using pneumatic or hand tools. The final surfaces shall be thoroughly rinsed with clean water to remove all remaining dirt and dust.
- C. Premoisten the prepared surface for at least two hours or reduce absorption of water by the parent concrete and to provide a reservoir for moist curing at the interface of the repair. The substrate should be saturated surface dry with no standing water. While the concrete surface is still damp, apply a thin 1/16 inch coat of neat cement slurry (mixed to the consistency of a heavy paste) with a bristle brush to provide a bond coat throughout the entire cavity of the repair. Before the slurry has dried or changed color, promptly install the repair concrete or dry-pack, as may be required or selected.
- D. For relatively small areas, ram repair concrete into this portion of the formed void. This concrete shall comprise a crumbly-dry 1-1-1.5 mixture of cement, concrete sand and pea gravel (or 3/4 inch gravel) mixed slightly damp to the touch (just short of "balling"). The "dry-pack" consistency of the concrete shall be zero slumps, but moist enough so that when it is rodded and tamped until dense, an excess of paste will appear on the surface in the form of a spider web. In cases of unformed voids of thinner section, do not build-up repair in excess of a depth which will sag with the weight of the fresh mortar or concrete. Trowel smooth with heavy pressure.
- E. In all cases, the concrete shall be of the driest possible consistency and mix composition so that it can be worked into the corners and angles of forms and around the reinforcement, without permitting the materials to segregate or free water to collect on the surface, due consideration being given to the methods of placing and compacting. Source and mixture of concrete shall be submitted for approval.

Town of Canton WPCA

- F. Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited which has hardened sufficiently to cause the formation of seams and planes of weakness within the section. All concrete shall be thoroughly consolidated and trowelled dense, smooth and plane. Avoid premature and excessive trowelling which could cause sagging.
- G. All repair areas and adjacent parent concrete surfaces shall be treated immediately after finishing to provide continuous moist curing without change in color for at least 7 days. Surfaces shall be covered with damp burlap and sealed with taped polyethylene. Membrane curing compounds shall not be used.
- H. Leave finished work and adjacent concrete surfaces in a neat, clean condition with no evidence of spillovers or staining.

3.10 CLEANING

- A. Concrete surfaces shall be cleaned of objectionable stains as determined by the WPCA's Technical Consultant. Materials containing acid in any form or methods which will damage the "skin" of concrete surfaces shall not be employed, except where otherwise specified.

END OF SECTION

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SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes description of Contractor's responsibilities regarding painting including the following:
 - 1. Interior and exterior sides of hollow metal steel doors and frames.
 - 2. Wetwell interior and exterior.
 - 3. All aluminum or steel in contact with or embedded in concrete or masonry.
 - 4. All exposed electrical conduit, conduit fittings and outlet boxes.
 - 5. All interior equipment, valves and piping.
 - 6. Outdoor carbon steel from generator exhaust, LPG, and natural gas piping.
 - 7. All exposed piping.
 - 8. Walls, floors and ceilings
 - 9. All piping support systems.
 - 10. Back painting all steel, including lifting beams, lintels, and door frames that will be inaccessible to finish painting.
 - 11. Touch-up priming of shop primers.
- B. Complete painting in accordance with the Specifications and the paint manufacturer's current surface preparation and application instructions.
- C. Items which are specified to receive factory painting shall not be covered under this Section, except for compatibility of primer coatings.

1.2 REFERENCES

- A. Steel Structures Painting Council (SSPC):
 - 1. Paint Application Specifications PA 1-64, No. 1 Shop, Field and Maintenance Painting.
 - 2. Surface Preparation Specifications; No. 5 White Metal Blast Cleaning (SP 5-63), No. 10 Near-White Blast Cleaning (SP 10-63T), No. 6 Commercial Blast Cleaning (Sp 6-63) and NO. 3 Power Tool Cleaning (SP 3-63), including 1971 editorial changes.
- B. Military Specifications for Primer (Wash) Pretreatment, Blue (Formula No. 117-B for Metals), MIL-P-15328C(1).
- C. ANSI Standards - Comply with ANSI A13.1 for lettering size and viewing angles of identification devices.
- D. Occupational Safety and Health Association (OSHA).

Town of Canton WPCA

1.3 SUBMITTALS

- A. List of coating products proposed, giving brand, type and manufacturer.
- B. Manufacturer's current printed recommendations and product data sheets for each.
- C. Field painting applicator's correspondence for determining compatibility of field coatings with primers and for selecting manufacturer producing field coats.
- D. Submit color chips of materials proposed, and sample panels of paints and coatings selected. Make samples not less than 12 inches square, on sheet metal for metal coatings and on cement asbestos board for masonry and concrete coatings.
- E. When requested by the WPCA's Technical Consultant, provide product container labels and labeled mixing instructions for products utilized in the work.

1.4 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL

- A. Store paints and painter's materials only in areas designated solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal, to these areas.
- B. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.
- C. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours. Finally, dispose of waste in an approved disposal system.

1.5 DELIVERY, HANDLING, STORAGE, PROTECTION

- A. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated outdated, prematurely opened, or diluted materials.
- B. Store coated items carefully. Avoid damaging or dirtying coatings by contact with soil, pavement or other harmful materials which might necessitate special cleaning. Use suitable blocking during storage.
- C. Do not expose primed surfaces to weather for more than six months before top coating. Allow less time if recommended by coating manufacturer.
- D. During surface preparation, cleaning and painting operations, protect all surfaces not to be painted.
- E. Protect coated items, whether prime or finish, from damage due to shipping and handling. Use padding, blocking, fabric slings and extra care as required.
- F. Upon completion of field painting, ensure coatings are undamaged and in good condition. Make good damaged or deteriorated coatings resulting from failure to observe foregoing requirements.

1.6 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

Town of Canton WPCA

2. Do not apply coatings when dust is being generated.
- B. Protection:
 1. Cover or otherwise protect finish work of other trades and surfaces not being painted concurrently or not to be painted.
- C. All shop primed ferrous metals shall be primed using the same coatings specified for field applied touch-up priming in the field paint schedule.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

- A. Paint Coatings - Suitable for intended use, recommended by their manufacturer for intended service.
- B. Products Used - Minimum of five years satisfactory use under similar service conditions.
- C. Use products of one manufacturer in any one paint coating system; all coating materials compatible. Coatings for touch-up; same as original.

2.2 COLORS AND FINISHES

- A. All finish colors shall be as selected from manufacturer's color chips. The WPCA will select the colors. Match final colors to selected color chips, as scheduled.
- B. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.
- C. Unless otherwise indicated, for finish paint use gloss or semi-gloss on metal and concrete.

2.3 COATING TYPES

- A. Coatings are described in the following list with minimum dry film thicknesses (DFT) required and abbreviations for identification on PAINT SCHEDULE:

Town of Canton WPCA

COATING SCHEDULE

Abbr.	Description (Minimum solids content by volume)	DFT/Coat (Mils)	Tnemec Brand	Valspar Brand	Kop-Coat Brand
APE	Aliphatic Polyurethane Enamel (49 Percent)	1.5-2.0	Endura-Shield Series 70	40 Series	1122BRS
BF	Block Filler (50 percent)	100 sq. ft./gal.	54-562 Masonry Filler	79-W-8	Flexide Block Filler
CTE	Coal Tar Epoxy (74 Percent)	14.0-20.0	Tneme-Tar 46H-413	578 J-1	Bitumastic 300M High Build
EP	Epoxy Primer (54 percent)	3.0-4.0	Epoxo-line Series 66	89 Series	340 Gold Primer
FPE	Floor Polyamide Epoxy (47 percent)	3.0	Tneme-tread Series 67	V84 Series	Glamorglaze 200 Epoxy
HSL	High Solids Liner (83 percent)	8.0-10.0	Tneme Liner Series 61	24 Series	Super Hi-Gard 891
PE	Polyamide Epoxy Finish (56 percent)	4.0-6.0	Epoxo-line Series 66	89 Series	Hi-Gard Epoxy Coating
PEF	Polyamide Epoxy Finish (80 percent)	8.0-10.0	Ceram-Ion II Series 83	24 Series	Super Hi-Guard Epoxy Coating
PVA	Polyvinyl Acrylic Primer (28 percent)	2.0-3.0	PVA Sealer- Primer 51-792	79-W-1	620 Acrylic
WBE	Water Based Epoxy (41 percent)	3.0	Series 111 & 112 Tneme-Tuf Coat	Water Epoxy Enamel 5 Series	600 Acrylic

- B. Description of coating types includes minimum acceptable percent, by volume of component solids. Brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO; Kop-Coat, Inc., Pittsburgh, PA; and Valspar Corp., Short Hills, NH, or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work.
- B. Do not proceed with surface preparation or coating application until conditions are suitable.

3.2 PREPARATION

- A. Basic Steps:
 - 1. Arrange to do all preparation and paint work in heated enclosure unless ambient weather conditions ensure still, dry air and 50°F. temperature. Do not apply paints to surfaces in direct sunlight.
 - 2. Coordinate cleaning and painting operations to eliminate contamination of one by the other.
 - 3. Maintain all coating materials at manufacture's recommended mixing and application temperatures for not less than 24 hours before use. Have clean, proper containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.
 - 4. Ensure proper coordination of materials to be applied hereunder with previous coatings on affected surfaces. Have all manufacturers' written directions on hand, and follow them strictly, except where otherwise specified.
 - 5. Carefully coordinate preparation and material compatibility requirements of paint systems used by manufacturers to shop prime equipment.
- B. Before any paint application, carefully clean all surfaces to be coated of dust, dirt, grease, rust, mill scale, paint unsuitable for top coatings, efflorescence, oil, moisture, foreign matter or conditions detrimental to coating bond and durability.
 - 1. Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.
 - 2. Fill imperfections and holes in surfaces to be painted.
- C. Metals:
 - 1. Ferrous metals, including field welds and unprimed shop welds without shop prime coats, shall be prepared in accordance with the following standard specifications:
 - a. Commercial blast cleaned (SSPC-SP-6).
 - b. Near-white Blast Cleaning (SSPC-SP-10).
 - c. White Metal Blast Cleaning (SSPC-SP-5).
 - 2. A Needle gun may be used for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface.

Town of Canton WPCA

3. Ferrous metals with shop primers cleaned as previously specified, shall be prepared in accordance with the manufacturer's recommendations.
 4. Bituminous coated metals for paint finish-clean of all dirt, grease, oil and foreign matter, and prime with a barrier coat to seal the bitumen and prevent bleeding and discoloration of finish.
 5. Non-ferrous and galvanized metal surfaces for finish; clean of all dirt, grease, oil and foreign substance, wash thoroughly with grease solvent, then permit to dry. Apply coatings as outlined in Section 3.06A.
- D. Provide a high degree of cleaning for acceptable equivalent paint products when recommended by the paint manufacturer in his printed surface preparation recommendations.
- E. Concrete unit masonry for paint finishes:
1. Clean thoroughly by brushing, scraping and sanding or grinding slick areas.
 2. Solvent wash oil, grease, and paint spots before applying block filler.
- F. Before applying field coat, touch-up abraded areas of shop coats with paint of the same type. Apply an entire coat if necessary. Touch-up coats are in addition to, and not a substitute for first field coat. Clean deteriorated surfaces to bare metal before applying touch-up coat.
- G. After installation and before applying field coats, touch up all scratches and blemishes on equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer.

3.3 APPLICATION

- A. In general, apply minimum of one under coat and one finish coat to all previously primed surfaces. Following careful inspection of surfaces not previously primed, prepare and clean as specified, apply proper prime coat and minimum of one under coat and one finish coat. Refer to Paint Schedule at end of section.
- B. Conditions:
1. Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing. Avoid painting of surfaces while they are exposed to the sun.
 2. Paint surfaces which have been cleaned, pretreated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.
 3. Coat blast cleaned metal surfaces immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.
- C. Methods:
1. Spraying with an adequate apparatus may be substituted for brush application of suitable paints and in locations suitable for spraying.

Town of Canton WPCA

2. Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations, except where specifically directed otherwise. Control temperature of materials upon mixing and application, surface temperature and condition, thinning and modifying.
3. Protect surfaces to be coated, before, during and after application unless ambient weather conditions are favorable.

D. Workmanship:

1. Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.
 - a. Control thinning for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.
 - b. Record quantities of materials of each type, for each coat, used.
2. Apply paints and coatings using skilled painters, brushed or rolled out carefully to a smooth, even coating without runs or sags. Flow enamel on evenly and smoothly. Allow each coat of paint to dry thoroughly, on the surface and throughout the film thickness, before the next coat is applied. High polymer coatings may be excepted from the drying requirement if recoat time is specified by manufacturer.
3. Finish surfaces - Uniform in finish and color, and free from flash spots and brush marks.
4. Accessory items, finish hardware, lighting fixtures, escutcheons, plates, trim and similar finish items not to be painted: Remove or carefully mask before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.

3.4 PROTECTION AND CLEAN-UP

- A. Protect all materials and surfaces painted or coated under this section, from time of surface preparation until the final coat has fully dried. Also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of this work. Upon completion of the work, clean up all paint spots, oil, and stains from floors, glass, hardware, and similar finished items.

3.5 PAINT SCHEDULE

- A. Coordinate, schedule and confirm the various cleaning, touch-up and finishing operations. Ensure the transmission of materials data, color selections and coating system methods between the coating applicators. Take responsibility for not exceeding exposure and recoat time limits.

Town of Canton WPCA

PAINT SCHEDULE

Surface or Item	Shop Primer	Paint Coats		
		1st	2nd	Final
Interior Concrete Masonry Units	--	BF	PE	PEF
Exposed hollow metal doors, pressed metal frames and window frames	EP	EP	PE	APE
Aluminum imbedded in or in contact with concrete or masonry	--	CTE	--	--
Exposed electrical conduit, conduit fittings, and outlet boxes against concrete	--	PE	--	APE
Ferrous metal equipment	EP	EP	PE	APE
Non-ferrous surfaces including copper pipes	--	PE	--	APE
Exposed ductile iron, fittings and valves	EP	EP	--	PE
Exposed interior structural steel	EP	EP	PE	APE
Piping and duct support systems	--	EP	EP	PE
Vent pipes	EP	EP	--	PE
Concrete Floors	--	FPE	--	FPE
Wetwell Interior/Exterior	--	CTE	CTE	--
Wood, exterior	--	PVA	APE	APE
Wood, interior	--	PVA	HSL	HSL
Drywall	--	PVA	WBE	WBE

B. Color code all piping in accordance with the following schedule. Stainless steel and PVC piping will not be painted. For stainless steel and PVC, color coding shall apply to the background color of the identification markers.

<u>Pipe</u>	<u>Color</u>
Sewage	Gray
Potable Water	Blue
Plant Water	Orange
Drain Lines	Gray
Seal Water	Orange w/ Yellow Bands
Gas Pipes	Red

C. Bands for the above colors shall be 2 inch bands painted on pipes at approximately 10 foot intervals.

Town of Canton WPCA

3.6 FINAL TOUCH-UP

- A. Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish as necessary or required to leave surfaces in perfect condition.
- B. After doors have been fitted and hung, refinish edges, tops and bottoms.

END OF SECTION

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SECTION 11000

EQUIPMENT - GENERAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. This Section of the Specifications covers the general requirements for equipment and related services.
2. Handling, storage, and installation of materials and equipment during the progress of the work.
3. Furnish and install anchor bolts, assembly hardware, and foundations.
4. Provide the services of Manufacturer's Representatives for start-up, inspection, and testing.
5. Provide lubricants, spare parts, nameplates, special tools, and safety equipment.
6. Surface preparation and shop prime painting of equipment.
7. Off-site inspection.
8. Equipment substitutions.
9. O&M manuals for all mechanical and electrical equipment furnished.

B. Related Sections

1. Section 03310 - Cast-In-Place Concrete
2. Section 11306 - Pumping System Components

1.2 SUBMITTALS

A. Operation and Maintenance Manual

1. Submit Operating and Maintenance Manual, as well as parts list for accessories provided under this section. Include product data, shop drawings, and wiring diagrams in the maintenance manual.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Anchor bolts, nuts, washers, bolt sleeves, and assembly hardware shall be Type 316 stainless steel. Expansion bolts shall be "Thunderstuds", as manufactured by Unifast Industries, Inc., Hauppauge, NY 11788; Redhead "Wedge Anchors" as manufactured by ITT Phillips, Michigan City, ID 46360; Parabolt as manufactured by the Molly Division Emhart Corp., or approved equal. All expansion bolts and associated hardware are to be stainless steel.

PART 3 EXECUTION

3.1 ERECTION, INSTALLATION, APPLICATION

- A. Handling, Storage and Installation - The Contractor shall provide dry, heated, ventilated storage facilities for materials and equipment awaiting incorporation in the Work. He shall be responsible for the protection, loss of, or damage to materials and equipment furnished until final completion and acceptance of the work. Storage and demurrage charges by suppliers and transportation companies shall be borne by the Contractor. Defective material and equipment shall be removed immediately from the site of the work.
- B. Anchor Bolts, Inserts and Assembly Hardware
 - 1. Anchor bolts and expansion bolts shall be provided by the manufacturer and set accurately in the work by the Contractor. Anchor bolts that are set before the concrete has been placed shall be carefully held in templates of approved design. Where indicated on the drawings, specified, or required, anchor bolts shall be provided with square plates at least 4" by 4" by 3/8" or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, or spalling concrete during the drilling and setting. The WPCA's Technical Consultant shall approve the setting of expansion bolts after placement of concrete.
 - 2. Concrete inserts shall be designed by the manufacturer to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.
 - 3. Assembly hardware shall be provided in accordance with the complete parts list by the manufacturer. All assembly hardware shall be 316 stainless steel, labeled, and packaged separately for delivery to the job site.
- C. Foundations, Installation, and Grouting
 - 1. The Contractor shall furnish the necessary materials and construct concrete foundations for all equipment installed. Foundation size and elevations may be determined in the field by the WPCA's Technical Consultant. The tops of foundations shall be at such elevations as will permit grouting as specified below.
 - 2. All equipment shall be installed by skilled mechanics in accordance with the instructions of the manufacturer.
 - 3. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1" for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work.

Town of Canton WPCA

Unless otherwise approved, all grout shall be an approved non-metallic non-shrink grout.

4. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a 1" chamfer around the top edge of the finished foundation.
5. Foundations shall be rubbed in accordance with Division 3 requirements.

D. Services of a Manufacturer's Representative

1. The Contractor shall arrange for a qualified service representative from each company manufacturing or supplying equipment to perform the work herein described.
2. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:
 - a. Soundness (without cracked or otherwise damaged parts).
 - b. Completeness in all details, as specified.
 - c. Correctness of setting, alignment, and relative arrangement of various parts.
 - d. Adequacy and correctness of packing, sealing and lubricants, etc.
3. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.
4. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the WPCA's Technical Consultant a complete, signed report of the results of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report shall certify that the equipment (1) has been satisfactorily installed and conforms to the contract requirements; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping, supports or anchor bolts; (4) has been operated under full load and operates satisfactorily; and (5) that nothing in the installation will render the manufacturer's warranty null and void.
5. After the WPCA's Technical Consultant has reviewed the reports from the manufacturer's representatives, the Contractor shall make arrangements to have the manufacturer's representatives present when the field acceptance tests are made.

Town of Canton WPCA

E. Lubricants

1. Prior to testing and acceptance, the Contractor shall furnish a one year's supply of all lubricants recommended by the manufacturers of each component of the equipment furnished and installed.

F. Spare Parts

1. Spare parts shall be packed in suitable containers or boxes bearing labels clearly designating the contents and the piece of equipment for which they are intended. Spare parts to be provided are defined in the applicable Sections.

G. Special Tools

1. For each type of equipment furnished, the Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices) that may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.
2. Special tools are considered to be those which because of their limited use are not normally available, but which are necessary for the particular equipment.

H. Nameplates

1. Each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation. Motor nameplates shall be provided.

I. Equipment Drive Guards

1. All equipment driven by open shafts, belts, chains, or gears shall be provided with approved all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized 1" mesh screen (woven wire or expanded metal) set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. Equipment guards shall conform to all applicable OSHA requirements.

