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MOUNT PLEASANT WATERWORKS

WATER DISTRIBUTION SYSTEM TECHNICAL SPECIFICATIONS & CONSTRUCTION DETAILS

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SC DEPT. OF HEALTH & ENVIRONMENTAL CONTROL	
BUREAU OF WATER	
STANDARD SPECIFICATIONS APPROVAL	
WATER SYSTEMS ☒	SEWER SYSTEMS ☐
DATE APPROVED: 6/03/19	BY: MPH
APPROVED BY:	FOR: water distribution lines and appurtenances



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SECTION 02072

DEMOLITION, CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition, cutting and patching of existing construction where shown on Drawings, or as required to accommodate new work shown or specified.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 03002 - Concrete.
 - 4. Section 09905 - Painting and Protective Coatings.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Indicating manufacturer and type of:
 - a. Proposed nonshrink grout.
 - b. Epoxy bonding adhesive.
 - c. Proposed materials and methods to be used for matching and repairing existing construction.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. General:
 - 1. Salvage items, designated for Owner's salvage, as a functional unit.
 - 2. Clean, list and tag for storage.
 - 3. Protect from damage and deliver to location designated.
 - 4. Salvage each item with auxiliary or associated equipment required for operation.

1.4 CONDITIONS

- A. Perform preliminary investigations as required to ascertain extent of work.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate and reschedule work as required to preclude interference with other operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
 - 1. Nonshrink grout:
 - a. Supreme Grout by Gifford Hill.
 - b. Masterflow 713 Plus by BASF Building Systems.
 - c. Sika Grout 212 by Sika.
 - 2. Epoxy bonding adhesive:
 - a. Euco No.452 MV by Euclid Chemical Co.
 - b. Sikadur 32, Hi-Mod by Sika Corporation.
- B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

- A. Temporary Partitions:
 - 1. Plywood: 1/2 IN minimum for interior or exterior use.
 - 2. Paneling: 1/4 IN minimum for interior use.
- B. Nonshrink Grout:
 - 1. Nonmetallic, noncorrosive and nonstaining.
 - 2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
 - 3. Grout to produce a positive but controlled expansion. Mass expansion not to be created by gas liberation or by other means.
 - 4. Minimum compressive strength at 28 days to be 6500 psi.
 - 5. Coat exposed edges of grout with a cure/seal compound recommended by grout manufacturer.

- C. Epoxy Bonding Adhesive:
 - 1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide temporary partitions as required in public areas.
 - 1. Construct partitions of braced plywood in exterior areas.
 - 2. Adequately braced paneling may be used in interior areas.
- B. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.
- C. Provide substantial barricades and safety lights as required.
- D. Provide temporary dustproof partitions where indicated or necessary.
 - 1. Prevent infiltration of dust into occupied areas.
- E. Provide temporary weather protection as necessary.

3.2 INSTALLATION

- A. Cutting and Removal:
 - 1. Remove existing work indicated to be removed, or as necessary for installation of new work.
 - 2. Neatly cut and remove materials, and prepare all openings to receive new work.
 - 3. Remove masonry or concrete in small sections.
- B. Modification of Existing Concrete:
 - 1. Where indicated, remove existing concrete and finish remaining surfaces as specified in Section 03002.
 - a. Protect remaining concrete from damage.
 - b. Make openings by sawing through the existing concrete.
 - c. Concrete may be broken out after initial saw cuts in the event concrete thickness prevents cutting through.
 - d. Where sawing is not possible, make openings by drilling holes around perimeter of opening and then chipping out the concrete.
 - 1. Holes shall be sufficient in number to prevent damage to remaining concrete.
 - 2. Oversize required openings in existing concrete 1 IN on all sides and build back to required opening size by means of non-shrink grout epoxy bonded to the existing concrete.
 - 3. Where oversized openings cannot be made, remove the concrete to the required opening size and cut back exposed reinforcing 1 IN from face of concrete and fill resulting holes with non-shrink grout.
- C. Removal of Existing Anchor Bolts or Other Protruding Elements:
 - 1. Removed to a depth of 1/2 IN from finished surface.
 - 2. Fill void with non-shrink grout.
- D. Matching and Patching:
 - 1. Walls, ceilings, floors or partitions:
 - a. Repair abutting walls, ceilings, floors or partitions disturbed by removal.
 - b. Match and patch existing construction disturbed during installation of new work.
 - 2. Methods and materials:
 - a. Similar in appearance, and equal in quality to adjacent areas for areas or surfaces being repaired.
 - B. Subject to review of Engineer.
- E. Salvaged Items:
 - 1. Thoroughly dry and clean all metal surfaces.
 - 2. Prime all bare metal in accordance with Section 09905.
 - 3. Clean and lubricate motors and other moving parts.
 - 4. Brace motors attached to flexible mountings until reinstallation.
 - 5. Dispose of items or materials not designated for Owner's salvage or reuse. Promptly remove from site.
 - 6. Do not store or sell Contractor salvaged items or materials on site.
- F. Clean Up:
 - 1. Transport debris and legally dispose of offsite.