J. Protection Against Electrolysis

1. Where dissimilar metals are used in conjunction with each other, suitable installation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coating, non-metallic separators or washers, or other approved materials.

K. Surface Preparation and Shop Prime Painting

1. Paint System: Upon receipt of approval by the WPCA's Technical Consultant, the Contractor shall notify all equipment and material suppliers of the selected manufacturer of the paint for the project. Written direction shall be given to each supplier by the Contractor with prime paint designations, colors, and mill thickness coverage requirements. Primer paint must be of the

Town of Canton WPCA

same manufacturer as the field applied top coats. Surface preparation and shop priming shall be in accordance with the provisions of Section 09900 unless otherwise specified in Division 11 Sections. Standard manufacturers' finishes are not acceptable. Chains, sprockets, gears and the like shall be shipped from the factory with a heavy coating of protective grease.

2. Certain equipment is specified to be field prepared and field primed. Refer to appropriate equipment sections for definition.

L. Gauges

1. Gauges shall be furnished on the suction and discharge of each pump. In addition, gauges shall be furnished on equipment as defined by appropriate equipment sections.

M. Off-Site Inspection

1. Fabrication, manufacture, painting or testing work may be inspected by the WPCA's Technical Consultant before shipment. The Contractor shall give notice to the WPCA's Technical Consultant of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the WPCA's Technical Consultant in ample time so that the necessary arrangements for the inspection can be made.

N. Plant Equipment Substitutions Which Cause Engineering and Contract Changes

1. Plant equipment installation as shown on the approved Plans and as specified herein, shall be based on the equipment furnished by one manufacturer.

3.2 PERFORMANCE TESTS - GENERAL

- A. All equipment, components and systems, including those furnished by subcontractors, must be demonstrated to achieve compliance with the specified performance requirements.
- B. The Contractor shall furnish, at his expense, all chemicals required for the shake-down and the performance testing of all systems furnished.

END OF SECTION

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SECTION 11240

CHEMICAL FEED AND STORAGE SYSTEM

PART 1 GENERAL

1.1 SCOPE

- A. U.S. Filter's Bioxide® is specified for controlling odors generated from the formation of Hydrogen Sulfide in the collection system.
- B. Work under this section includes a complete chemical feed system for the control of hydrogen sulfide. The system shall consist of a feed system composed of chemical feed pumps, feed controls, liquid storage tanks, and all piping and appurtenances required to feed Bioxide® into the wastewater system, and one (1) full load of Bioxide® product for each chemical feed station is included in the work to facilitate start-up and system optimization. All materials shall be provided in accordance with these specifications.
- C. All components of the system shall be compatible with the conditions and chemicals to which they are subjected to during the normal operation of the system. Compounds with which the materials must be compatible include, but are not limited to:
 - 1. Hydrogen Sulfide
 - 2. Bioxide® solution

1.2 PROCESS DESCRIPTION

- A. The system shall provide for bulk storage of Bioxide® product and metering of the product from the bulk storage tank to the wastewater collection system. The system shall contain controls as necessary to facilitate variation in feed rates over a 24-hr period. A calibration cylinder shall be permanently installed to facilitate calibration of feed pumps.
- B. The Bioxide® material shall utilize the inherent ability of the facultative bacteria normally present in wastewater to metabolize hydrogen sulfide and other odor-causing, reduced sulfur containing compounds. The material shall provide nitrate-oxygen to the wastewater to support this biochemical mechanism. This nitrate-oxygen shall be applied via nitrate salts. The material shall be chemically stable, allowing continuous removal of sulfide contributed by side streams downstream of the application point. As a result of the biochemical process, the material shall provide the additional benefit of biochemical oxygen demand (BOD) reduction in the wastewater.

1.3 MANUFACTURER

- A. All components of the feed system shall be provided by a single manufacturer who shall have sole-source responsibility for the system.
- B. The manufacturer of this equipment shall be one recognized and established in the design, production, and operation of chemical feed injection systems. The manufacturer shall provide, with the submittal data, a list of 10 systems in operation using Bioxide® for the control of hydrogen sulfide and other odor causing

Town of Canton WPCA

components associated with municipal wastewater. These systems must have been in operation at least five years. The list shall include correct names, phone numbers, length of service and design criteria.

- C. The manufacturer shall be experienced in odor control for low pressure sewer systems.
- D. The manufacturer shall maintain regular production facilities at their place of business. These facilities shall be open for inspection by a representative of the WPCA or its Technical Consultant at any time during construction and testing of this equipment.
- E. The manufacturer of the feed system shall be an Underwriters Laboratories listed manufacturer of Enclosed Industrial Control Panels.
- F. The system shall be provided by USFilter's Davis Products of Sarasota, Florida.

1.4 SUBMITTAL

- A. The manufacturer shall submit complete shop drawings and engineering data to the Owner or Engineer, upon request. These submittals shall include, at a minimum:
 - 1. Drawings showing plan and elevation views of the feed system
 - 2. Control system layout drawing
 - 3. Control systems electrical diagram
 - 4. Manufacture's catalogue information on major system components including, but not limited to:
 - a. Chemical Feed Pumps
 - b. Chemical Feed Controls
 - c. Liquid Storage Tanks
 - 5. Statement of design conditions and performance guarantee
 - 6. Statement of warranty
 - 7. Reference list as described in section 1.3, B above
- B. The manufacturer shall submit complete Operation and Maintenance manuals to the WPCA. These manuals shall include at a minimum:
 - 1. Information in hazards associated with the system and the appropriate safety precautions
 - 2. Material Safety Data Sheets- Bioxide®
 - 3. Equipment installation instructions
 - 4. Equipment startup instructions
 - 5. Equipment maintenance procedures
 - 6. Troubleshooting guide

7. Individual operation and maintenance information on major system components, including but not limited to:
 - a. Chemical Feed Pumps
 - b. Chemical Feed Controls
 - c. Liquid Storage Tanks

PART 2 ODOR CONTROL PRODUCTS

2.1 PRODUCT INFORMATION

A. Technical Requirements

1. The material supplied shall be an aqueous solution of calcium nitrate containing a minimum of 3.5 pounds of nitrate-oxygen per gallon.
2. The material shall be capable of reducing the dissolved hydrogen sulfide concentration in wastewater to less than 0.1 mg/l.
3. The material shall be free of any objectionable odor-producing compounds.
4. The pH of the material shall not be less than 4.0 nor greater than 7.5.

B. Safety Requirements

1. The material shall contain no hazardous substances as defined by both the Federal EPA's and State CERCLA lists.
2. The material shall be exempt from Federal DOT placard requirements.
3. Recommended handling procedures for the material shall require protective gloves and safety glasses only. Any material recommending more sophisticated equipment (i.e., face shield, body suit, etc.) during routine handling shall not be considered.

2.2 CHEMICAL STORAGE TANKS - (GENERAL)

The chemical storage tank shall be constructed of Rotationally Molded High-Density Crosslinked Polyethylene (HDXLPE). No other material of construction shall be acceptable.

- A. High density crosslinked polyethylene tanks shall be manufactured by the rotational molding process in accordance with ASTM D 1998-93 Standard Specification for Polyethylene Upright Storage Tanks, Type 1 only. Rotational Molding shall be defined as a three-stage process consisting of loading the mold with powdered resin, fusing the resin by heating while rotating the mold about more than one axis, and cooling and removing the molded article.
- B. Plastics. The molding powder used shall be Marlex CL-250 or CL-200 as manufactured by Phillips 66, or powders of equal physical and chemical properties.
 1. The polyethylene shall preferably be virgin material. Any use of regrind, recycled, or reprocessed materials or combinations of such materials shall not rely upon the performance data of their original constituents, but must meet the requirements of this standard in its own right.

Town of Canton WPCA

2. The polyethylene shall have a stress-cracking resistance of 500 h minimum F50 in accordance with Test Method D 1693, Condition A, full-strength stress-cracking agent. The test specimens may be compression molded or rotationally molded. If compression molded, Procedure C of Practice D 1928 shall be followed for both types of polyethylene with a minimum platen temperature of 350 °F (177 °C). If it is crosslinkable polyethylene the temperature shall be 390 °F (197 °C) and the platen shall be kept closed under full pressure for 5 minutes at the specified temperature in order to bring about the crosslinking reaction. If the test specimens are rotationally molded, the conditions for rotational molding shall be similar to the conditions used for molding a vessel from this polyethylene.
- C. Fillers and Pigments. The plastic shall contain no fillers. All plastic shall contain an ultraviolet stabilizer at a level adequate to give protection for the intended service life of the vessel, minimum of 0.25%. This stabilizer shall be compounded in the polyethylene. Pigments must be compounded at the same time of resin manufacture.
- D. Vessel Construction
1. Mechanical properties. The nominal value for the properties of the materials shall be based on the molded parts:

Property	ASTM	Value	Units
Density	D105	59(0.937-0.944)	Lb/ft ³ (S.G.)
ESCR spec. thickness 0.125"	D1693	900-1000	Hrs.
Tensile Strength Ultimate 2"/min.	D638 Type IV	2600	PSI
Elongation at Break 2"/min.	D638 Type IV	450	%
Vicat Softening Temp.	D1525	255	°F
Brittleness Temp.	D746	-180	°F
Flexural Modulus	D790	100,000-110,000	PSI

2. Design Parameters.
 - a. Hoop Stress. The vessels shall be designed with a hoop stress value no greater than 600 psi at 100 °F with a safety factor of no less than 2, using the Barlow Formula for calculating wall thickness.
 - b. Wall Thickness. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the Barlow Formula. The wall thickness shall be based on the maximum temperature of the service.
 - c. Cut edges. All edges where openings are cut into the vessel shall be trimmed smooth.
 - d. Appearance. Type 1 finished vessel walls shall be free, as commercially practicable of visual defects such as foreign inclusions, air bubbles,

pinholes, pimples, crazing, cracking, and delaminations that will impair the serviceability of the vessel.

- e. Dimensions and Tolerance. The vessel diameter shall be measured externally. The tolerances on the outside diameter, including out of roundness, shall be plus or minus 1 percent. Measurement shall be taken in a vertical position.

E. Fittings

1. All fittings with the exception of the overfill protection site glass, shall be located on the tank top or dome. No penetration of the tank side-wall shall be made.
2. Plastic Fittings. Plastic fittings shall be “bulk-head” or “two-flange” style and shall be constructed of PVC. There shall be 4 bolts on any bolted flanges up to and including 3 inch, 8 bolts on fittings 4 inch - 8 inch diameter, and 12 bolts on 10 inch - 12 inch fittings. All bolts shall be all thread design with heads completely encapsulated in polyethylene. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4" of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material: (Green-316 grade S.S., Red-Hastelloy "C", Blue-Monel, Black-Titanium). Each bolt shall have a gasket, which is on the inside of the vessel.
3. Openings that are cut in vessel to install fittings shall not have sharp corners. Holes shall have minimum clearance to insure best performance of fittings.
4. For all flanged connectors, the flange drilling and bolting shall be in accordance with ANSI/ASME B-16.5 for 150-psi pressure class straddling the principle centerline of the vessel.

F. Tank Manway Covers

1. Manway covers shall be 15-24-inch diameter.
2. Manway covers shall have either a threaded or bolted cover or gasket

2.3 CHEMICAL STORAGE TANK – SPECIFICATIONS

- A. The chemical storage tank shall be double-wall and shall have the following capacity and approximate dimensions (+/- 5%):

Parameter	Chemical Tanks
Nominal Capacity	1,550 U.S. gal
Diameter	8'
Height	7'
Empty Weight	900 lb.

2.4 CHEMICAL FEED CONTROLS

Town of Canton WPCA

- A. General. The operation of the Chemical Feed System shall be controlled from a Control Panel. All equipment control switches, pilot lights, controllers, etc. and the chemical feed pumps shall be housed in this panel. The control system shall be UL Approved and shall bear the UL Listed Enclosed Industrial Control Panel Label.
- B. Enclosure. The control panel enclosure shall be constructed of 316 stainless steel and shall be rated NEMA 3R. It shall be equipped with a door with a continuous hinge. The hinged door shall have two latches and shall be capable of locking via a padlock. The enclosure shall be mounted on the control stand, which shall contain the calibration stand.
- C. Components. The Control Box Shall Contain the following:
 - 2- 24 Hour Time Clocks
 - 1- 15 Amp Circuit Breaker, 115 volt
 - 1- Ground Fault Receptacle
 - 5- On/Off Switches with LED Indicator Lights
 - 2- Chemical Feed Pumps
 - 1- Cooling Fan
 - 2- Dry Contact to Receive Signal From Remote Source
- D. Controls Layout. All manually operated controls (control switches, pilot lights, etc.) shall be located on a panel behind the enclosure door. The panel shall be outfitted with a main power disconnect located in the Control Stand.
- E. Standards. All control system design, fabrication, and wiring shall conform to the standards of Underwriter's Laboratories, National Electrical Code, and any other applicable federal, state, or local codes.
- F. System Operation. Chemical Feed Pumps. The bellows pump shall be controlled by a three-position HAND/OFF/AUTO switch. When in the AUTO position the pump shall be controlled by a timer. The timer shall turn the pump on and off based upon preset time intervals. When in the HAND position the pump shall run, regardless of the preset time interval. Either one or both chemical feed pumps may turn on or off at preset speeds and preset times.
- G. Control Stand. Pump control box shall be mounted on a 316 stainless steel pedestal.
 - 1. Calibration Cylinder. The stand shall be used to house a calibration cylinder used to measure the chemical being injected into the system. A 3 way valve shall be located at the top and bottom of the calibration tube to facilitate flow measurement. Access inside this pedestal shall be accomplished through a door located on the front of the pedestal. Instructions for use of this cylinder shall be permanently affixed to the interior of the enclosure.
 - 2. Disconnect Switch. A main power disconnect shall be located in the control stand.

2.5 CHEMICAL FEED PUMPS

Town of Canton WPCA

1. General. Provide USFilter's Davis Products Bellows Pump(s) as shown on the following table. Each pump shall include motor, base, sealed bearings, flexible coupling and check valve filters.

Quantity	Model No.	Adjustable Flow Rate Range (mL/min)	Max Discharge Pressure (psi)
	15907-001	5-50	40
	15907-002	12-120	40
	15908-001	63-630	20
	15908-002	105-1050	20
	15908-003	151-1510	20

2. Performance. Pump rates and maximum discharge pressures shall be in accordance with the table above.
 - a. The pumps shall be self-priming capable of suction lifts, when dry, up to seven (7) feet, and with bellows full, they will prime up to twenty (20) feet.
 - b. Flow rate of each pump shall be adjustable by (a) diameter of bellows, and (b) adjustment of stroke length. A calibration cylinder and valves will be installed to calibrate pump feed rates.
 - c. Pump suction and discharge shall be 3/8" ID polypropylene barbed connection for "T" tubing. A 1-1/2" wye strainer will be installed.

3. Construction.

<u>Material</u>	<u>Material</u>
<u>Reference</u>	<u>Material</u>
Bellows	Polypropylene
Poppet valves	EPT®
O-rings	EPT®
Springs	Hastelloy C

4. Motors. Motor shall be totally enclosed 115 volt, 60 Hz, 0.034 HP, single-phase and shall be rated for continuous duty.

2.6 PIPING & APPURTENANCES

- A. All suction and discharge piping shall be standard 1/2", Schedule 80 PVC. All valves, fittings, and connectors shall be Schedule 80 PVC.
- B. All fill line piping shall be 2" Schedule 80 PVC. All fill line valves, fittings, and connectors shall be Schedule 80 PVC.
- C. Fill line shall have a 2" stainless steel male camlock with a 2" plastic female camlock cap.
- D. All chemical feed seals shall be compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the feed system.

- E. All fittings shall be solvent-welded or threaded.

2.7 LEVEL INDICATOR

- A. Provide one tank liquid level indicator. The indicator shall provide an audible and visual indication at a predetermined "High" tank level. It shall provide a visual indication at predetermined "Reorder" and "Low" levels. The liquid level indicator shall operate by utilizing three level sensor floats with mercury switches to indicate HI Level, Refill Level, and Empty Warning. Audible alarms and indicator lights shall be activated by the level sensor floats when the chemical level reaches the predetermined setpoints. The audible alarm shall operate an adjustable time delay, sounding for a limited period of time upon the high level condition. The visual indicator shall remain illuminated until the level condition is eliminated.

PART 3 EXECUTION

3.1 SITE AND UTILITIES

- A. The feed system, storage tank, and other appurtenances shall be located on a foundation as shown in drawing. The following utilities shall be provided at the feed system site and located as shown on the drawing
- B. Electrical. One 120 VAC, 60 Hz, 15 amp single-phase electrical service shall be required.

3.2 EQUIPMENT SHOP TESTING

- A. Before shipping the equipment, the Manufacturer shall perform shop tests. These tests shall include at a minimum:
 - 1. Visual inspection of all equipment.
 - 2. Complete assembly, start-up, and "wet-test" of feed pumps and calibration piping.

3.3 INSTALLATION

- A. The system shall be installed in accordance with the manufacturer's instructions. All installation personnel shall be trained and qualified in the areas of plumbing, electrical work, and instrumentation as required to complete the installation.

3.4 FIELD TESTS

- A. The performance of the system shall be demonstrated to reduce hydrogen sulfide to meet with the odor control levels set forth in these Specifications per manufacturer's standard practice.
- B. If required, Manufacturer shall make any changes to the system, at his own expense, that may be necessary to assure satisfactory and efficient operation of this system.

3.5 WARRANTY

- A. The Manufacturer shall guarantee that the Chemical Feed & Storage system will perform as described in these Specifications. The Manufacturer shall warrant the system, complete, to be free from defects in materials or workmanship for a period twelve (12) months from final acceptance. The Manufacturer shall repair or provide replacement for any defective components under this warranty. In addition, the chemical storage tanks shall be warranted for a period of five (5) years from warranty start date.

END OF SECTION

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SECTION 11306

PUMPING SYSTEM COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Submersible wastewater pumps, controls, and related equipment.
2. Each submersible wastewater pumping system shall include a minimum of two submersible pumping units, motors, guide rails, pump controller/level control system, level control system, flow metering equipment, SCADA equipment, and any other related accessories necessary to establish a fully operational pumping system as specified herein and shown on the plans.
3. All materials and equipment located in the wetwell shall be of explosion proof type construction and comply with National Electrical Code requirements for Class I, Groups C and D, Division 1 locations.
4. All materials and equipment located in the valve pit shall comply with National Electrical Code requirements for Class I, Groups C and D, Division 2 locations.
5. The pump manufacturer shall have the responsibility for ensuring the compatibility of the entire submersible pumping system at each pump station site.

B. Related Sections

1. Design Standards
2. Section 11000 - Equipment - General.
3. Division 15 – Mechanical Work.
4. Division 16 - Electrical Work.

1.2 REFERENCES

- A. ANSI-B16-1 Cast Iron Flanges and Flanged Fittings.
- B. ANSI-A21-8 Cast Iron Pressure Pipe, Bituminous Coated, Centrifugally cast.
- C. ANSI-A21-10 Ductile Iron Fittings, 2-inch through 48-inch.
- D. ANSI-A21-51 Ductile Iron Pipe, Centrifugally cast in Metal Molds.
- E. American Gear Manufacturers Association (AGMA) Standards.
- F. Occupational Safety and Health Administration (OSHA) Standards.

1.3 SUBMITTALS

- A. Comply with the pertinent provisions of Section 01300 - Submittals.
- B. A single submittal shall be provided for the entire submersible pumping system including all equipment specified in this section. The pump manufacturer is responsible for ensuring full system compatibility prior to submitting equipment to the Engineer for approval.
- C. Product Data:
 - 1. Submit manufacturer's product data, installation and start-up instructions, use limitations and recommendations for each material used. Provide certifications stating that the materials comply with the Requirements.
 - 2. Provide descriptive literature, bulletins and catalogs of the equipment.
- D. Pump Data:
 - 1. Indicate pump type, capacity and power requirements. Submit certified pump curves showing pump performance characteristics with pump and system operating points plotted. Submit operational test results.
 - 2. Indicate dimension, required clearances, openings, method of assembly of components, and alarm levels.
 - 3. Provide certified shop and erection drawings showing all-important details of construction, dimensions, and anchor bolt locations.
- E. Wiring Diagrams:
 - 1. Submit manufacturer's electrical requirements for pumps including ladder-type wiring diagrams for interlock and control wiring, clearly indicating required field electrical connections.
- F. Operation and Maintenance Manual:
 - 1. Submit Operation and Maintenance Manual and parts lists for pumps, controls, and accessories, including "trouble shooting" maintenance guide. Include product data, shop drawings, and wiring diagrams in maintenance manual.