END OF SECTION

SECTION 02110 SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Site clearing, tree protection, stripping topsoil and demolition.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 01530 – Tree Protection
 - 4. Section 01560 - Environment Protection and Special Controls
 - 5. Section 02260 - Topsoiling and Finished Grading.
 - 6. Section 02270 - Soil Erosion and Sediment Control.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect existing trees and other vegetation to remain against damage.
 - 1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
 - 2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
 - 3. Refer to Section 01530 for tree protection and removal requirements.
- B. Repair or replace trees and vegetation damaged by construction operations.
 - 1. Repair to be performed by or under the direction of a qualified arborist.
 - 2. Remove trees which cannot be repaired and restore to full-growth status.
 - 3. Replace with new trees at inch per inch damaged or as mitigation requires (minimum 4 IN caliper).
- C. Owner will obtain authority for removal and alteration work on adjoining property.

3.2 SITE CLEARING

- A. Topsoil Removal:
 - 1. Strip topsoil to depths encountered.
 - a. Remove heavy growths of grass before stripping.
 - b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
 - c. Separate from underlying subsoil or objectionable material.
 - 2. Stockpile topsoil where directed by Engineer.
 - a. Construct storage piles to freely drain surface water.
 - b. Seed or cover storage piles to prevent erosion.
 - 3. Do not strip topsoil in wooded areas where no change in grade occurs.
 - 4. Borrow topsoil: Reasonably free of subsoil, objects over 2 IN DIA, weeds and roots.
- B. Clearing and Grubbing:
 - 1. Clear from within limits of construction all trees not marked to remain.
 - a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.
 - 2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and debris encountered.
 - a. Totally grub under areas to be paved.
 - b. Grubbing in lawn areas:
 - 1) In cut areas, totally grub.
 - 2) In fill areas, where fill is less than 3 FT totally grub ground.
 - 3) Where fill is 3 FT or more in depth, stumps may be left no higher than 6 IN above pre-existing ground surface.
- C. Disposal of Waste Materials:
 - 1. Do not burn combustible materials on site.
 - 2. Remove all waste materials from site.
 - 3. Do not bury organic matter on site.

3.3 ACCEPTANCE

- A. Upon completion of the site clearing, obtain Engineer's acceptance of the extent of clearing, depth of stripping and rough grade.

END OF SECTION

SECTION 02113

TEMPORARY BYPASS PUMPING AND FLOW CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements for temporary bypass pumping and flow control of peak sewage flows.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. 01060 - Special Conditions
 - 4. 01340 – Submittals

1.2 QUALITY ASSURANCE

- A. Contractor to provide qualifications for the bypass pumping including:
 - 1. A minimum of five (5) years in experience in operations that successfully utilized bypass pumping systems of equal or larger capacity to the system specified in this section.
 - 2. Submit references for at least five (5) previous projects that successfully utilized bypass pumping systems of equal or larger capacity to the system specified in this section.
- B. Qualifications shall be approved by the Owner and Engineer prior to any work on the site.