1.4 QUALITY ASSURANCE

- A. The equipment specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacturing and assembly of the equipment furnished. Upon request, the Contractor shall furnish manufacturer's qualification data including value of like work, location, and references.
- B. Manufacturer's Qualifications - Firms regularly engaged in the manufacture of submersible wastewater pumps of types and sizes required whose products have been in satisfactory use in similar service for not less than 10 years.

- C. Operational Test - Provide operational test on pumps, motors and controls, in accordance with Standards of the Hydraulic Institute (HI). Provide recordings of tests that substantiate correct performance of equipment at design head, capacity, suction lift, speed, horsepower and efficiency.

1.5 WARRANTY

- A. The manufacturer of the equipment shall provide ten-year warranties for the pumping units. The remainder of the submersible pumping system equipment shall be free from defects in design, material and workmanship for a period not less than five years. The manufacturer shall replace in kind any component, major or accessory, whether of his or other manufacturer during the guarantee period at no cost to the WPCA. Included in the parts replacement are all materials or labor excepting those items that are normally consumed in service such as light bulbs.

PART 2 PRODUCTS

2.1 SUBMERSIBLE WASTEWATER PUMPS

A. Manufacturers

1. ITT Flygt Corp., Inc.

B. Requirements

1. The Contractor shall furnish and install submersible pumps capable of delivering ambient temperature-raw sewage on a continuous or intermittent basis.

C. Mix Flush Valve

1. One pump shall be provided with one Flygt Mix Flush Valve System suitable for Class 1, Division 1, Group C & D installations. The valve will mix the wastewater automatically. The valve is to be mounted directly on one pump volute to direct part of the pumped discharge to flush solids into suspension at the start of each pumping cycle. The valve shall be positioned on the pump volute to provide a non-clogging flow operation. The valve shall be open at the beginning of each pumping cycle producing a jet flow with a minimum pressure of 37 psi and closed under full pump discharge after a pre-selected time. The valve shall be operated by the liquid being pumped through a self-contained hydraulic system. A means of adjustment should be provided to achieve a 30-second flushing period for different load and flow conditions.

D. Tools and Spare Parts

1. One set of all special tools required for normal operation and maintenance.
2. The manufacturer shall furnish a complete set of recommended spare parts for each of the pumps provided, including as a minimum; O-ring kit, wear rings, seals, impeller, component fasteners, power cord, cooling oils and all other replaceable components.
3. A spare pump discharge mating assembly shall be provided for each of the pumps being provided.

4. Provide a spare submersible pressure transducer assembly, complete with manufacturer's power/instrumentation cable, and all other accessories.

2.2 FLOW METER – TRANSMITTER/INDICATOR

- A. Unit to have a surface-mounted transmitter/indicator:
- B. Model IMT25 as manufactured by Foxboro, or approved equal by Rosemount.
- C. Indicator shall be equipped with totalized flow display, and shall be labeled "TOTALIZED FLOW (GALLONS)".
- D. Provide flow rate outputs to the circular chart recorder in the Outdoor Electrical Enclosure and the Monitoring System as well. Output signal for the Monitoring System shall be 4 to 20 mA DC, clearly labeled "Flow Rate, 4-20 mA DC".

2.3 GENERATOR RECEPTACLE

- A. Receptacle shall be watertight pin and sleeve with neoprene sealing glands.
- B. Receptacle shall be four-pole, five-wire.
- C. Rated for 120/208 volt, 3 phase, Y system.
- D. Receptacle shall meet CSA Standard C22.2 #182.1.
- E. Receptacle shall be Hubbell Catalog # 5125R6W.

2.4 PORTABLE PUMP DISCHARGE CONNECTION:

- A. The station header pipe shall incorporate a 2-way plug valve to permit emergency access to the pump station force main after isolation of the pumps. Valve body shall be cast iron with flanged end connections drilled to 125 pound standard. The plug valve shall be non-lubricated type, furnished with a drip-tight shutoff plug mounted in stainless steel or Teflon over phenolic bearings, and shall have a resilient facing bonded to the sealing surface.
- B. The 4-inch bypass connection shall be accessible behind the hinged access panel at the valve pit, and shall terminate with a male OPW type quick connect fitting.

2.5 FINISH

- A. The pumps, piping, and exposed steel framework shall have a prime coat of a zinc based synthetic primer. The finish coat shall be an automotive grade white acrylic enamel as defined in Section 09900.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Pumps
 1. Installation of pumps, and appurtenances shall be strictly in accordance with the recommendations and instructions of the manufacturer and located as shown on the approved Drawings or as approved by the WPCA's Technical Consultant.
 2. Field test shall not be conducted until such time that installation is complete and ready for testing.

3.2 FIELD TESTS AND SERVICE

- A. The systems shall be complete in all respects. Omission of any required items to provide a working system to the satisfaction of the shall be corrected in the field by the Contractor. The supplier of the pumps and motor shall provide one 8-hour day of field service, minimum, to set up, adjust, check and start up the station. On a second 8-hour day following the acceptable startup, the WPCA's operators shall be trained by the same servicemen in the operation and maintenance of the equipment. The servicemen shall have a thorough technical background in the startup and operation of the complete system.
- B. After installation of each station and when sewage is available, each unit shall be given a running test during which it shall demonstrate its ability to operate satisfactorily. During the tests, observations shall be made of head, capacity, and motor input to detect any defects in the equipment. All defects or defective equipment revealed by or noted during the tests shall be repeated until satisfactory results are obtained. The Contractor shall furnish all labor, piping, equipment and materials necessary for testing.
- C. All adjustments necessary to place equipment in satisfactory working order shall be made at the time of the above tests.
- D. All piping and fittings shall be installed true to alignment and rigidly supported thrust anchors shall be provided where required. Pressure and leakage tests will be required. The test pressures for the various pipelines shall be at least two times the operating pressure or 150 PSI maximum. The test is to be conducted for a period of four (4) hours. The Contractor will be required to provide all necessary apparatus and connections to conduct pressure and leakage tests.
- E. Operation and Maintenance Instructions
 - 1. The pump station manufacturer shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator to operate and maintain the pump station and all equipment supplied by the station manufacturer. Said instructions shall assume that the operator is familiar with pumps, motors, piping and valves, but that he has not previously operated and/or maintained the exact equipment supplied.
 - 2. The instructions shall be prepared as a system manual applicable solely to the pump station and equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
 - 3. The instructions shall include the following:
 - a. Descriptions of, and operating instructions for, each major component of the pump station as supplied.
 - b. Instructions for operation of the pump station in all intended modes of operation.
 - c. Instruction for all adjustments that must be performed at initial startup of the pump station, adjustments, which must be performed after the replacement of the level control system components, and adjustments, which must be performed in the course of preventative maintenance as specified by the manufacturer.

Town of Canton WPCA

- d. Electrical schematic diagram of the pump station as supplied, prepared in accordance with NMTBA and JIC standards. Schematics shall show, to the extent of authorized repair, pump motor branch, control, and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of overall schematic diagram.
 - e. Layout drawing of the pump station as supplied, prepared in accordance with good commercial practice, showing the locations of all pumps, motors, valves, and piping.
4. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall pump station instructions shall not be acceptable.
 5. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these Specifications. Instruction manuals applicable to many different configurations and pump stations, and which require the operator to selectively read portions of the instructions shall not be acceptable.

END OF SECTION

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SECTION 11307

SEWAGE GRINDER PUMP STATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Sewage grinder pump stations
 - 2. Connecting grinder pump station to sewer main
 - 3. Electrical work for grinder pump station
- B. Related Sections
 - 1. Section 02315 – Excavation, Backfill and Compaction
 - 2. Section 03310 – Cast-In-Place Concrete
 - 3. Section 11000 – Equipment – General
 - 4. Section 16050 – Basic Electrical Requirements.
- C. Related Sewer Construction Details
 - 1. No. 027 – Sewage Grinder Pump
 - 2. No. 028 – Sewage Grinder Pump Electrical Wiring Diagram

1.2 REFERENCES

- A. State of Connecticut Department of Transportation, Standards and Specifications for Roads, Bridges, and Incidental Construction, Form 816, 2004.

1.3 SUBMITTALS

- A. Submit complete shop drawings of the pump station, piping, check valve, and appurtenances.
- B. Prior to commencing the work, submit certified test results of the grinder pump, including pump curves.
- C. Submit results of factory leak test of pump station.
- D. Upon completion of field startup, submit pump station startup authorization forms, including documentation as to whether on not the pump is ready for gravity service tie-in.
- E. Submit buoyancy calculations for the tank and concrete anchor design.

1.4 QUALITY ASSURANCE

- A. The WPCA wishes to maintain the current standard equipment throughout the sewage system. Therefore, the manufacturer of the sewage grinder pump stations shall be Environment/One Corporation.

1.5 WARRANTY

- A. The manufacturer of the sewage grinder pump stations shall expressly warrant that the sewage grinder pump stations and all accessories, including but not limited to the panel and redundant check valve, will be free from material and workmanship defects for a period of twenty-four (24) months. A warranty shall also be provided for the installation of each pump station for a period of 24 months. The warranty periods shall start from the date of substantial completion.

PART 2 PRODUCTS

2.1 GENERAL

- A. The sewage grinder pumping station shall be a complete unit including pump, motor, electrical panel and all required accessories. The pump station manufacturer shall be responsible for furnishing all equipment necessary for a complete and operational system.
- B. The simplex grinder pump stations shall have a minimum 47 gallon wet well storage capacity.

2.2 MANUFACTURER

- A. Only Environment/One grinder pumps will be accepted
- B. The simplex grinder pump stations shall be Environment/One Corporation Model GP 2010-93 Pump Stations. No other type of simplex grinder pump units will be allowed for this project.

2.3 PUMP

- A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a mechanical seal. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. The material shall be suited for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.
- B. The single pump installation discharge shall be rated for the following conditions:
 - 1. 15 gpm at 0 psig.
 - 2. 11 gpm at 40 psig.
 - 3. 9 gpm at 60 psig.

2.4 GRINDER

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder shall be of the rotating type with a stationary hardened and ground chrome steel shredding ring spaced in accurate close annular alignment with the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars. This

assembly shall be dynamically balanced and shall operate without objectionable noise or vibration over the entire range of recommended operating pressures.

- B. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
 - 1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
 - 2. The inlet shroud shall have a diameter of no less than 5 inches.
 - 3. At maximum flow, the average inlet velocity must not exceed 0.2 feet per second.
 - 4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
- C. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of foreign objects, such as paper, wood, plastic, glass and rubber, to finely-divided particles which will pass freely through the passages of the pump and the discharge piping.

2.5 MOTOR

- A. At a minimum, the motor shall be a 1 HP, 1725 RPM, 60 Hertz, 230 volts, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.

2.6 MECHANICAL SEAL

- A. The core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.7 TANKS AND INTEGRAL ACCESSWAY

- A. The tank shall be made of high density polyethylene of a grade selected for environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of outside wall are to be of minimum amplitude of 1½-inches to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be a minimum 0.250-inch thick. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to maximum external soil and hydrostatic pressure.

Town of Canton WPCA

- B. The tank shall be furnished with one EPDM grommet fitting to accept 4-inch Schedule 40 PVC inlet drain piping. The simplex tank shall have a nominal capacity of 60 gallons.
- C. The accessway shall be an integral extension of the wet well assembly and include a lockable cover assembly providing low profile mounting and water-tight capability. Accessway design and construction shall facilitate field adjustment of station height in increments of 4-inches or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
- D. The station shall have all necessary penetrations molded in and factory sealed. A 1-inch rigid steel conduit for the power and control cable shall be included in the penetrations. No field penetrations will be acceptable.
- E. All discharge piping within the tank shall be 304 Series Stainless Steel and shall terminate outside the accessway bulkhead with a stainless steel, 1¼-inch female NPT fitting.
 - 1. The discharge piping shall include a stainless steel ball valve rated for 200 psi WOG. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
 - 2. Install a four foot long flexible connector to the pump discharge. Flexible connector shall be supplied as part of the grinder pump assembly and be as manufactured by Environment One Corporation. The connector shall be 1¼-inch, IPS, SDR 11 HDPE piping. Each end shall have a 304 stainless steel, multi-level mechanical transition piece hydraulically compressed onto the polyethylene pipe. The tank side shall be 1¼-inch male NPT threads and the street side shall be 1¼-inch NPT threads. The transition fittings shall be designed so that as the internal pressure within the pipe increases, the sealing surface area on the barb increases. Under zero internal pressure the compression strain and tensional strain created by the compression of the multi-level barbs is greater than the stresses created by the relaxation and/or thermo expansion and contraction. The entire assembly shall be rated for 160 psi working pressure.
- F. The access way shall include a single NEMA 4X electrical quick disconnect for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. The accessway shall also include a 2-inch PVC vent to prevent sewage gases from accumulating in the tank.
- G. Place a concrete anchor around the outside of the tank to prevent flotation. The concrete anchor shall be cast-in-place on a level surface, reinforced steel lifting lugs embedded, then allowed to cure to a sufficient strength for carrying to and setting in the final location. The concrete ring shall provide a ballast weight to counterbalance the buoyant forces that would be present if the station was being installed empty and fully submerged in water. The minimum factor of safety against buoyancy shall be 1.20. The concrete shall be ¾" - 3000 psi.

2.8 CHECK VALVES

- A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge piping. The check valve shall provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Working parts shall be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to ensure seating even at a very low back pressure. The valve body shall be an injection molded part made of glass filled PVC.
- B. Provide a separate check valve with each grinder pump station for installation in the service lateral between the grinder pump station and the sewer main in the street. The valve shall be 1½-inch gravity-operated flapper type check valve as specified above. Additional check valves will also be required at each additional low pressure connection shown on the approved Drawings, where a common service line from the street branches to serve multiple grinder pump stations.

2.9 ANTI-SIPHON VALVE

- A. The pump shall be equipped with an anti-siphon, vacuum relief valve in the discharge piping just below the integral check valve to insure that the pump cannot lose prime, even under negative pressure conditions in the discharge piping.

2.10 CORE UNIT

- A. The grinder pump station shall have cartridge type easily removable core assemblies containing pump, motor, grinder, controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit, shall be established by 100% factory test at a minimum of 5 psig.

2.11 CONTROLS

- A. Necessary controls shall be located in the top housing of the core unit. The top housing shall be attached with stainless steel fasteners.
- B. Non-fouling wastewater level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing shall be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type.
- C. To ensure reliable operation of the pressure sensitive switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment.
- D. Provide 6 conductor, 12 gauge, type SJOW cables pre-wired and watertight with NEMA 4x electrical disconnect to meet UL requirements. The length of the cable shall be as required for each installation.

2.12 ALARM/DISCONNECT PANEL

- A. Each grinder pump station shall include a NEMA 3R, UL listed alarm/disconnect panel suitable for wall or pole mounting. The NEMA 3R enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, padlocked cover, secured dead front and component knockouts. The enclosure shall not exceed 7.5" W x 8.75" H x 3.75" D.
- B. The panel shall contain one (1) - 15 amp, double pole circuit breaker for the power circuit, and one (1) 15 amp single pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, push to run feature and a complete alarm circuit, including a normally open dry contact to operate an exterior alarm light.
- C. The alarm/disconnect panel shall include audio & visual alarm and push-to-run switch. The alarm sequence shall be as follows:
 - 1. When liquid level in the sewage wet-well rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close.
 - 2. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.
 - 3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.
- D. The visual alarm lamp shall be inside a red fluted lens at least 2-inches in diameter and 1-11/16 inches in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 3R rating.
- E. The audio alarm shall be a printed circuit board in conjunction with an 86 dB buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being de-activated by depressing a push-type switch which is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.
- F. The entire alarm/disconnect panel as manufactured shall be listed by Underwriters laboratories, Inc.

2.13 PORTABLE GENERATOR CONNECTION CABLE

- A. Supply four portable generator connection cables to allow grinder pump operation with an emergency generator during periods of extended power outages. In the event that normal power is lost, one end of the cable can be manually connected to the electrical quick disconnect inside the pump chamber and the other to an emergency power source.
- B. The portable generator connection cables shall be one hundred and fifty feet (150') long and be fitted with a plug compatible for a direct connection to the WPCA's emergency generator.

2.14 GENERATOR TRANSFER SWITCH PANEL

- A. Each grinder pump shall be furnished with a generator transfer switch to allow grinder pump operation with an emergency generator during periods of extended power outages. In the event that normal power is lost the transfer switch can be manually set to disconnect the normal source of power and connect the grinder pump to an emergency power source.
- B. Transfer of power from the normal supply source to generator shall be through the use of a three position, circuit isolating load break selector switch clearly marked LINE-OFF-GEN. Functions of the switch positions are as follows:
 - LINE The grinder pump is connected to the normal source of power.
 - OFF Grinder pump is disconnected from both the normal and the emergency power sources.
 - GEN Grinder pump is connected to the emergency power source.
- C. The normal source of power and the grinder pump shall be permanently connected to terminals L1, L2 and terminals T1, T2 respectively in the generator transfer switch.
- D. A 20 amp; 250 volt; 2 pole; 3 wire NEMA L6-20P flanged inlet receptacle shall be provided for temporary cord and receptacle connection to the emergency generator. This receptacle shall be wired such that the receptacle blades will in no case be powered from and supply other than the emergency generator.
- E. The three position selector switch and generator receptacle shall be prewired and dead front panel mounted behind the hinged cover of a NEMA 4X fiberglass enclosure with approximate dimensions of 8" wide x 10" long x 5" deep.

2.15 SERVICEABILITY

- A. The grinder pump core unit shall have two lifting hooks complete with a nylon lift-out harness connected to its top housing to facilitate easy core removal when necessary. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation. A push to run feature shall be provided for field trouble shooting. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.
- B. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station.

2.16 EXTERIOR ALARM LIGHT

- A. Furnish an alarm light rated for exterior mounting. Alarm light shall be red and shall be vandal proof.

PART 3 EXECUTION

3.1 FACTORY TEST

- A. The grinder pump shall be submerged and operated a minimum of 5 minutes during the factory test. This procedure will include the testing of all ancillary components

such as the anti-siphon valve, check valve, discharge line, level sensors and each unit's dedicated controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. Submit certified test results for approval showing the operation of the grinder pump at two (2) different points on its curve, with the maximum pressure no less than 60 psi. The certified pump performance curve shall include head, capacity, brake horsepower, pump efficiency, and date of test. The manufacturer shall inform the WPCA's Technical Consultant a minimum of two weeks prior to the factory test that the test will be performed. The WPCA's Technical Consultant may witness the factory test.

- B. The pump station shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets, etc.). Results of this test shall be submitted to the Engineer for approval.
- C. The pump station shall not be shipped prior to approval of the certified pump curves and the factory leak test by the WPCA's Technical Consultant.

3.2 DELIVERY

- A. The grinder pump stations are to be delivered to the job site in two separate pieces, with the core unit separate from the tank. The grinder pump stations shall be individually mounted on wooden pallets.
 - 1. In order to avoid damaging the core unit during installation, the Contractor's installation personnel shall be trained by an authorized representative, prior to installing the first core unit. This training shall be performed in the presence of the WPCA's Technical Consultant.

3.3 INSTALLATION

- A. Prior to installation, visit each home to receive a grinder pump and review existing electrical services. Coordinate and necessary repairs and upgrades with Property Owner.
- B. Investigate each home to determine location and depth of existing home gravity sewer. Coordinate proposed depth of grinder pump with depth of existing gravity sewer to septic system.
- C. The grinder pump stations shall be installed in a location mutually agreeable by the WPCA, its Technical Consultant, and the Property Owner. The location shall be determined prior to installation.
 - 1. The station shall be located as close as possible to the house, but no closer than ten (10) feet.
 - 2. The Contractor is responsible for assuring that the proper grinder pump station location has been designated, prior to installation.
 - 3. Grinder pump locations as shown on the Drawings are approximate. The final location shall be coordinated between all abovementioned parties prior to installation.

Town of Canton WPCA

- D. Provide electrical work in accordance with Section 16050 and as shown on the Drawings.
 - 1. A 30 amp, 240 volt, single phase circuit shall be provided. Wiring from the panelboard or fuse box shall include:
 - a. Two (2) #10 phase conductors
 - b. One (1) #10 neutral conductor
 - c. One (1) #10 ground wire
 - 2. The 30 amp circuit is recommended by the manufacturer so as to coordinate the 15 amp circuit breakers in the grinder pump station with the supply power circuit breaker fuse.
 - 3. Provide all electrical components for a complete and operational grinder pump system including connections, switches, wiring, and rigid steel conduit to pump unit.
- E. The Property Owner will be responsible for all electrical work between the alarm/disconnect panel, mounted on the exterior of the house by Contractor, to the main electrical feed panel within the house. The Property Owner shall be solely responsible for any modifications, including electrical service upgrades, for the main electric feed to the alarm/ disconnect panel in order to make the grinder pump operational.
- F. Excavation, backfill and compaction are specified under Section 02315. The requirements of Section 02315 shall apply to the installation of the grinder pump station and piping. Set grinder pump station on 8-inches of crushed stone. The pump station shall not be set into place until the excavation and compaction have been approved by the WPCA's Technical Consultant.
- G. Install the grinder pump station in accordance with the manufacturer's recommendations. Installation shall be accomplished so that 1" to 4" of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow for a concrete anchor.
- H. Install the grinder pump station at a minimum depth of four (4) feet from grade to the top of the 1½-inch PVC discharge line, to assure maximum frost protection.
- I. Install check valve in the 1½-inch service lateral between the grinder pump station and the sewer main in the street. Valve shall be installed at the property line on the grinder pump side of the ball valve and valve box, as shown on the Drawings. The valve shall be installed horizontal to allow proper seating of the flapper.
- J. Restore all properties to their original condition, including but not limited to curb and sidewalk replacement; driveway repair, replacement, and/or overlaying; landscaping repairs and replacement; and loaming and seeding.
- K. Install and wire the alarm/disconnect panel and the exterior alarm light to the grinder pump station in accordance with Section 16050. If a house has adequate electric service but no space in the main circuit or fuse panel, provide sub-panel with additional switches.

Town of Canton WPCA

- L. Complete work under this and related items without disruption to the existing septic system. At the time final connection to the house is to be made, notify the homeowner of a disruption in sewer service a minimum of 48 hours in advance.
- M. Pumping of existing septic systems in order to complete work under this or related piping items will be directed by the WPCA's Technical Consultant when necessary.
- N. In the event of unforeseeable circumstances, such as excavation through an unidentified septic system, the WPCA and its Technical Consultant may authorize an emergency septic pumping.
- O. Inspect each grinder pump station wet well for debris which could be detrimental to the grinder pump core. Clean, vacuum or take any other necessary actions to prevent core damage prior to filling wet well with water for startup testing.
- P. The Property Owner will be responsible for final gravity service connection work from the grinder pump to the house and abandonment of their septic system. The intent is that this work will be completed only after the Contractor's substantial completion date in order to avoid work conflicts. However, performing this work after substantial completion cannot be guaranteed.

3.4 START-UP AND FIELD TESTING

- A. Test each grinder pump station and the low pressure sewer system prior to the final connection between the house plumbing and pump station.
- B. The manufacturer shall provide the services of qualified factory trained technician who shall inspect the placement and wiring of the station, perform field tests as specified herein, and instruct the WPCA in the operation and maintenance of the equipment before the station is accepted by the WPCA. All equipment and materials necessary to perform testing shall be the responsibility of the installing Contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.
- C. Upon completion of the installation, the authorized factory technician shall perform the following test on the station:
 - 1. Make certain all discharge shut-off valves are fully open.
 - 2. Turn ON the alarm power circuit.
 - 3. Fill the wet well with water to a depth sufficient to verify the high level alarm is operating. Shut off water.
 - 4. Turn ON pumps power circuit. Initiate pump operation to verify automatic "on/off" controls are operative. Pump should immediately turn ON. Within one (1) minute alarm light will turn OFF. Within three (3) minutes the pump will turn OFF.
- D. Upon completion of the start-up and testing, the manufacturer shall submit to the Engineer the start-up authorization form describing the results of the tests performed for each grinder pump station. This form shall indicate whether or not the unit is ready for the residential gravity sewer connection. Record each pump serial number and appropriate house address on form.

Town of Canton WPCA

- E. After backfilling the pump station, the Contractor shall test the discharge piping in accordance with Section 02503.
- F. The completed installation including the pump station discharge piping shall be tested to the satisfaction of the Engineer prior to approval of the system. Start up authorization forms must be submitted prior to final acceptance of the system.

3.5 OPERATION AND MAINTENANCE MANUAL

- A. Two copies of the Operation and Maintenance Manual shall be provided and submitted to the WPCA.
- B. User instructions for the grinder pump station, including model and serial numbers, shall be provided to the Property Owner immediately following installation.

END OF SECTION

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SECTION 15050

PIPING - GENERAL

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Permit requirements and documentation
2. Sleeves and seals for all wall, floor and roof penetrations
3. Escutcheons
4. Wall Pipes
5. Anchor bolts
6. Pipe and equipment coatings
7. Piping installation
8. Testing
9. Cleaning

B. Related Sections

1. Section 09900 - Painting
2. Section 15060 - Hangers and Supports
3. Section 15075 - Mechanical Identification
4. Yard piping for process piping, utility services, sanitary, storm, and roof drainage systems outside the building is included in Division 2.

1.2 SUBMITTALS

- A. Material specifications and shop drawings for all materials and equipment furnished under this Section.
- B. Layout drawing for hangers and supports.
- C. Certificates of Compliance on all pipe materials.

1.3 QUALITY ASSURANCE

- A. The location of all equipment, fixtures, and piping is considered to be approximate only and the WPCA's Technical Consultant has the right to change at any time before the work is installed, the position of equipment and piping to meet structural conditions, avoid interferences, provide proper clearances or for other sufficient causes.
- B. Secure all permits and pay all fees required to carry out the piping work. Comply with all laws, ordinances, codes, rules, and regulations of the local and state authorities having jurisdiction over any of the work specified herein. Where

Town of Canton WPCA

provisions of the Contract are in conflict with the codes, the more stringent of either the codes or the Contract documents shall govern.

- C. Offsets and fittings required to avoid field interferences and provide improved layout shall be provided.
- D. All pipe, tube, hose, and fittings in a given specification section shall be the product of a single manufacturer who is experienced in the manufacture of the materials to be furnished. The manufacturer must have provided materials which have been successfully installed and operated for at least 5 years in a similar application.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installing, and no piece shall be installed which is found to be defective. Any damage to the pipe linings or coatings shall be repaired as directed.
- B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner. All pipe and fittings shall be thoroughly cleaned before installing, shall be kept clean until they are used in the work, and when installed shall conform to the lines, grades and dimensions required.
- C. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Sleeves and Seals - Furnish all sleeves required under this Division. Coordinate the sleeve locations and elevations for placement.
 - 1. Sleeves will be required at the locations shown on the approved Drawings or as specified herein. The type of wall penetration shown on the approved Drawings shall govern over the summary presented herein.
 - 2. Sleeves shall be Schedule 5S stainless steel in accordance with ASTM A-778 with seep rings. Seep rings shall be welded continuous, placed on the center of the sleeve and project 3 inches. Floor sleeves shall be 3 inches longer than the floor slab depth and shall project 3 inches above finish floor level for housekeeping purposes. Wall sleeves shall be the same length as the wall thickness. Sleeves passing through partition walls do not require seep rings.
 - 3. Sleeves for carrier pipes 1 inch diameter and less shall be Type WSK as manufactured by O.Z. Electrical Manufacturing Company, Brooklyn, NY, Wall-Seal by Dresser Manufacturing, Thunderline, or approved equal.

4. Sleeves with seals as described hereinafter shall be used for all carrier pipes larger than 1 inch in diameter. Seals between steel sleeve and carrier pipe shall be made using "Linkseal" as manufactured by Thunderline Corporation, Wayne, Michigan, Red Hed Supply, Viessmann Manufacturing or approved equal. Sizing of sleeves, selection of link model numbers and sizes shall be in strict accordance with the manufacturer's instructions to ensure water-tightness.
 - a. Same environment on both sides of wall or floor - sleeves are required. No seal between the pipe and sleeve is required in these locations.
 - b. Pipes passing through foundation walls with soil on both sides - pipes shall pass through an oversized opening. Sleeves with seals are not required at these locations.
 - c. Sanitary soil pipes, floor drain pipes, and roof drain pipes passing through walls and floors between areas of different environments - water stopped sleeves shall be used and sealed as described above.
 5. Pipes penetrating a concrete floor poured on soil above grade shall be poured in place. Pipes shall be fully isolated with full depth, ¼ inch thick, self-expanding cork or other bond-breaking material held securely in place during concrete placement. The annular space at finish floor shall be caulked.
- B. Escutcheons - Where uncovered pipe passes through finished walls or ceilings, a chrome plated escutcheon shall be provided.
- C. Wall Pipes - Wall pipes shall be provided where called for on the approved Drawings. Wall pipes shall be provided with a 3 inch high seep ring welded continuous and placed on the center of the pipe. Seep ring shall be ASTM A36 steel, minimum ¼ inch thick. Wall pipe interior shall be finished equal to main line with end connections as required (MJ, Flanged, PE, Push-on Bell).
- D. Anchor Bolts - Anchor bolts, nuts, washers, and bolt sleeves shall be Type 316 stainless steel. Expansion bolts shall be "Thunderstuds," as manufactured by Unifast Industries, Inc., Hauppauge, NY, Redhead "Wedge Anchors" as manufactured by ITT Phillips; Michigan City, Indiana or Molly parabolts as manufactured by USM Corporation, Shelton, CT. All expansion bolts and associated hardware shall be stainless steel.

2.2 FINISHES

- A. Pipe and Equipment Coatings - Under the provisions of Section 09900, the prime and field applied coatings are to be the products of a single manufacturer.
1. Once a paint manufacturer has been approved for this project, order all of his exposed pipe (except stainless steel), valves, fittings, equipment, hangers and supports prime coated with paint of the same manufacturer. Specifically, all piping that is not to be buried or bituminous coated soil pipe shall be furnished with an exterior prime coat instead of bituminous coating. Materials shall be coated in accordance with Section 09900. All pipe, valves, fittings, etc. shall be thoroughly cleaned in accordance with the applicable sections of the AWWA Specifications, before coatings are applied. Flange faces shall be cleaned and primed to prevent bleeding.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean and prepare pipe joints to be free of scale, dirt, and debris prior to connections.
- B. Surface preparation of all piping, supports and hangers is included in Section 09900.

3.2 INSTALLATION

- A. Work shall be installed in accordance with the manufacturer's printed instructions and shall be plumb and true to line. Piping shall be installed as close to walls, and ceilings as possible yet facilitating maintenance and access to valves and devices. In general, piping systems shall parallel walls, partitions, and structural members. Offsets and fittings to accomplish a neat and workmanlike installation shall be provided. Piping shall be installed true to the grades required as shown on the Drawings.
- B. Care shall be taken such that stresses are not imposed on the pipe during installation.
- C. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and joint method and their locations shall be verified from approved piping layout drawings and the structural drawings. Layouts for hanger and supports shall be submitted to the WPCA's Technical Consultant for approval. Pipe hangers and supports shall conform to the requirements of Section 15060.
- D. All valves, fittings, and appurtenances needed on the pipelines shall be set and jointed as required.
- E. Equipment Connections - Provide unions and control valves on services to equipment provided under other Sections. All valves are to be installed in the upright position. Valves shall be installed and located so they can be operated easily and shall be located adjacent to the equipment.
- F. Unions - All piping 2 inches and smaller shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the WPCA's Technical Consultant.
- G. Cutting and Patching - Sleeves not initially set in the work shall be cut in place with permission of the WPCA's Technical Consultant. This work shall be performed by workmen competent to do the work and equipped with proper hand tools. Power tools with the exception of core boring machines shall not be used.
- H. Welding - Welding shall only be performed by certified welders tested in the position applicable to the work. Welding shall be performed in accordance with AWS standards. Copies of welding certifications shall be provided to the WPCA's Technical Consultant.
- I. Pipe Identification and marking shall be in accordance with Section 15075.

3.3 REPAIR/RESTORATION

- A. During the course of the Work, protect all materials, fixtures, and equipment from damage. Any damage to piping, linings or coatings shall be repaired to the satisfaction of the WPCA's Technical Consultant or replaced.

3.4 FIELD QUALITY CONTROL

- A. Testing - Test all piping systems in accordance with the piping Section requirements or to the code applicable to the location where the work is performed. Pipes shall hold pressure without the addition of water or additional pumping. Additional tests or methods may be required by local ordinances or inspection authorities. Tests shall be repeated as necessary to make the systems tight and accepted. Provide all water, air, or gas, apparatus, gauges, and materials necessary for performing tests.
- B. Provide all equipment, materials, and apparatus to conduct pressure tests as required by code or the individual Piping Sections. All tests will be witnessed by the WPCA's Technical Consultant. Any leaks shall be repaired and the pipe retested to the satisfaction of the WPCA's Technical Consultant.
- C. Test pressure and duration shall be as specified in the individual Piping sections.

3.5 CLEANING

- A. At the completion of the Work, thoroughly clean all piping and equipment installed. Remove all concrete, stickers, rust stains, foreign matter and discoloration. Piping and equipment shall be in a thoroughly clean condition and ready for finish painting.
- B. All potable water piping shall be thoroughly flushed and disinfected prior to placing in service in a manner approved by the WPCA's Technical Consultant.

END OF SECTION

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SECTION 15060

HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Concrete pipe supports
 - 2. Manufactured piping hangers and supports
 - 3. Manufactured shelf brackets
 - 4. Process ductwork supports and stands
 - 5. Miscellaneous materials
 - 6. Pipe alignment guides
- B. Related Sections
 - 1. Section 03310 - Cast-in-Place Concrete
 - 2. Section 15050 - Piping – General
- C. Related Sewer Construction Details
 - 1. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
 - 2. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
 - 3. No. 025 – Low Pressure Sewer Junction Cleanout Structure
 - 4. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
 - 5. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
 - 6. No. 030 – Force Main In-Line Cleanout Structure

1.2 REFERENCES

- A. Manufacturers' Standardization Society SP-58, Pipe Hangers and Supports - Materials Design and Manufacture
- B. Manufacturers' Standardization Society SP-69, Pipe Hangers and Supports - Selection and Application
- C. Manufacturers' Standardization Society SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices
- D. Manufacturers' Standardization Society SP-90, Guidelines on Terminology for Pipe Hangers and Supports

- E. ASTM A 36 - Specification for Structural Steel
- F. ASTM A 780 - Practice for Repair of Damaged Hot Dipped Galvanized Coatings
- G. ASTM C 150 - Specification for Portland Cement
- H. ASTM C 404 - Specification for Aggregates for Masonry Grout
- I. ASME B 31.9 - Building Services Piping
- J. American Welding Society (AWS) Structural Welding Code

1.3 DESIGN REQUIREMENTS

- A. Mechanical components and systems and their attachments shall be designed in accordance with Connecticut Building Code Requirements.

1.4 SUBMITTALS

- A. Product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.
- B. Product certificates signed by the manufacturer of hangers and supports certifying that their products meet the specified requirements and complies with Manufacturers' Standardization Society Standards.
- C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.
- D. Assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

1.5 QUALITY ASSURANCE

- A. Provide anchors and supports in conformance with the Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. (MSS). All materials, design, manufacture, selection, application and fabrication shall be in conformance with the appropriate MSS numbers.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code-Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has underground re-certification.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Concrete Pipe Supports - All process piping shall be provided with concrete pipe supports wherever feasible. Supports shall be a minimum 10 inches thick from finished floor to the centerline of pipe. Concrete shall be secured to floor using drilled-in anchors at all four corners. Concrete shall be provided with $\frac{3}{4}$ inch chamfer on all edges and a rubbed finish in accordance with Section 03310. Provide a plastic sheet between concrete support and piping. Pipe shall be socket clamped and anchored to the concrete support. Socket clamp shall be stainless steel for

Town of Canton WPCA

stainless steel pipe and hot-dipped galvanized for D.I. pipe. Anchor bolts shall be stainless steel.

B. **Manufactured Piping Hangers and Supports** - Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.

1. Components shall be stainless steel where installed for stainless steel piping. As a minimum, components to be stainless steel include clevis hangers, pipe clamps, pipe supports, plate bases, pipe saddles, U-bolts, floor stanchions, threaded rod with nuts, rod couplings, brackets and all miscellaneous connecting and supporting hardware. Structural steel work required for pipe racks and trapezes shall be A-36 steel, sandblasted, primed and finish painted using the approved paint system for this project.
2. As a minimum, all components shall have hot-dipped galvanized coatings where installed for all other piping and equipment.
3. Components shall have a nonmetallic coating where installed for piping and equipment in chemical feed areas.
4. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
5. All hangers and supports shall have some form of adjustment available after installation.
6. Hanger rods shall be subjected to tension only. Lateral and axial movements shall be accommodated by proper linkage in the rod assembly.
7. Strut channel hangers shall be used to support parallel piping. Strut clamps, straps, and rollers shall be used to maintain proper alignment. Thermal expansion roller hangers shall be utilized for all heating supply and return lines. Strut channel trapeze hanger systems shall be hot-dipped galvanized after fabrication (ASTM A123). Hardware shall be electro-plated zinc (ASTM B633).
8. Floor supported process piping shall be supported by pipe supports which are provided with a base stand secured to the concrete using stainless steel anchors, adjustable shank, saddle, U-bolt, and hex nuts to hold pipe securely to the saddle.

C. **Manufactured Shelf Brackets**

1. Shelf brackets shall be designed for a 1,200 pound design load.
2. Brackets shall be sized with horizontal and vertical legs approximately equal to the shelf width.
3. Construct brackets using 2½ inch by 2½ inch by ¼ inch stainless steel angle material.

- D. Miscellaneous Materials
 - 1. Steel Plates, Shapes, and Bars shall conform to ASTM A 36.
 - 2. Cement Grout - Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- E. Pipe Alignment Guides - Factory fabricated, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installing until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89.
- B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers. Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS D-1.1.
- C. Install supports with maximum spacings complying with MSS SP-69.
- D. Install supports with minimum rod diameter complying with MSS SP-69.
- E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- H. Install hangers and supports so that piping live and dead loading and stress from movement will not be transmitted to connected equipment.

Town of Canton WPCA

- I. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded.
- J. Insulated Piping - Comply with the following installation requirements.
 - 1. Clamps - Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
 - 2. Saddles - Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
 - 3. Shields - Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in accordance with MSS SP-58.
 - 4. Pipes 8 inch and larger shall have wood inserts.
 - 5. Insert material shall be at least as long as the protective shield.
 - 6. Thermal Hanger Shields - Install where indicated, with insulation of same thickness as piping.
- K. Anchors
 - 1. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 - 2. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.
 - 3. Anchor Spacings - Where not otherwise indicated, install anchors at ends of principal pipe runs. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.
- L. Pipe Alignment Guides
 - 1. Install pipe alignment guides on piping that adjoins expansion joints and elsewhere as indicated.
 - 2. Anchor to building substrate.
- M. Equipment Supports
 - 1. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
 - 2. Grouting - Place grout under supports for piping and equipment.
- N. Shelf Bracket Supports
 - 1. Anchor brackets into concrete wall using anchors specified in Section 15050.

3.3 CONSTRUCTION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding - Comply with AWS D1-1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contoured welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustment - Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 CLEANING

- A. For galvanized surfaces clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Painted Identification Materials.
2. Plastic Pipe Markers.
3. Plastic Duct Markers.
4. Valve Tags.
5. Valve Schedule Frames.
6. Plastic Equipment Markers.
7. Plasticized Tags.

B. Related Sections

1. Section 09900 - Painting
2. Division 15 Sections which specify Pipe and Valve marking and identification.

1.2 REFERENCES

- A. ANSI Standards - Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

- A. Manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples of each color, lettering style and other graphic representation required for each identification material or system.
- C. Valve schedule for each piping system, typewritten and reproduced on 8½" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves that are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.

1.4 QUALITY ASSURANCE

- A. Mechanical identification materials shall be provided by firms regularly engaged in manufacture of identification devices of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.

1.5 MAINTENANCE

A. Extra materials

1. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
2. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide mechanical identification materials of one of the following or an approved equal:

1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Seton Name Plate Corp.

2.2 MATERIALS

A. Mechanical Identification Materials

1. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

B. Painted Identification Materials

1. Provide standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4 inch high letters for ductwork and not less than 3/4 inch high letters for access door signs and similar operational instructions. Provide 1-inch high letters for labeling tanks between 0-20 gallons; 2-inch high letters for tanks between 20-500 gallons; and 4-inch high letters for tanks greater than 500 gallons.
2. Utilize standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
3. Utilize standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

C. Plastic Pipe Markers

1. Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

Town of Canton WPCA

2. Furnish 1-inch thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2 inches beyond each end of plastic pipe marker.
3. For external diameters less than 6 inch (including insulation if any), provide full-band pipe markers, extending 360° around pipe at each location, fastened by one of the following methods:
 - a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
4. For external diameters of 6 inch and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - a. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
5. Color-coding shall apply to the background color of the identification markers. Color-code all pipe markers in accordance with Section 09900.
6. Manufacturer's standard pre-printed nomenclature that best describes piping system in each instance, as selected by the WPCA's Technical Consultant in cases of variance with names as shown or specified. Custom wording shall be provided when no standard nomenclature is available.
7. Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

D. Plastic Duct Markers

1. Provide manufacturer's standard laminated plastic, color-coded duct markers. Conform to the following color code:
 - a. Green - Cold air.
 - b. Yellow - Hot air.
 - c. Yellow/Green - Supply air.
 - d. Blue - Exhaust, outside, return and mixed air.
 - e. For hazardous exhausts, use colors and designs recommended by ANSI A13.1.
2. Include the following nomenclature:
 - a. Direction of air flow.
 - b. Duct service (supply, return, exhaust, etc.).
 - c. Duct origin (from).
 - d. Duct destination (to).
 - e. Design cfm.

Town of Canton WPCA

E. Valve Tags

1. Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in ¼ inch high letters and sequenced valve numbers ½ inch high, and with 5/32 inch hole for fastener.
 - a. Provide 1-1/2 inch diameter tags, except as otherwise indicated.
 - b. Provide size and shape as specified or scheduled for each piping system.
 - c. Fill tag engraving with black enamel.
2. Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
3. Provide manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8-inch center hole to allow attachment.

F. Valve Schedule Frames

1. General - For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

G. Plastic Equipment Markers

1. Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color code:
 - a. Green - Cooling equipment and components.
 - b. Yellow - Heating equipment and components.
 - c. Yellow/Green - Combination cooling and heating equipment and components.
 - d. Blue - Equipment and components that do not meet any of the above criteria.
 - e. For hazardous equipment, use colors and designs recommended by ANSI A13.1.
2. Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.
3. Provide approximate 2-1/2 inch by 4 inch markers for control devices, dampers, and valves; and 4-1/2 inch by 6 inch for equipment.

H. Plasticized Tags

1. Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing approximately 3-1/4 inch by 5-5/8 inch, with brass grommets and wire fasteners and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

I. Lettering and Graphics

1. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
2. Where multiple systems of same generic name are shown and specified, provide identification that indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 EXECUTION

3.1 INSTALLATION

- A. Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of removable concealment, if any.
- B. Ductwork Identification
 1. General - Identify air supply, return, exhaust, intake and relief ductwork with duct markers; or provide stenciled signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).
 2. Location - In each space where ductwork is exposed, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacings along exposed runs.
 3. Access Doors - Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
 4. Concealed Doors - Where access doors are concealed plasticized tags may be installed for identification in lieu of specified signs, at Installer's option.

C. Piping System Identification

1. Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - a. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
2. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced intermediately at maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment.

D. Valve Identification

1. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

E. Mechanical Equipment Identification

1. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - a. Main control and operating valves, including safety devices and hazardous units.
 - b. Meters, gauges, thermometers and similar units.
 - c. Pumps, compressors, condensers and similar motor-driven units.
 - d. Fans, blowers, primary balancing dampers and mixing boxes.

Town of Canton WPCA

- e. Packaged HVAC central-station or zone-type units.
 - f. Tanks and pressure vessels.
 - g. Strainers, filters, water treatment systems and similar equipment.
2. Where lettering larger than 1 inch height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.
 3. Minimum $\frac{1}{4}$ inch high lettering for name of unit where viewing distance is less than 2 feet, $\frac{1}{2}$ inch high for distances up to 6 feet and proportionately larger lettering for greater distances. Provide secondary lettering of 67% to 75% of size of the principal lettering.
 4. In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
 5. At Installer's option, where equipment to be identified is concealed, plasticized tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment).
 - a. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at Installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

3.2 ADJUSTING

- A. Relocate any mechanical identification device, which has become visually blocked by work of this division or other divisions.

3.3 CLEANING

- A. Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

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SECTION 15080

MECHANICAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Piping Systems Insulation:
 - a. Fiberglass.
 - 2. Ductwork Insulation:
 - a. Fiberglass.
 - 3. Generator Exhaust Pipe and Silencer Insulation
 - a. Calcium Silicate
 - 4. Protective saddles, shields, and thermal hanger shields.
- B. Related Sections
 - 1. Section 15050 - Piping - General

1.2 REFERENCES

- A. ASTM C 533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation
- B. ASTM C 547 - Specification for Mineral Fiber Preformed Pipe Insulation.
- C. ASTM C 553 - Specification for Mineral Fiber Blanket and Felt Insulation (Industrial Type).
- D. ASTM C 612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
- E. ASTM C 921 - Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- F. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Manufacturer's sample of each piping insulation type required, and of each duct and equipment insulation type required. Affix label to sample completely describing product.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications - Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar services for not less than 3 years.
- B. Installers' Qualifications - Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for the project.
- C. Flame/Smoke Ratings - Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
 - 1. Exception - Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.
 - 2. Exception - Industrial mechanical insulation that will not affect life safety egress of building may have flame spread index of 75 and smoke developed index of 150.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer - Subject to compliance with requirements, provide products of one of the following or an approved equal:
 - 1. Knauf Fiber Glass GmbH.
 - 2. Manville Products Corp.
 - 3. Owens-Corning Fiberglass Corp.
 - 4. Childers Products Co.
 - 5. Specialty Products and Insulation Co.

2.2 MATERIALS

- A. Piping Insulation
 - 1. Fiberglass Piping Insulation - ASTM C 547, Class 1 unless otherwise indicated.
 - 2. Jackets for Piping Insulation - ASTM C921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

- a. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
 - b. Encase exterior piping insulation with aluminum jacket with weather-proof construction.
 3. Piping Insulation Accessories - Provide staples, bands, wires, and cement as recommended by insulation manufacturer for applications indicated.
 4. Piping Insulation Compounds - Provide adhesives, sealers, and protective finishes as recommended by insulation manufacturer for applications indicated.
- B. Equipment Insulation Materials
1. Insulate the generator exhaust muffler and all exhaust piping within the building.
 2. Calcium Silicate Equipment Insulation – ASTM C 533, Type I, Block 3½ inches thick.
 3. Jacketing Material for Equipment Insulation – Provide presized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
 4. Equipment Insulation Compounds – Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
 5. Equipment Insulation Accessories – Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 APPLICATION

A. Plumbing Piping

1. Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.
2. Cold Piping
 - a. Application Requirements - Insulate the following cold plumbing piping systems:
 - 1) Potable cold water piping.

- 2) Plumbing vents within 6 lineal feet of roof outlet.
- b. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - 1) Fiberglass – 1 inch thickness.
- 3. Hot Piping
 - a. Application requirements - Insulate the following hot plumbing piping systems:
 - 1) Potable hot water piping.
 - b. Insulate each piping system specified above with one of the following types and thicknesses of insulation.
 - 1) Fiberglass – 1 inch thick for pipe sizes up to and including 6 inch, 1-½ inches thick for pipe sizes over 6 inch.
- B. Generator Exhaust Pipe and Silencer
 - 1. Calcium Silicate - 3½ inches thick

3.3 INSTALLATION

- A. General
 - 1. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Piping Insulation
 - 1. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
 - 2. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
 - 3. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
 - 4. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
 - 5. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
 - 6. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
 - 7. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or bank over the butt joints. For cold piping

Town of Canton WPCA

apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

C. Equipment Insulation

1. Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
4. Do not apply insulation to equipment, breechings, or stacks while hot.
5. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
6. Cost insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions. Cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
7. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2 inches. Apply over vapor barrier where applicable.
8. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
9. Provide removable insulation sections to cover parts of equipment that must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
10. Equipment Exposed to Weather – Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.4 REPAIR/RESTORATION

- A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units, at no additional cost to the Owner.

3.5 PROTECTION

- A. The Contractor shall provide the required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 15101

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Ductile Iron Pipe and Fittings.
- B. Related Sections
 - 1. Section 02514 – Ductile Iron Pipe and Fittings
 - 2. Section 09900 - Painting
 - 3. Section 15050 - Piping – General
- C. Related Sewer Construction Details
 - 1. No. 023 – Low Pressure Sewer In-Line Air Release, Flushing, & Cleanout Structure
 - 2. No. 024 – Low Pressure Sewer Terminal Cleanout & Terminal Cleanout With Air Release Structure(s)
 - 3. No. 025 – Low Pressure Sewer Junction Cleanout Structure
 - 4. No. 026 – Low Pressure Sewer Junction Air Release, Flushing, and Cleanout Structure
 - 5. No. 029 – Force Main In-Line Air Release, Flushing, & Cleanout Structure
 - 6. No. 030 – Force Main In-Line Cleanout Structure

1.2 REFERENCES

- A. ANSI A21.51 (AWWA-C151) Standard Specification for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds for Water and Other Liquids.
- B. ANSI A21.50 (AWWA-C150) Standard Specification for the Thickness Design of Ductile Iron Pipe.
- C. ANSI A21.10 (AWWA-C110) Standard Specification for Cast Iron Fittings 2" through 48" for Water and Other Liquids.
- D. ANSI A21.4 (AWWA-C104) Standard Specification for Cement-Mortar Lining for Cast Iron Pipe and Fittings for Water.
- E. ANSI A21.11 (AWWA-C111) Standard Specification for Rubber-Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.
- F. ANSI A21.15 (AWWA-C115) Standard Specification for Flanged Ductile Iron Pipe with Threaded Flanges.

G. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

1.3 SUBMITTALS

A. Comply with the provisions of Section 15050.

1.4 QUALITY ASSURANCE

A. Comply with the provisions of Section 15050.

B. The ductile iron pipe, gray iron or ductile iron fittings to be provided and installed under this Contract shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate sworn certificates of the tests and the results. Fittings shall be manufactured in the United States of America.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with the provisions of Section 15050.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being installed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Where not indicated, as a minimum, interior piping shall be Class 53 and buried piping shall be Class 52 with a rated working pressure of 250 psi.

B. Flanges shall be faced and drilled after being screwed on the pipe, with flanges true to 90° with the pipe axis and shall be installed flush with the end of the pipe. Uni-flange type couplings are not acceptable. Flanged ductile iron pipe shall be classified by Underwriter's Lab, Inc. in accordance with ANSI A21.15 (AWWA C115).

C. Ductile iron pipe and fittings for sewage or sludge service shall be bituminous coated on the interior.

D. Fittings shall be ductile iron or gray iron. Flanges and fittings shall conform to ANSI A21.10 (AWWA C110) for 250 psi minimum pressure rating. Fittings and pipe shall have standard 125# flanges, flat faced.

E. Filler flanges and beveled filler flanges shall be furnished and installed as required by the Drawings or approved by the Engineer. Filler flanges and beveled filler flanges shall be furnished faced and drilled complete with extra length bolts. Filler flanges shall be equal to Clow Fig. F-1984 and beveled filler flanges shall be equal to Clow Fig. F-1986. Filler flanges and/or beveled filler flanges shall be installed only where approved by the WPCA's Technical Consultant.

F. Flanged joints shall be assembled with bolts and nuts, bolt studs with nut on each end, or studs with nuts in tapped flanges. Bolts and nuts shall be manufactured in accordance with ASTM A307, Grade B, cad plated with X-Heavy nuts. Nuts and bolts shall be provided with an anti-seize, thread lubricating compound. Gaskets for flanged joints shall be full face, 1/8 inch red rubber.

Town of Canton WPCA

- G. Sleeves and wall pipes shall be furnished and placed in accordance with the requirements of Section 15050.

2.2 FINISHES

- A. Exterior of pipe shall be primed and finish painted in accordance with Section 15050 and Section 09900.

PART 3 EXECUTION

3.1 PREPARATION

- A. Pipe surface preparation shall be the work of this Section and shall be performed in accordance with Section 09900.

3.2 INSTALLATION

- A. Comply with the provisions of Section 15050.
- B. Flanged joints shall be made with opposite bolts tightened alternately and evenly. Bolt threads shall extend no more than 2-3 threads beyond the nut after tightening.

3.3 FIELD QUALITY CONTROL

- A. Comply with the provisions of Section 15050.
- B. Pressure and leakage tests will be required. The test pressures for the various pipe lines shall be at least two times the operating pressure of the system or 150 psi maximum. Actual test pressures will be determined by the WPCA's Technical Consultant. Test pressure shall be maintained with no loss in pressure for a period of 4 hours minimum.

END OF SECTION

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SECTION 15103

COPPER PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes description of Contractor's responsibilities to provide all labor, materials, equipment, and incidentals required to furnish and install copper piping and fittings as shown on the approved Drawings, and as specified herein.
- B. Related Sections
 - 1. Section 02513 – Copper Pipe and Fittings
 - 2. Section 02519 - Water Services
 - 3. Section 09900 - Painting
 - 4. Section 15050 - Piping - General
 - 5. Section 15060 - Hangers and Supports

1.2 REFERENCES

- A. All pipe and fittings shall conform to the latest edition of the following specifications unless otherwise specified herein.
 - 1. Seamless Copper Water Tube ASTM B88
 - 2. Cast Bronze Threaded Fittings ANSI B16.15
 - 3. 150 and 300 lbs.
 - 4. Cast Bronze Fittings for ANSI B16.26
 - 5. Flared Copper Tubing
 - 6. Cast Bronze Solder Joint ANSI B16.18
 - 7. Pressure Fittings
 - 8. Wrought Copper and Bronze ANSI B16.22
 - 9. Solder Joint Pressure Fittings
 - 10. Hard Drawn Copper Tubing, Federal Specifications
 - 11. Type L WW T-799C

1.3 SUBMITTALS

- A. Comply with provisions of Section 15050.

1.4 QUALITY ASSURANCE

- A. Comply with provisions of Section 15050.

Town of Canton WPCA

- B. All copper pipe and fittings shall be of domestic manufacture and shall be the product of a single manufacturer who is experienced in the manufacture of the materials to be furnished.
- C. The materials shall be manufactured and installed in accordance with the best practices and methods and shall be suitable for the intended service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the pertinent provisions of Section 01660 and 15050.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Copper pipe shall include copper pipe, copper tubing, and fittings as specified herein.
- B. Copper pipe and tubing for pressurized systems shall have a minimum working pressure of 150 psig.
- C. Copper pipe for aboveground water distribution piping, equipment drains, and vents shall be Type L, hard drawn, seamless conforming to ASTM B88. Fittings shall be cast brass or bronze recessed solder type. Solder shall be 95% tin and 5% antimony solder. Do not use core solder.
- D. Copper pipe for below ground piping systems shall be Type K, soft or hard temper, seamless, conforming to ASTM B88. Fittings shall be cast brass or bronze recessed soldered type. Solder shall be 45% silver solder.
- E. Copper pipe for instrumentation piping shall be ASTM B88, Type L, annealed. Fittings shall be flared or compression type conforming to ANSI B16.26.
- F. Copper piping requiring threaded joints shall be ASTM B42, hard drawn temper and regular weight. Fittings shall be threaded cast bronze or brass conforming to ANSI B16.15, Class 250.
- G. Unions shall be cast bronze or brass with ground joints.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All piping shall be installed to proper line, grade and dimensions and shall be rigidly supported. Except as otherwise required, changes in direction shall be made using proper fittings, and piping shall run parallel and at right angles to walls. Systems shall be arranged with low points and drains to permit complete drainage of the system.
- B. Unions shall be provided close to main pieces of equipment and in branch lines to permit ready dismantling of piping without disturbing main pipe lines or adjacent branch lines.
- C. Threaded joints shall be made with solder to thread adapters. Threaded joints shall be made tight with graphite paste or other approved pipe compound.

Town of Canton WPCA

- D. Sleeves and wall pipes shall be furnished and placed in accordance with the requirements of Section 15050.
- E. In soldered joints, surfaces of pipe and fittings to be joined shall be cleaned with fine sandpaper to bright metal. Both surfaces to be joined shall be completely covered with a soldering flux. Joints shall be evenly heated from all sides before applying solder. Excess flux shall be removed from the joint after the solder has hardened. In threaded joints, threads shall be clean and undamaged.
- F. Copper drain piping shall be installed as required to conduct stuffing box leakage from the pump bases and (where applicable) drip cups or similar pump drain connections to the nearest floor drain or open end drain. Piping shall be of the same size as the drain connection on the respective pump, but shall not be smaller than $\frac{3}{4}$ ". Unions shall be provided as close as possible to the pump. Tees with removable plugs shall be used in lieu of 90° bends such as clogged lines may be easily rodded out.

3.2 TESTING

- A. Water piping shall be flushed clean with water and pressure tested at 100 psi. Test pressure shall be maintained with no loss in pressure for a period of 4 hours. Equipment and drain piping shall be tested at 50 psi pressure.
- B. The Contractor shall provide all equipment, materials, and apparatus to conduct tests. Any leaks shall be repaired and the pipe retested to the satisfaction of WPCA's Technical Consultant.

3.3 SURFACE PREPARATION AND PAINTING

- A. Pipe surface preparation, prime painting and finish painting is included in Section 09900.

3.4 PIPE MARKING AND IDENTIFICATION

- A. Pipe identification is included in the work of this section. All identification systems shall conform to the requirements of Sections 09900.

END OF SECTION

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SECTION 15110

VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Manual Operators
 - 2. Resilient Seated Gate Valves
 - 3. Ball Valves
 - 4. Globe Valves
 - 5. Plug Valves
 - 6. Gas Cocks
 - 7. Natural Gas Flexible Connections
- B. RELATED SECTIONS
 - 1. Section 09900 - Painting

1.2 REFERENCES

- A. ASTM A126, Specifications for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- B. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi tensile
- C. ASTM A563 - Specification for Carbon and Alloy Steel Nuts
- D. ASTM B62 Specification for Composition Bronze or Ounce Metal Castings
- E. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- F. ASTM D4101 - Specification for Propylene Plastic Injection and Extrusion Materials
- G. AWWA C500 - Standard for Gate Valves, for Water and Sewerage Systems
- H. AWWA C509 - Standard for Resilient-Seated Gate Valves, for Water and Sewerage Systems
- I. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
- J. AWWA C800 - Standard for Underground Service Line Valves and Fittings
- K. MSS SP45 - Standard for Bypass and Drain Connections
- L. MSS SP80 - Standard for Bronze Gate, Globe, Angle and Check Valves

1.3 SUBMITTALS

- A. Product data including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.
- B. Wiring diagrams, product and performance data for electrical and pneumatic actuators, electric check valves, solenoid valves and pump directors.
- C. Performance and sizing data for air release valves including manufacturer's recommended sizing requirements.
- D. Valve operating and seating torques for all valves equipped with electric or pneumatic actuators.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Ensure valves are dry and internally protected against rust and corrosion.
 - 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
 - 3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open: and block swing check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.
- C. Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels and stems as lifting or rigging points.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Provide O&M manuals for all valves.

PART 2 PRODUCTS

2.1 GENERAL

- A. Pressure and Temperature Ratings - As scheduled and required to suit.
- B. Sizes - Same size as upstream pipe, unless otherwise indicated.
- C. Extended Stems - Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

Town of Canton WPCA

- D. Bypass and Drain Connections - Comply with MSS SP-45 bypass and drain connections.
- E. Valves shall have the same end connections and an equivalent or higher pressure rating as the pipeline in which it is installed.

2.2 MANUAL OPERATORS

- A. Provide lever handles for quarter-turn valves 4 inches and smaller. Provide one lever handle for each valve supplied.
- B. Valves 6 inches and larger shall be equipped with gear actuators capable of withstanding an overload input torque of 450 ft/lbs at full open or closed positions without change to the valve or valve operation. All gearing shall be enclosed with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator housing shall be cast iron (ASTM A126 Class B).
- C. Manual actuator hand wheels shall be furnished on valves 6 inches and larger. Valves shall be mounted vertically with right angle drive actuators. All components of the actuators shall be designed to withstand, without damage, a pull of 200 pounds as required by AWWA C504 - Section 12.3. Actuators shall be designed to close with an effort of less than 40 pounds torque.
- D. Provide manual actuator chain wheels on valves 2½ inches and larger located more than 6 feet above finished floor. Chainwheel actuators shall be furnished with a galvanized chainwheel, galvanized chain guide and galvanized chain extending to 5 feet above finished floor.

2.3 RESILIENT SEATED GATE VALVES

- A. Gate valves shall be of the resilient seated wedge type, fusion bonded epoxy coated to AWWA C550, cast iron body design. They shall comply with the AWWA Gate Valve Standard C-509 as latest revised.
- B. Valves shall be rated for zero leakage at 200 psi water working pressure and have a 400 psi hydrostatic test. All testing shall be conducted in accordance with AWWA C-509.
- C. Gate valves shall be furnished with 125# ANSI B16.1 flange drilling.
- D. All cast iron shall conform to ASTM-A-126 Class B. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed. Stems shall be manganese bronze having a minimum tensile strength of 60,000 psi, a minimum yield of 20,000 psi. Bolts shall be electro-zinc plated with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.
- E. Resilient Seated Gate Valves shall be of the non-rising stem type (NRS) meeting the requirements of AWWA C509. NRS stem thrust collars shall be cast integral with the stem and machined to size. A stainless steel thrust bearing shall be incorporated, as required, to optimize operating torques. Valves shall be furnished with two O-ring stem seals located above the thrust collar and one below. O-rings shall be set in grooves in the stem. The O-ring grooves shall not be less than the root diameter of the stem threads. The internal and external iron surfaces of the valve body and

bonnet shall be coated with fusion bonded epoxy to AWWA C550 Standards. Gates for all valve sizes shall be completely encapsulated in rubber including stem bore, be field replaceable and provide a dual seal on the mating body seat. Valve shall be capable of installation in any position with rated sealing in both directions. Rubber seats of specially compounded SBR material shall be utilized and be capable of sealing under normal conditions. The valve body shall have integral guides engaging integral lugs in the gate in a tongue and groove manner, supporting the gate throughout the entire open/close travel. The inside and outside of valve body, bonnet and seal plate shall be coated with fusion bonded epoxy meeting AWWA C550 latest revision.

- F. All valves shall be open to the left (counterclockwise).
- G. Resilient seated gate valves shall be Style 3067 as manufactured by M&H Valve Co., Anniston, Alabama, equivalent by American Flow Control, Clow, Kennedy, Mueller, or approved equal.

2.4 BALL VALVES

- A. Ball valves, 1½ inch and smaller - rated for 150 psi saturated steam pressure, 600 psi WOG pressure; two-piece adaptor load construction; with bronze body conforming to ASTM B 62, single reduced port, chrome-plated brass ball, glass reinforced "Teflon" or "TFE" seats and seals, blowout-proof stem, soldered, screwed or flanged ends, and vinyl-covered steel handle. For air service provide stainless steel ball and stem with screwed or flanged ends.
- B. Ball Valves, 2 inch and larger - Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, single reduced port, chrome-plated brass ball, glass reinforced "teflon" or "TFE" seats and seals blowout proof stem, soldered, screwed or flanged ends, and vinyl-covered steel handle. For air service provide stainless steel ball and stem with screwed or flanged ends.
- C. Ball Valves - Stainless steel, flanged or threaded ends, all sizes, shall be Type 316 stainless steel body, ball, stem, cap and packing gland. Packing and seats shall be Teflon. Flanged valves shall be Class 150, threaded valves shall be rated for 100 psi at 400°F.
- D. Ball valves for PVC pipe shall be molded of Type 1, Grade 1 PVC and for CPVC pipe shall be Type 4, Grade 1 CPVC in accordance with ASTM D1784 with socket, threaded or flanged ends as required. Ball valves shall have Teflon ball seats and EPDM or Viton stem and body seals. Ball valves shall carry a pressure rating of 150 psig WOG at 73°F. ¼ inch to 6 inch ball valves shall be of true union design.
- E. Ball valves for polypropylene pipe shall be molded of virgin non-pigmented polypropylene in accordance with ASTM D4101 with fusion welded, threaded, or flanged ends as required. Ball valves shall have Teflon ball seats and Viton stem and body seals. Ball valves shall carry a pressure rating of 150 psig WOG at 73°F ¼ inch to 6 inch ball valves shall be of the true union design.

2.5 GLOBE VALVES

- A. Globe Valves, 2-inch and Smaller - MSS SP-80; Class 125; body and screwed bonnet of ASTM B62 cast bronze; with threaded or solder ends, bronze or replaceable composition disc, copper-silicon alloy stem, bronze packing gland, non-asbestos packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.
- B. Globe valves, stainless steel flanged or threaded, all sizes, shall be Type 316 stainless steel body, bonnet, disc, stem, gland and packing nut. Packing shall be Teflon. Flanged valves shall be Class 150, threaded valves shall be Class 200.

2.6 PLUG VALVES

- A. Valve body casting shall be ASTM A126 CL B cast iron using high pressure molding techniques.
- B. Provide flanged ends
- C. Flange diameter, thickness and drilling shall conform to ANSI B16.1 Class 125.
- D. Provide a welded 90% nickel seat for corrosion and erosion resistance specially profiled for low torque and extended seat life.
- E. Stem seal: U cup self-adjusting.
- F. Provide permanently lubricated 316 grade stainless steel bearings located in the body and bonnet, along with upper and lower PTFE thrust washers, to ensure consistently low operating torque.
- G. The plug shall be supported on integral trunnions, with the plug face covered with an elastomer that is molded (2½ inch to 12 inch) or vulcanized (on 14 inch and larger) to the casting providing tight shut off in either direction including under vacuum conditions. Provide Buna-N trim.
- H. Bonnet seal: "O" rings.
- I. Provide round or rectangular port full bore design with streamlined internal contours for high capacity straight through flow in the full open position, reducing turbulence and pressure drop and the effect of erosive media.
- J. All valves shall be open to the left (counterclockwise).
- K. Provide 175 psi (2½ inch to 12 inch) and 150 psi (14 inch to 36 inch) lubricated plug valves with sealant injection gun and pre-packed year's supply of NSF approved sealant.
- L. Plug valves shall be manufactured by DeZurick, Milliken, Valmatic, or approved equal.

2.7 GAS COCKS

- A. Gas cocks less than 2 inch - 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.

2.8 NATURAL GAS FLEXIBLE CONNECTIONS

- A. Flexible connections shall be stainless steel corrugated tubing with stainless steel braid cover, length shall be 12 inches, threaded ends. Flexible connections shall be as manufactured by Dormont Manufacturing Co., Model SSC-16B or an approved equal.

2.9 FINISHES

- A. Exterior of valves shall be primed and finish painted in accordance with Section 09900.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- C. Examine threads on both the valve and the mating pipe for form (i.e., out-or-round or local identification) and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Replace defective valves with new valves.

3.2 INSTALLATION

- A. General Applications - Refer to the drawings and piping system specification sections for specific valve applications and arrangements.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
- D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Install swing check valves in a horizontal position with hinge pin level.
- H. Valves and actuators shall be installed to be plumb in the vertical direction.

3.3 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.4 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.5 FIELD QUALITY CONTROL

- A. After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.6 CLEANING

- A. Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

3.7 SURFACE PREPARATION AND PAINTING

- A. Surface preparation shall be work of this Section and shall be performed in accordance with Section 09900.

3.8 FINAL ACCEPTANCE AND WARRANTY

- A. Final acceptance of all equipment furnished under these Specifications will be withheld until after field testing by the WPCA's Technical Consultant. The manufacturer and the Contractor shall guarantee the equipment against defects of any kind for a period of one year after final testing and acceptance.

END OF SECTION

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SECTION 15125

METERS & GAUGES

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. Pressure gauges and fittings.

1.2 RELATED SECTIONS

- A. Section 11306 –Pumping System Components

1.3 SUBMITTALS

- A. Product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.
- B. Product certificates signed by manufacturers of meters and gauges certifying accuracy's under specified operating conditions and products' compliance with specific requirements.
- C. Maintenance data for each type of meter and gauge for inclusion in Operation and Maintenance Manuals.

1.4 QUALITY ASSURANCE

- A. UL Compliance - Comply with applicable UL standards pertaining to meters and gauges.
- B. ASME and ISA Compliances - Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers - Provide products by one of the following or an approved equal:
 - 1. Pressure Gauges and Accessories
 - a. Ametek, U.S. Gauge Div.
 - b. Ashcroft Dresser Industries Instrument Div.
 - c. Trerice (H.O.) Co.
 - d. Weksler Instruments.
 - e. Approved Equal.

2.2 PRESSURE GAUGES

- A. Pressure gauges shall be provided where shown on the approved drawings, specified in the detailed specifications or required for a complete installation.
- B. Gauges shall be mounted on the suction and discharge of each pump on a section of pipe where the cross-section of pipe is constant and straight, five to ten pipe diameters downstream from any elbow, valve or other similar turn or obstruction that might cause turbulence at the gauge tapping section. Gauges shall be installed on the seal water piping of each pump. Gauges shall be installed on the up stream and downstream piping of each pressure regulating valve.
- C. The gauge tap shall be ½" NPT and shall be free from burrs or other irregularities.
- D. Pressure gauges shall be a 4½" diameter minimum, black FRP (fiberglass reinforced polypropylene) case, glycerine filled, acrylic lens, screwed lens ring, solid front, blow-out back, bronze bourbon tube, ½" NPT brass socket, bottom connection, stainless steel brushed movement, 1% accuracy full scale ANSI B 40.1 grade 2A.
- E. Select the proper vacuum, compound, or pressure range for the service intended. Pressure ranges shall be approximately twice the normal working pressure. Pressure ranges shall be graduated in PSI, vacuum ranges in inches of mercury, pressure gauges for all pumps shall be graduated in both PSI and feet of water.
- F. Pressure gauges shall be provided with an external ½" NPT brass snubber to reduce the pressure pulsations to the gauge and a ½" NPT brass shut off ball valve.
- G. Provide a diaphragm protection seal where indicated, to the gauge and snubber to prevent the media to be measured from clogging or corroding the bourdon tube of the pressure gauge. Diaphragm protection seal shall be of the cleanout design type which will allow cleaning of the lower diaphragm assembly chamber without loss of the fill fluid between the gauge and seal and shall not require refilling or recalibration. The upper housing shall be plated steel and have a ¼" NPT instrument connection. The diaphragm element shall not be less than 2½" in diameter and shall be made of solid teflon, chlorine and sulfur dioxide service shall have a tantalum diaphragm element, the lower housing shall be suitable of the service intended and shall have a ½" NPT process connection. Pressure gauges and snubbers that are assembled to diaphragm seals shall be filled with instrument oil fill fluid between the gauge and seal. All gauges and seal assemblies shall be tested and calibrated to ensure proper operation.

PART 3 EXECUTION

3.1 ADJUSTING

- A. Adjust faces of meters and gauges to proper angle for best visibility.

3.2 CLEANING

- A. Clean windows of gauges and factory finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15140

DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Water distribution piping to a point 10 feet outside the building including
 - a. Potable cold water piping
 - b. Potable hot water piping
 - c. Fittings and specialties

B. Related Sections

1. Section 15050 - Piping - General
2. Section 15060 - Hangers and Supports.
3. Section 15075 - Mechanical Identification.
4. Section 15110 - Valves and Appurtenances.

1.2 REFERENCES

- A. ASME B31.9 - Code for Pressure Piping - Building Services Piping
- B. BOCA Basic National Plumbing Code
- C. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
- D. ASTM B32 - Specification for Solder Metal
- E. ASTM B88 - Specification for Seamless Copper Water Tube
- F. AWWA C651 - Standard for Disinfecting Water Mains

1.3 DEFINITIONS

- A. Water Distribution Piping - A pipe within the building or on the premises that conveys water from the water service pipe or meter to the points of usage.
- B. Water Service Piping - The pipe from the water main or other source of potable water supply, to the water distributing system of the building served.
- C. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.4 SUBMITTALS

- A. Comply with the provisions of Section 15050.
- B. Product data for each pipe material, pipe fitting, piping specialty and valve specified. Provide manufacturers catalog information. Indicate valve data and ratings.

Town of Canton WPCA

- C. Certification of Compliance with ASME and UL fabrication requirements where specified.
- D. Test reports specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements - comply with the provisions of the following:
 - 1. ASME B31.9 "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 - 2. BOCA Basic National Plumbing Code
- B. Comply with the provisions of Section 15050 regarding permit requirements, welder certifications and documentation.
- C. The manufacturer's name and pressure rating shall be marked on valve body.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with the provisions of Section 15050 and 15110.

1.7 SEQUENCING

- A. Coordinate the installation of pipe sleeves for wall and floor penetrations.

1.8 EXTRA MATERIALS

- A. Maintenance Stock - Furnish one valve key for each key operated hydrant, bibb, or faucet installed.
- B. Provide two repacking kits for each size valve.
- C. Provide spare parts kit for each backflow preventer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer - Subject to compliance with requirements, provide products by one of the following or an approved equal:
 - 1. Hose Bibbs
 - a. Chicago Faucet
 - b. Mansfield Plumbing Products
 - c. Nibco, Inc.
 - d. Watts Regulator Co.
 - e. J.R. Smith Mfg. Co.
 - 2. Backflow Preventers
 - a. Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.
 - b. Hersey Products, Inc.

Town of Canton WPCA

- c. ITT Lawler; Fluid Handling Div.
 - d. Watts Regulator Co.
3. Y-Pattern Strainers
- a. Armstrong Machine Works
 - b. Hoffman Specialty ITT; Fluid Handling Div.
 - c. Metraflex Co.
 - d. Spirax Sarco.
 - e. Trane Co.
 - f. Watts Regulator Co.
4. Wall Hydrants
- a. Josam Mfg. Co.
 - b. Smith, (Jay R.) Mfg. Co.
 - c. Tyler Pipe; Sub. of Tyler Corp.
 - d. Woodford Mfg. Co.
 - e. Zurn Industries, Inc., Hydromechanics Div.
5. Pressure Regulating Valves
- a. A.W. Cash Valve Mfg. Corp.
 - b. Cla-Val Co.
 - c. Spence Engineering Co., Inc.
 - d. Watts Regulator Co.
 - e. Fisher
6. Water Meters
- a. As approved by the WPCA and the local Water Department.
7. Relief Valves
- a. A.W. Cash Valve Mfg. Corp.
 - b. Conbraco Industries, Inc.
 - c. Watts Regulators C.
 - d. Zurn Industries, Hydromechanics Div.
8. Water Hammer Arresters
- a. Amtrol, Inc.
 - b. Jay R. Smith Mfg. Co.

- c. Tyler Pipe; Sub. of Tyler Corp.
- d. Zurn Industries, Inc.; Hydromechanics Div.
- 9. Dielectric Waterway Fittings
 - a. Victaulic Company of America
 - b. Grinnel Corp.
 - c. Pipeco.
- 10. Dielectric Unions
 - a. Perfection Corp.
 - b. Watts Regulator Co.
 - c. Grinnel Corp.
- 11. Trap Seal Primers
 - a. Mifab Co.
 - b. Or equal.

2.2 MATERIALS

A. Piping

- 1. Above grade - Drawn Temper Copper Tubing - ASTM B88, Type L.
- 2. Below grade (2 inch and smaller) - Annealed Temper Copper Tubing -ASTM B88, Type K.

B. Fittings

- 1. Wrought-Copper Fittings - ANSI B16.22, Streamlined pattern.
- 2. Cast Bronze Flanges - ANSI B16.24, Class 150; raised ground face, bolt holes spot faced.
- 3. Unions - ANSI B16.39, malleable iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.
- 4. Dielectric Unions - Threaded or soldered end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.

C. Joints and Joining Materials

- 1. Solder Filler Metals - ASTM B32, 95-5 Tin-Antimony.

D. General duty valves (i.e., gate, globe, check, ball and butterfly valves) are specified in Section 15110, Valves and Appurtenances. Special duty valves are specified below by their generic name; refer to Part 3 Paragraph 3.8 "VALVE APPLICATION" for specific uses and applications for each valve specified.

Town of Canton WPCA

- E. Hose Bibbs – Hose bibs shall be bronze body, renewable composition disc, tee handle, $\frac{3}{4}$ inch NPT inlet, $\frac{3}{4}$ inch hose outlet or $\frac{1}{2}$ inch NPT inlet, and $\frac{1}{2}$ inch hose outlet. Integral vacuum breaker shall be in conformance with ANSI/ASSE Standard 1011.
- F. Recessed Non-Freeze Wall Hydrants – Shall be cast bronze box, with chrome plated face, tee handle key, vacuum breaker, hinged locking cover, $\frac{3}{4}$ ” inlet, and hose outlet. Bronze casing shall be length to suit wall thickness.
- G. Trap Seal Primers for Floor Drains
 1. Shall be trap seal primer distribution unit with outlet connection (for $\frac{1}{2}$ copper tubing) to each floor drain.
 2. Trap seal primer, distribution unit, and air gap fitting to be as manufactured by Mifab, or equal
- H. Backflow Preventers – Reduced Pressure Type
 1. DEP approved reduced pressure principle assembly consisting of shutoff valves on inlet and outlet, and strainer on inlet. Assemblies shall include test cocks, and pressure-differential relief valve located between 2 positive seating check valves, and comply with requirements of ANSI/ASSE Standard 1013.
 2. Backflow prevention units shall be of size noted on the Drawings and be equal to Watts Model 909S equivalent by FEBCO, Hersey, or approved equal, with two resilient seated bronze ball valves and strainer.
 3. Backflow preventers will be installed at the locations shown on the Drawings and where required by the Plumbing Code.
 4. Furnish 1 spare parts kit.
- I. Y-Strainers – 2 inch to 12 inch Y-Strainers
 1. Y-Strainers shall be constructed of high-tensile ASTM A-126, Class B cast iron with blowoff connections and self-aligning cylindrical stainless steel screens.
 2. Strainers shall be Class 125, designed for a working pressure of 200 psi at 210°F.
 3. Strainers shall be suitable for potable water service. Size shall be as shown on the plans.
 4. Strainers shall be Model No. 77F as manufactured by Watts Regulator Co., or approved equal.
- J. Y-Strainers - $\frac{1}{4}$ inch to $\frac{1}{2}$ inch
 1. Strainer shall be bronze with screwed end connections, rated for 250 psi @ 210°F.
 2. Strainer shall have a 24 mesh stainless steel screen.
 3. Strainer shall be Series 27 as manufactured by Watts Regulator Co. or approved equal.

Town of Canton WPCA

- K. Recessed Non-Freeze Wall Hydrants shall be cast-bronze box, with chrome plated face, tee handle key, vacuum breaker, hinged locking cover, ¾ inch inlet, and hose outlet. Bronze casing shall be length to suit wall thickness.
- L. Balance Valves shall be Class 125, bronze body, bronze plugs, screw driver operated, straight or angle pattern, with soldered end connections.
- M. Pressure Regulating Valves shall be single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.
- N. Water Hammer Arresters shall be bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
- O. Relief Valves shall be in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.
 - 1. Combined Pressure - Temperature Relief Valves - Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi.
- P. Sill Faucets shall be bronze body, with renewable composition disc, wheel handle, ¾ inch hose outlet.
- Q. Dielectric pipe couplings shall be in accordance with Section 15110.
- R. Anchor bolts, nuts, washers, and bolt sleeves shall be in accordance with Section 15050.
- S. Sleeves and seals shall be in accordance with Section 15050.
- T. Water meters shall be constructed of durable bronze with a maincase that is corrosion resistant, including thrust compensated rotors, graphite bearings, and shall have a turbine element (AWWA Class II Turbine) for measuring high flows and a dual suspension rotating disc for low flows. The meter shall have a stainless steel calibration vane for field calibration. A maximum operating pressure of 150 psi and a normal operation range as tabulated. The water meter shall be Type HP Turbine water meter manufactured by Neptune Schlumberger or approved equal.

<u>Size</u>	<u>AWWA Standard Flow</u>
2"	4 to 160 gpm
3"	8 to 350 gpm
4"	15 to 630 gpm
5"	30 to 1400 gpm

2.3 FINISHES

- A. Comply with the provisions of Section 15050.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with the provisions of Section 15050.

3.3 PIPING INSTALLATION

- A. Comply with the provisions of Section 15050.
- B. General Locations and Arrangements - Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- C. Use fittings for all changes in direction and all branch connections.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- F. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- H. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- I. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, ¾ inch ball valve, and short ¾ inch threaded nipple and cap.
- J. Exterior Wall Penetrations - Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals in accordance with Section 15050.
- K. Install piping level with no pitch.
- L. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building.

- M. Install shutoff valve at service entrance inside building; complete with strainer, pressure gauge, and test tee with valve.
- N. Pipe identification and marking is included in Section 15075.
- O. Hanger, supports and anchor devices shall be in accordance with Section 15060.

3.4 INSTALLATION OF VALVES

- A. Sectional Valves - Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inch and smaller, use ball valves; for sectional valves 2½ inch and larger, use ball or butterfly valves.
- B. Shutoff Valves - Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 3 inch or smaller, use ball valves; for shutoff valves 4 inch and larger, use ball or butterfly valves.
- C. Drain Valves - Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system. For drain valves 3 inch and smaller, use ball valves; for drain valves 4 inch and larger, use ball or butterfly valves.
- D. Check Valves - Install swing check valves on discharge side of each pump, and elsewhere as indicated.
- E. Hose Bibs - Install on exposed piping where indicated, with vacuum breaker.

3.5 INSTALLATION OF PIPING SPECIALTIES

- A. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet without valves, to nearest floor drain.
- B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gauge on valve outlet.
- C. Install water meters in accordance with utility company's installation instructions and requirements.

3.6 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures - Provide water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.
- B. Mechanical Equipment Connections - Connect water piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.7 PIPE APPLICATIONS

- A. Install Type L, drawn copper tubing with wrought copper fittings and solder joints for 4 inch and smaller, above ground within building.

- B. Install Type K, annealed temper copper tubing with wrought copper fittings and solder joints for 2 inch and smaller, below ground within building.

3.8 VALVE APPLICATIONS

- A. General Duty Valve Applications - The Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shut-off Duty - use ball valves.
 - 2. Throttling Duty - use ball and needle valves.

3.9 FIELD QUALITY CONTROL

- A. Inspections
 - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - a. Rough-in Inspection - Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection - Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
 - 3. Reinspections - Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
 - 4. Reports - Prepare inspection reports, signed by the plumbing official.

3.10 TESTING

- A. Test for leaks and defects in all new water distribution piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
- B. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
- C. Cap and subject the piping system to a static water pressure of 125 psig. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
- D. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
- E. Prepare reports for all tests and required corrective action.

3.11 CLEANING AND DISINFECTION

- A. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
- B. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in AWWA C651, or as described below:
 - 1. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
 - 2. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
 - 3. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - 4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water going from the system.
 - 5. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
- C. Prepare reports for all purging and disinfecting activities.
- D. Do not discharge chlorinated water to the environment in order to prevent chlorinated water from entering groundwater or surface water. All flushing water must be collected and disposed of properly.
- E. The discharge of water used for chlorination and flushing of the water mains shall be in strict conformance with all applicable local, state and federal regulations. Either completely dechlorinate the water prior to its discharge to the environment or, alternatively, collect all water and haul off site for proper disposal at a wastewater treatment plant. All costs associated with the discharge and/or disposal of the water used for chlorination and/or flushing shall be included in the work.

END OF SECTION

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SECTION 15150

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

- A. Section Includes
 - 1. Building sanitary and storm drainage to a point 10 feet outside the exterior building foundation wall
 - 2. Vent piping systems
 - 3. Drains and drainage specialties
- B. Related Sections
 - 1. Section 15050 – Piping - General
 - 2. Section 15060 – Hangers and Supports
 - 3. Section 15080 - Mechanical Identification
 - 4. Section 15140 – Domestic Water Piping
- C. Related Sewer Construction Details
 - 1. No. 034 – Gasoline and Sand Trap

1.2 REFERENCES

- A. BOCA Basic National Plumbing Code.
- B. ASTM A74 - Specification for Cast Iron Soil Pipe and Fittings.
- C. ASTM B32 - Specification for Solder Metal.
- D. ASTM B306 - Specification for Copper Drainage Tube.
- E. ASTM C564 - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- F. Cast Iron Soil Pipe Institute (CISPI).
- G. Connecticut State Building Code.

1.3 DEFINITIONS

- A. Building Drain - That part of the lowest piping of a drainage system that receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the drainage system.
- B. Vent System - A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.4 SUBMITTALS

- A. Material specification and shop drawings for all materials and equipment furnished under this Section.
- B. Product data for the following products.
 - 1. Drainage piping specialties.
 - 2. Floor sinks.
- C. Vent piping plan drawn to scale

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements - comply with the provisions of the following:
 - 1. BOCA Basic National Plumbing Code
 - 2. Connecticut State Building Code.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with the provisions of Section 15050.

1.7 SEQUENCING

- A. Coordinate the installation of flashing and roof penetrations.
- B. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- C. Coordinate with installation of drainage systems as necessary to interface building drains with drainage piping systems installed under Division 2.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer - Subject to compliance with requirements, provide drainage and vent systems from one of the following or an approved equal:
 - 1. Drainage Piping Specialties, including expansion joints, drains, and vent caps:
 - a. Ancon, Inc.
 - b. Josam Mfg. Co.
 - c. Jay R. Smith Mfg. Co.
 - d. Tyler Pipe; Subs. of Tyler Corp.
 - e. Zurn Industries, Inc.; Hydromechanics Div.

2.2 MATERIALS

- A. Above Ground Piping and Fittings
 - 1. Hubless Cast-Iron Soil Pipe - CISPI Standard 301, service weight, cast-iron soil pipe with 24 gauge type 304 corrosion resistant 18-8 chromium-nickel

Town of Canton WPCA

bearing stainless steel no-hub fittings with neoprene gaskets conforming to CISPI Standard 310. Clamp shall be high torque type (100 to 125 in/lbs), of same construction (Type 304 stainless) as above.

2. Copper Tube - ASTM B306, DWV with ASME B16.23 cast bronze or ASME B16.29 wrought copper fittings and ASTM B32 solder joints, Grade 50B.
- B. Underground Pipe and Fittings
1. Cast-Iron Soil Pipe - ASTM A74, service weight, hub-and-spigot soil pipe and fittings. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.
 2. Neoprene Compression Gaskets - ASTM C564.
- C. Expansion Joints - Cast-iron body with adjustable bronze sleeve, bronze bolt and wing nuts.
- D. Cleanout Plugs - Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.
- E. Floor Cleanouts - Cast-iron body and frame, with cleanout plug and adjustable round top as follows:
1. Floor Cleanouts in Process Areas/Mechanical Rooms - Cast-iron Top - Manufacturer's standard cast iron body, access cover with cleanout, heavy-duty scoriated secured ductile iron cover, internal recessed threaded bronze plug, J.R. Smith Series 4233, or equivalent model by Josam, Zurn, or approved equal.
 2. Floor Cleanouts in Finished Areas - Nickel bronze top, manufacturer's standard cast iron body, with adjustable top, spigot connection, internal bronze countersunk plug, solid scoriated secured bronze cover, J.R. Smith Series 4033, equivalent by Josam, Zurn or approved equal.
- F. Flashing Flanges - Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.
- G. Vent Flashing Sleeves - Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- H. Frost-Proof Vent Caps - Construct of galvanized iron, copper, or lead-coated copper, sized to provide 1 inch air space between outside of vent pipe and inside of flashing collar extension.
- I. Vandal-Proof Vent Caps - Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

J. Floor Sinks

1. Shall be cast iron sanitary floor sinks painted inside and out, with acid resisting interior weep holes, bottom outlet, inside caulk connection, internal dome strainer, nickaloy sanitary sloped rim, and nickaloy light-duty anti-tilting super-flow grate.
2. Series 49110 (Model 49114) by Josam Company, Michigan City, IN, 4" pipe size, weighing 77.6 pounds.
3. Floor sinks to be provided with a ½" trap seal primer tapping. Refer to Section 15140 (Domestic Water Piping) for information regarding automatic trap priming devices to be used in conjunction with the floor sinks.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- C. Examine walls, floors, roof, and plumbing changes for suitable conditions where piping and specialties are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected at no additional cost to the Owner.

3.2 PREPARATION

- A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.
- C. Shape bottom of trench to fit bottom of pipe for 90° (bottom ¼ of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements - Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated. Drain locations as shown on the plans are approximate and may have to be varied in the field.
- B. Use fittings for all changes in direction and all branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. Exterior Wall Penetrations - Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals in accordance with Section 15050.
- H. Make changes in direction for drainage and vent piping using approximate 45° wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90° shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- I. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- J. Install building drain pitch down at minimum slope of ¼ inch per foot (2%) for piping 3 inch and smaller, and 1/8 inch per foot (1%) for piping 4 inch and larger.
- K. Extend building drain to connect to drainage piping, of size and in location indicated for service entrance to building.
- L. Minimize number of roof penetrations for vent piping by combining individual vents into common vents, to the extent possible.
- M. Hanger, supports, and anchor devices shall be in accordance with Section 15060.

3.4 INSTALLATION OF PIPING SPECIALTIES

- A. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.
- B. Above Ground Cleanouts - Install in above ground piping and building drain piping as indicated, and:
 - 1. as required by plumbing code;
 - 2. at each change in direction of piping greater than 45°;
 - 3. at minimum intervals of 50' for piping 4 inch and smaller;

- 4. at base of each vertical soil or waste stack.
- C. Flashing Flanges - Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- D. Vent Flashing Sleeves - Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.
- E. Frost-Proof Vent Caps - Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1" clearance between vent pipe and roof substrate.

3.5 INSTALLATION OF FLOOR DRAINS

- A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

<u>Depression in Inches</u>	<u>Radius of Area Drained - Feet</u>
1/2	5
3/4	10
1	15
1 1/4	20
1 1/2	25

- D. Trap all drains.
- E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- F. Position drains so that they are accessible and easy to maintain.

3.6 CONNECTIONS

- A. Piping Runouts to Fixtures - Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.7 PIPE APPLICATIONS - ABOVE GROUND, WITHIN BUILDING

- A. Above Ground, Within Building
 - 1. Install copper tube with cast bronze fittings for 3 inch and smaller, drainage and vent pipe. Solder joints in accordance with the procedures specified in AWS "Soldering Manual".
 - 2. Install hubless, service weight, cast-iron soil pipe and fittings for larger than 3 inch drainage and vent pipe. Make compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

B. Below Ground, Within Building

1. Install hub-and-spigot, standard weight, cast-iron, soil pipe and fittings with gasketed joints for 15 inch and smaller drainage pipe. Make compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

3.8 FIELD QUALITY CONTROL

A. Inspections

1. Do not enclose, cover, or put into operation drainage and vent piping systems until it has been inspected and approved by the authority having jurisdiction.
2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - a. Rough-in Inspection - Arrange for inspection of the piping system before concealed or closed-in after system if roughed-in, and prior to setting fixtures.
 - b. Final Inspection - Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
3. Reinspections - Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection by the plumbing official.
4. Reports - Prepare inspection reports, signed by the plumbing official.

B. Piping System Test - Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:

1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure - Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.

Town of Canton WPCA

4. Finished Plumbing Test Procedure - After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1 inch water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.10 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

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SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Basic Electrical Requirements
 - 2. As-Built Documentation
- B. Related Sections
 - 1. Section 16080 – Electrical Testing
- C. Related Sewer Construction Details
 - 1. No. 027 – Sewage Grinder Pump
 - 2. No. 028 – Sewage Grinder Pump Electrical Wiring Diagram

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. Connecticut State Building Code
- C. NFPA 79 – Electrical Standard for Industrial Machinery
- D. ANSI/ISA-S5.4 – Instrument Loop Diagrams

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and reports.
- B. Submit As-Built documentation in accordance with Section 01770. I&C documentation shall conform with the latest versions of NFPA 79 and ANSI/ISA-S5.4.
- C. Submit a written warranty.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable Connecticut Building Code.
- B. Electrical - Conform to Connecticut Electrical Code.
- C. Conform to applicable Town Building Codes.

1.5 PROJECT CONDITIONS

- A. Install Work in locations shown on approved Drawings.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain approval from WPCA’s Technical Consultant before proceeding.

- C. Location of electrical equipment, devices, and similar items, as indicated on approved drawings, are approximate only. Exact locations are to be determined by Contractor during construction. If any location is different from those indicated (greater than 5 feet away from location shown on Drawings), WPCA's Technical Consultant.
- D. Equipment wiring
 - 1. Before pulling any power or control wire or installing conduit, obtain equipment electrical and control installation instructions and wiring diagrams. Any discrepancies from what is shown on the electrical drawings shall be brought to the attention of the Developer's Engineer and the WPCA's Technical Consultant. The WPCA's Technical Consultant will review proposed changes that may be necessary.
- E. Record Drawings: Maintain a master set of record drawings showing the changes and deviations from the Drawings or the approved shop drawings. Make markups as the changes are made.
- F. Where underground electric facilities are installed, measure, record, and submit as built dimensions.

1.6 SEQUENCING AND SCHEDULING

- A. Construct Work in sequence under provisions of Section 01325.

1.7 WARRANTY

- A. Submit a written warranty, executed by the Contractor and manufacturer agreeing to the replacement and installation of all material, parts and adjustments required due to failure in materials or workmanship within one year from final acceptance of the Work.

1.8 SEISMIC REQUIREMENTS

- A. Components, systems and their supports shall be designed in accordance with the Connecticut State Building Code.

PART 2 PRODUCTS

2.1 FINAL SYSTEM DOCUMENTATION

- A. Prior to final acceptance of the system, provide operating and maintenance manuals (O&M's) in accordance with Section 01330 covering instruction and maintenance on each type of equipment, as noted herein.
 - 1. The O&M's shall be submitted in three ring binder notebooks. And shall provide the following as a minimum.
 - a. A comprehensive index broken down into sections and sub-sections, etc.
 - b. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.
 - c. Full specifications on each item.

Town of Canton WPCA

- d. Detailed service, maintenance and operation instructions for each item supplied.
 - e. System schematic drawings “as Constructed”, illustrating all components, piping and electrical connections of the systems supplied under Division 16.
 - f. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
 - g. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
 - h. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.
 - i. A complete “As Constructed” set of approved shop drawings.
 - j. The format of the O&M manual shall meet the following general requirements:
 - 1) First will be the complete, comprehensive index.
 - 2) Next will be a section with the operating instructions including complete overview of the system.
 - 3) Next will be a section with a complete parts list as described above.
 - 4) Next will be a section that includes all schematic diagrams, wiring diagrams etc. of the “As Constructed System”.
 - 5) Next will be product information.
 - 6) Section and sub-section, etc. dividers shall be provided for easy reference.
 - 7) Each product shall have a separate divider for easy reference.
 - 8) Each instrument section shall have data sheets indicating the Tag names (as used on the Drawings), manufacturer, complete model number, complete specifications, and a parameter setup sheet, per tag name. Following the parameter setup sheets will be the manufacturers O&M manual in its entirety.
2. Final documentation shall be written specifically for this project, but may include standard and modified standard documentation. Modifications to existing hardware or software manuals shall be made on the respective pages or inserted adjacent to the modified pages. All standard documentation furnished shall have all portions that apply clearly indicated. All portions that do not apply shall be lined out.
 3. The manuals shall contain all illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment

furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

4. The requirements for final documentation include the following:
 - a. As-Built documentation shall include all previous submittals, as described in this Specification, updated to reflect the as-built system.
 - b. The maintenance documentation shall describe the detailed preventative and corrective procedures required to keep the System in good operating condition. All hardware maintenance manuals shall make reference to appropriate diagnostics, where applicable, and all necessary timing diagrams shall be included. A maintenance manual or a set of manuals shall be furnished for all delivered hardware, including peripherals. The hardware maintenance documentation shall include, as a minimum, the following information:
 - 1) Operation information – This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.
 - 2) Preventative-maintenance instructions – These instructions shall include all applicable visual examinations, hardware testing and diagnostics routines, and the adjustments necessary for periodic preventative maintenance of the system.
 - 3) Corrective-maintenance instructions – These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction.
 - 4) Parts information – This information shall include the identification of each replaceable or field-repairable module. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross-references between Contractor's part number and manufacturer's part numbers shall be provided. All PC boards shall be identified by; manufacturer and model number, slot number, part name and configuration (if applicable).

PART 3 EXECUTION

3.1 PREPARATION

- A. Test all electrical components in accordance with Section 16080 and as indicated in individual electrical equipment specification sections.
- B. Perform all electrical equipment installation, checkout, and test in a safe manner. Provide the following special safety precautions, as appropriate:

Town of Canton WPCA

1. Locking and tagging procedures.
 2. Barricades.
 3. De-energization and/or isolation of equipment prior to testing.
 4. Review of procedures with the WPCA and its Technical Consultant.
 5. Erection of warning signs.
 6. Stationing of guards and watchmen.
 7. Maintenance of voice communications.
 8. Personnel orientation.
- C. Before energizing any machine, visually inspect for serviceability. Verify that equipment and machines have been properly lubricated and aligned. Verify nameplate for electrical power requirements.

END OF SECTION

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SECTION 16060

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Power system grounding.
2. Electrical equipment and raceway grounding and bonding.
3. Grounding of piping, tanks, handrails and other conductive equipment.
4. Communication system grounding.

B. Related Sections

1. Section 16050 – Basic Electrical Requirements
2. Section 16080 – Electrical Testing

1.2 REFERENCES

- A. NFPA 70 – National Electrical Code

1.3 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral and ground bus at each building service entrance equipment to grounding electrodes. Grounding electrode system shall include a minimum of three (3) driven ground rods.
- B. Ground each separately derived system neutral to the nearest effectively grounded building structural steel member or, if such is not available, to the nearest grounding electrode other than a water pipe.
- C. Provide communications systems grounding conductor at point of service entrance and connect to nearest effectively grounded building structural steel member or, if such is not available, to the nearest grounding electrode other than a water pipe.
- D. Bond together exposed non-current carrying metal parts of electrical equipment, handrails, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, metallic tanks and all metallic piping.
- E. Install grounding in accordance with NEC Article 250.

1.4 SUBMITTALS

- A. Submit shop drawings, product data, and reports.
- B. Indicate layout of ground rods, location of system grounding electrode connections, and routing of grounding electrode conductor.
- C. Submit ground resistance testing reports in accordance with Section 16080.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Grounding conductors Type - insulated copper, minimum size #12 AWG and in accordance with NEC Tables 250-66, 250-122, or as indicated on Drawings.
- B. Ground Rods: Copper-clad steel, $\frac{3}{4}$ inch diameter, minimum length 10 feet.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide a separate, insulated equipment grounding conductor with each feeder and branch circuit. Terminate each end on a grounding lug, bus, or bushing.
- B. Use a minimum of #8 AWG copper wire to ground all piping, tanks, handrails and other conductive equipment or structures including ductwork and floor gratings.
- C. Use grounding bushings on all conduits stubbed up below equipment panelboards, switchboards and motor control centers. Bond all conduits to ground bus. Use grounding bushings to ground electrical equipment and exposed non-current carrying metal parts.
- D. Use cadweld, thermweld or brazed type ground connections for the grounding electrode system: cable to cable, cable to ground rod and cable to building structural steel and reinforcing steel connections.
- E. Supplementary Grounding Electrode: Use effectively grounded metal frame and rebar of the building and ground rods spaced a minimum of 10' apart in sufficient quantity to have a measured resistance to ground of not more than 5 ohms.
- F. Use minimum 6 AWG copper conductor for communications service grounding conductor. Leave 10' slack conductor at terminal board.
- G. Isolated Grounding Systems: Use insulated equipment grounding conductor and connect only to service grounding electrode.

3.2 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation and compliance with NEC Article 250.

3.3 TESTING

- A. Perform ground tests using a low resistance, Null balance type, ground testing ohmmeter, with test lead resistance compensated for. Use the type of test instrument which compensates for potential and current rod resistances.
- B. Test each ground rod and measure ground resistance. If resistance is not 5 ohms or less, drive additional rods to obtain a resistance of 5 ohms or less. Submit tabulation of results to WPCA's Technical Consultant. Include identification of electrode, date of reading and ground resistance value in the test reports.
- C. Ground resistance of conduits, equipment cases, and supporting frames, shall not vary from that of system as a whole and shall not exceed 5 ohms to ground. Submit all readings to WPCA's Technical Consultant.

Town of Canton WPCA

- D. Where ground test results identify the need for additional grounding conductors or rods that are not indicated or specified, changes shall be made to obtain acceptable values.

END OF SECTION

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SECTION 16070

ELECTRICAL HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Support channel
2. Fastening hardware
3. Anchor bolts

1.2 REFERENCES

- A. ASTM A-780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dipped Galvanized Coatings

1.3 SUBMITTALS

- A. Submit shop drawings, product data, and reports.

1.4 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 PRODUCTS

2.1 SUPPORT CHANNEL

- A. Support channel shall be galvanized steel unless noted otherwise
- B. Support channel assembly hardware shall be stainless steel
- C. Support channel shall be by Unistrut, Wayne, MI; B-Line, Highland, IL; Thomas&Betts, Memphis, TN; or approved equal.

2.2 FASTENING HARDWARE

- A. All fastening hardware shall be 304-stainless steel unless noted otherwise.

2.3 ANCHOR BOLTS

- A. Anchor bolts, nuts, washers, bolt sleeves, and assembly hardware shall be Type 316 stainless steel. Expansion bolts shall be “Kwik Bolt II” or “HVA Adhesive Anchor” by Hilti, Tulsa, OK; Redhead “Trubolt Wedge” or “Epcon Adhesive Anchor” by ITW Ramset / Red Head, Wood Dale, IL; or Parabolt as manufactured by the Molly Division Emhart Corp., or approved equal.
- B. All expansion/adhesive bolts and associated hardware are to be stainless steel.

2.4 PIPE CLAMPS AND STANDOFFS

- A. Pipe clamps and standoffs shall be one hole, malleable iron type. They shall be of the same manufacturer and shall be designed to be used together.

Town of Canton WPCA

- B. The finish shall be suitable for the piping system being supported. If PVC coated pipe is being supported, PVC coated clamps and standoffs shall be used.

2.5 THREADED RODS

- A. Threaded hanging rods shall be 304 stainless steel and be one piece. The size shall be suitable for the loads being supported.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, preset inserts or beam clamps. Do not use spring steel clips and clamps.
- B. Use expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- D. Do not use powder-actuated anchors.
- E. Fabricate supports from hot-dipped galvanized structural steel or hot-dipped galvanized steel channel rigidly welded or bolted to present a neat appearance. Use stainless steel hexagon head bolts with spring lock washers under all nuts. Coat ends of galvanized steel channel that has been cut with zinc-rich paint in accordance with ASTM A-780.
- F. Install freestanding electrical equipment on 4" concrete housekeeping pads.
- G. Install surface-mounted cabinets and panelboards with minimum of four 316 stainless steel anchors. Provide galvanized steel channel supports to stand cabinet 1" off wall.
- H. Bridge studs top and bottom with galvanized steel channels to support flush-mounted cabinets and panelboards in stud walls.
- I. Use standoffs on surface mounted conduit to maintain ¼" space between conduits and walls.

END OF SECTION

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SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Nameplates.
 - 2. Wire and cable markers.

1.2 REFERENCES

- A. NEMA WC5 - Thermoplastics - Insulated Wire and Cable for Transmission and Distribution of Electrical Energy
- B. ANSI C57

1.3 SUBMITTALS

- A. Provide schedule for nameplates.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Engraved three-layer plastic, white letters on a black background.

2.2 WIRE AND CABLE MARKERS

- A. Split sleeve or tubing type waterproof markers for wire sizes up to AWG10 (Thomas & Betts, Sur-Code Sleeve Markers or approved equal). Plastic impregnated cloth markers, resistant to abrasion, moisture, dirt and oil (Ideal or approved equal) for AWG 8 and larger wire sizes.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Wording of the nameplates shall be in conformance with Drawings and acceptable to the WPCA. Secure nameplates to equipment fronts using ASA Type U drive screws, and water resistant adhesive. Secure nameplate to face of panelboard doors one third of the way down from the top of the door.
- D. Embossed tape will not be permitted for any application.

3.2 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, switchgear, switchboards, motor control centers, at load connection and at each terminal board connection. Identify with branch circuit or

Town of Canton WPCA

feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

- B. Circuits passing through junction boxes shall be individually grouped and bound with Ty-raps.
- C. Include the following color coding of all conductors used for power or lighting circuits.
 - 1. 120/240 volt, single phase 3 wire
 - a. Black - Phase A
 - b. Red - Phase B
 - c. White - Neutral
 - d. Green - Equipment ground
 - 2. 120/208 volt, three phase 4 wire
 - a. Black - Phase A
 - b. Red - Phase B
 - c. Blue - Phase C
 - d. White - Neutral
 - e. Green - Equipment ground
 - 3. 277/480 volt 3 phase 4 wire
 - a. Brown - Phase A
 - b. Orange - Phase B
 - c. Yellow - Phase C
 - d. Gray - Neutral
 - e. Green - Equipment ground
- D. Color coding of multiconductor control cables shall be in accordance with NEMA Standard WC5.

3.3 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates of minimum letter height as scheduled below.
- B. Panelboards, Switchboards, Switchgear, and Motor Control Centers - ¼ inch to identify equipment designation, 1/8 inch to identify voltage rating and source.
- C. Switches, and Motor Starters in Panelboards, Switchboards, Switchgear, and Motor Control Centers - ¼ inch to identify circuit and load served, including location.
- D. Individual Circuit Breakers, Enclosed Switches, Remote Operator Stations, Time Clocks, Control Devices, and Motor Starters - 1/8 inch to identify load served.

Town of Canton WPCA

- E. Transformers - ¼ inch to identify equipment designation, 1/8 inch to identify primary and secondary voltages, primary source, and secondary load and location. Power transformer nameplates shall be in accordance with ANSI C57.
- F. Pumps, fans, and other electrical equipment - ¼ inch to identify equipment designation.
- G. Equipment With More Than One Power Source, Including Motors With Heaters - ¼ inch to identify power sources. Mount nameplate on motor disconnect switch, equipment enclosure, or other prominent location.

END OF SECTION

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SECTION 16080
ELECTRICAL TESTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Testing of Electrical Systems - General
 - 2. Electrical Test Equipment
 - 3. Electrical Test Procedures
 - 4. Specific Electrical Tests
- B. RELATED SECTIONS
 - 1. Section 16075 – Electrical Identification

1.2 REFERENCES

- A. Connecticut State Building Code.
- B. NFPA 79 – Electrical Standard for Industrial Machinery.
- C. ANSI/ISA-S5.4 – Instrument Loop Diagrams.
- D. ANSI C37

1.3 SUBMITTALS

- A. Submit motor test results.
- B. Submit megger test results.
- C. Submit grounding system test results.
- D. Submit As-Built documentation in accordance with Section 01780. I&C documentation shall conform with the latest versions of NFPA 79 and ANSI/ISA-S5.4.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 TESTING OF ELECTRICAL SYSTEMS - GENERAL

- A. Provide supervision, labor, materials, tools, test instruments and other equipment or services and expenses required to test, adjust, set, calibrate, and operationally check work and components of the various electrical and control systems and circuitry throughout the contract.
- B. After completion of testing replace wiring and equipment found defective (defined as failing to meet specified requirements).
- C. Do not void equipment warranties or guarantees by testing and checkout work. Checks and tests shall be supplemental to and compatible with the manufacturer's

Town of Canton WPCA

installation instructions. Where deviations are apparent, obtain the manufacturer's approved review of procedure prior to testing. Where any repairs, modifications, adjustments, tests or checks are to be made, contact WPCA's Technical Consultant to determine if the work should be performed by or with the manufacturer's representative. All checks and tests specified for proper operating and safety of equipment and personnel are to be performed concurrent with progression of the work, prior to final acceptance by the WPCA.

- D. At any stage of construction and when observed, any electrical equipment or system determined to be damaged, or faulty, is to be reported to WPCA's Technical Consultant. Corrective action requires the WPCA's Technical Consultant's approval prior to re-testing, and inspection.
- E. Prior to testing and start-up, equipment and wiring shall be properly and permanently identified with nameplates, and other identification as specified in Section 16075. Check and tighten terminals and connection points, remove shipping blocks and thoroughly clean equipment, repair damaged or scratched finishes, inspect for broken and missing parts and review and collect manufacturer's drawings and instructions for delivery to the WPCA's Technical Consultant. Make routine checks and tests as the job progresses to ensure that wiring and equipment is properly installed.
- F. Testing and checkout work is to be performed with fully qualified personnel skilled in the particular tests being conducted. Personnel are to have at least five years of experience with tests of same type and size as specified.
- G. Conduct tests in presence of WPCA's Technical Consultant. Notification is required seven (7) calendar days or more in advance when any test is to be performed, and do not start tests without approval.
- H. Make openings in circuits for test instruments and place and connect instruments, equipment, and devices, required for the tests. Upon completion of tests, remove instruments and instrument connections and restore circuits to permanent conditions.
- I. Identify test being performed, conductor or equipment the test is being performed on, date the test was performed, value of test results, person performing the test, the witness to the test, and the serial and model number and description of test instrument. Arrange information in tabular form and submit to WPCA's Technical Consultant for approval.
- J. When the electrical tests and inspections specified or required within Division 16 are complete and results reported, reviewed, and approved, that portion of the electrical equipment system or installation may be considered electrically complete. Affix appropriate, approved, and dated completion or calibration labels to the tested equipment and notify WPCA's Technical Consultant of electrical completion. If WPCA's Technical Consultant finds completed work unacceptable, he will notify Contractor in writing of unfinished or deficient work, with the reason for his rejection, to be corrected by Contractor. Contractor will notify WPCA's Technical Consultant in writing when exceptions have been corrected. The Contractor will prepare a "notification of Substantial Electrical Completion" for approval by WPCA's Technical Consultant following WPCA's Technical Consultant's acceptance of electrical completion. If later in-service operation or further testing identifies problems attributable to Contractor, these will be corrected.

3.2 ELECTRICAL TEST EQUIPMENT

- A. Test equipment used is to be inspected and calibrated.
- B. Perform calibration and setting checks with calibrated test instruments of at least twice that of the accuracy of the equipment, device, relay or meter under test. Dated calibration labels shall be visible on test equipment. Calibrations over 6 months old are not acceptable on field test instruments. Inspect test instruments for proper operation prior to proceeding with the tests.
- C. Perform ground tests using a low resistance, Null balance type, ground testing ohmmeter, with test lead resistance compensated for. Use the type of test instrument which compensates for potential and current rod resistances.

3.3 TEST PROCEDURES

- A. Prepare procedures and schedules for the work specified herein. This work is to be coordinated and compatible with both the work and schedule of the other crafts. Sequence the tests and checks so that the equipment can be energized immediately after the completion of the application tests.
- B. The test procedures shall provide specific instructions for the checking and testing of each electrical component of each system. Schedule tests and inspections as the job progresses.
- C. Testing and checkout work shall be conducted in a safe manner. Provide the following special safety precautions, as appropriate:
 - 1. Locking and tagging procedures
 - 2. Barricades
 - 3. Deenergization and/or isolation of equipment prior to testing
 - 4. Review of procedures with ENGINEER and Resident Project Representative
 - 5. Erection of warning signs
 - 6. Stationing of guards and watchmen
 - 7. Maintenance of voice communications
 - 8. Personnel orientation
- D. Before energizing any machine, visually inspect for serviceability. Check manufacturer's instruction manual for correct lubrication and ventilation. Align motor with driven equipment. Check nameplate for electrical power requirements.
- E. Insulation resistance measurements for motor feeders shall be performed with motors disconnected, measure insulation resistance from load side of contactors or circuit breakers.
- F. Perform insulation tests at the following times and conditions:
 - 1. Prior to energization and/or placing into service.
 - 2. When damage to the insulation is suspected or known to exist.

3. After repairs or modifications to the equipment affecting the insulation.
 4. Where lightning or other surge conditions are known to have existed on the circuit.
- G. Where ground test results identify the need for additional grounding conductors or rods that are not indicated or specified, design changes will be initiated to obtain the acceptable values.
- H. If the insulation resistance between conductors and ground in the motor control centers or switchgear reads below ANSI C37 minimums with the breakers out, follow the manufacturer's recommendations to restore readings to acceptable levels and retest.

3.4 SPECIFIC ELECTRICAL TESTS

A. Motors

1. Perform insulation tests on motor windings and record results.
2. Test run motors 1 HP and above uncoupled or unloaded, before placing into operation. Check the motor for rotation, speed, current and temperature rise under normal load and record the results.

B. Wire and Cable

1. Continuity test each control and/or low voltage (below 480 volts) wire and cable to verify the field applied tag per conductor and record results.

C. Relay Panels, Operator and Instrument Control Panels, Programmable Controllers, Micro-Processors, Battery Systems and Other Miscellaneous Equipment

1. Upon completion of equipment installation, visually and functionally test equipment and their control devices for tightness of connections and for proper operation. In the case of battery systems, static inverters and similar equipment, follow manufacturer's recommended test and installation manuals upon review and approval by WPCA's Technical Consultant. In the case of operator, instrument, and relay panels and cabinets or devices used solely for control, functionally test each circuit for proper operation and compliance with the Drawings and Specifications. Where functional testing is deemed undesirable by the WPCA's Technical Consultant from a safety or plant operational standpoint, then continuity and terminal connection verification checks will be acceptable.

D. Grounding Systems

1. Test in accordance with Section 16060.

END OF SECTION

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SECTION 16131

CONDUIT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Metal conduit.
2. PVC coated metal conduit.
3. Fittings and conduit bodies.
4. Conduit wall seals, new walls.
5. Fire stop fittings.
6. Underground warning tape.
7. Conduit expansion joint.

B. Related Sections

1. Section 02317 – Underground Warning Tape
2. Section 16060 – Grounding and Bonding
3. Section 16070 - Electrical Hangers and Supports.

1.2 REFERENCES

- A. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- B. ANSI/NFPA 70 - National Electric Code.
- C. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.
- D. ANSI C80.1 - Galvanized Rigid Steel Conduit, Cadmium Coated.

1.3 SUBMITTALS

- A. Submit shop drawings, product data and reports.
- B. Submit Riser Diagrams for the electrical installation.

1.4 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.6 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- D. Provide complete conduit systems between electrical equipment and devices as required.

PART 2 PRODUCTS

2.1 GENERAL CONDUIT REQUIREMENTS

- A. Minimum Size: $\frac{3}{4}$ inch unless otherwise specified.
- B. All locations: Use galvanized rigid steel conduit.
- C. Connections to portable equipment from junction boxes and connections to all motors: liquid tight flexible metal conduit.
 - 1. Minimum Length: 12 inches
 - 2. Maximum Length: 36 inches

2.2 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel fittings.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1.

2.4 CONDUIT WALL SEALS, NEW WALLS

- A. Type - sleeve and compression ring on both ends.
- B. Provide compression rings with hex head screws on sealing assembly.
- C. Manufacturers
 - 1. O-Z Gedney, Type WSK
 - 2. Or approved equal

2.5 FIRE STOP FITTINGS

- A. Type - Fittings with elastomeric rings to seal smoke and fumes.
- B. Fire rating of seal to be equal to or greater than rating of wall.
- C. Manufacturers
 - 1. O-Z Gedney, Type CFS.
 - 2. Or approved equal.

2.6 CONDUIT EXPANSION JOINT

- A. Description: Weather-tight, internal ground, expansion joint for galvanized rigid steel conduit, 4-inch maximum conduit movement.
- B. Manufacturer: Crouse-Hinds Type XJG, or approved equal.

2.7 UNDERGROUND WARNING TAPE

- A. Refer to Section 02317 (Underground Warning Tape).

2.8 FITTINGS AND CONDUIT BODIES

- A. Fittings
 - 1. Description - Threaded, malleable Iron. Coating to correspond with type of conduit system being used.
- B. Conduit Bodies
 - 1. Manufacturer
 - a. Appleton-Type Mogul - malleable iron.
 - b. or approved equal.
- C. Conduit Hubs
 - 1. Manufacturer
 - a. Crouse Hinds - Type HUB
 - b. or approved equal

PART 3 EXECUTION

3.1 INSTALLATION

- A. Junction boxes shown on drawings shall be provided in locations indicated. Additional boxes shall be provided as needed to comply with NFPA 70 requirements.
- B. Install conduit in accordance with NECA "Standards of Installation".
- C. Install nonmetallic conduit in accordance with manufacturer's instructions.
- D. Arrange supports to prevent misalignment during wiring installation.

Town of Canton WPCA

- E. Support conduit using coated steel or malleable iron straps, pipe hangers, U-bolt clamps and beam clamps.
- F. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- G. Fasten conduit supports to building structure and surfaces under provisions of Section 16070.
- H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- I. Do not attach conduit to ceiling support wires.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route exposed conduit parallel and perpendicular to walls.
- L. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- M. Route conduit in and under slab from point-to-point unless drawings indicate otherwise.
- N. Cross conduits in slab only with WPCA's Technical Consultant approval.
- O. Maintain adequate clearance between conduit and piping.
- P. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104°F.
- Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- R. Before installation of wires and cables, clean and dry inside of each conduit run.
- S. Use conduit hubs to fasten conduit to boxes and control panels in damp and wet locations.
- T. Install no more than equivalent of three 90° bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2" size.
- U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- W. Provide 100-lb. test nylon pull string in each conduit 2" or larger except sleeves and nipples.
- X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Y. Ground and bond conduit under provisions of Section 16060.
- Z. Do not penetrate waterproofing membranes in the structural floor slab or foundation walls without approval by, and in a manner acceptable to WPCA's Technical Consultant.

Town of Canton WPCA

- AA. Install metal conduit using only threaded fittings.
- BB. Use two locknuts, one inside and one outside of each box and enclosure when enclosure ratings are NEMA 1 or 12.
- CC. Install a chromium plated, spun or split type escutcheon on all exposed conduits passing through walls or ceilings.
- DD. Extend pipe sleeves $\frac{3}{4}$ " above finished floors.
- EE. Install a water and fire resistant caulking around all conduits passing through floors.
- FF. Install all empty conduits in floor so finished installation is flush with finished floor. Use suitable coupling and pipe plug.
- GG. Install motor feed and control wiring in the same conduit only when shown on approved plans or as approved by the WPCA's Technical Consultant.
- HH. Provide thru wall seals on all conduits passing through foundation walls.
- II. Provide a 4" band of black asphaltic paint, 2" in the concrete and 2" above floor, at all galvanized rigid steel conduit floor penetrations in pump chambers, tunnels, cellars and other below grade high moisture areas.
- JJ. Provide a 4" band of black asphaltic paint, 2" in the concrete and 2" in the soil, at all galvanized rigid steel penetrations through floors or walls into soil.
- KK. Install underground warning tape 12" above all underground conduits.
- LL. Install underground conduit with minimum cover, in accordance with National Electric Code or utility requirements, but no less than 36".
- MM. Install conduit expansion joint in the utility service feeder conduit.

END OF SECTION

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