1.3 REQUIREMENTS

- A. The temporary bypass pumping and flow control shall include the following.
 - 1. To facilitate completion of inspection, cleaning or rehabilitation work the Contractor shall provide;
 - a. Labor
 - b. Materials
 - c. Supervision
 - 2. Interruption of sewage flow shall be avoided whenever possible throughout the duration of the project. Contractor shall provide documentation of circumstances that would require service to be interrupted. Engineer and Owner shall approve interruption in service.
 - 3. The bypass flow shall be continuously monitored and metered.
 - 4. For each bypass set-up, a plug shall be provided at the bypass manhole and at the wetwell in the gravity sewer piping.

1.4 SUBMITTALS

- A. Bypass Pumping Plan:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Shall provide for accessibility of pedestrians and vehicular traffic.
 - 3. Plan shall be approved prior to any activities on the project site.
- B. Bypass Pumping Drawings
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Drawings indicating the scheme and location of temporary sewer plugs and bypass discharge lines for the project site. The drawings shall indicate the method and location for discharging the bypass lines.
 - 3. Flow control plan shall include, but not be limited to, the following:
 - a. Detailed procedures for handling wastewater flows.
 - b. Schedule
 - c. Location
 - d. Listing of equipment and capacities
 - 4. Bypass pumping plan shall include:
 - a. Staging areas for pumps
 - b. Sewer plugging method and type of plug
 - c. Number, size, material, location, and method of installation of suction piping
 - d. Bypass pump sizes, capacity, number of each size to be onsite, and power requirements.
 - e. Calculations of static lift, friction losses and flow velocity (pump curves showing pump-operation range for selection of bypass pumping pipe size.)
 - f. Downstream discharge plan
 - g. Thrust and restraint block sizes and locations
 - h. Method of noise control for each pump
 - i. Temporary pipe supports and anchoring required
 - j. Plans for access to bypass pumping locations
 - k. Schedule for installation of and maintenance of bypass pumping lines

- l. Plan indicating selection location of bypass pumping line locations
- m. Detailed plans of a redundant back up system that can handle equal flow as the primary system
- n. Method of operating primary and back-up pumps
- o. Emergency response plan
- 5. Staffing plan
- 6. Spillage prevention plan
- 7. Spillage cleanup plan
- 8. Odor control plan

PART 2 - PRODUCTS

2.1 NOISE RESTRICTIONS

- A. Pumps and other necessary equipment shall be equipped to keep the noise level below 69 dBA at 30 feet.

2.2 CAPACITY

- A. Estimated flows and heads shall be provided from the wastewater collection model. The Contractor is responsible for bypass pumping all actual flows to avoid any SSOs (Sanitary Sewer Overflows). One primary electric or diesel-powered pump shall be provided to handle the full flow volume at each location, with a diesel lag pump sized for the entire flow at each location. Pump shall operate using variable frequency drives. The primary back-up pumps shall operate via an automated start/stop controller with level transducers. When the lag pump operates, a 24-hour alarm system shall be used to notify the Contractor. Contractor shall arrive on site within 30 minutes of alarm being issued. The TDH of the existing system at each station will be provided. See sample table below. Contractor shall calculate the required TDH of each bypass system based on the additional headloss in the bypass piping configuration of the system. Note that many of the pumps are connected to manifolded force mains, so discharge head may vary depending on which other pumps are operating simultaneously.

Site	Peak Flow, Influent Line #1 (gpm)	Peak Flow, Influent Line #2 (gpm)	Peak Flow, Total (gpm)	Peak Head, TDH (ft)	Peak Head, TDH (psi)
PS #, Location	-	-	-	-	-

2.3 PIPING

- A. Temporary bypass piping shall be high density polyethylene pipe that complies with AWWA C-906, DR 11, and has a working pressure of 160 psi. Minimum cell classification values shall be 345464C as referenced in ASTM D3350 – latest edition.
- B. Provide fittings molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. All fittings shall be of the same manufacturer as the pipe being supplied.
- C. Use the butt fusion method for joining sections of polyethylene pipe into continuous lengths, per the manufacturer's instructions.

2.4 ELECTRICAL

- A. Electrical power shall be provided by Contractor. Lighting shall be provided in all spaces at all times where necessary for good and proper workmanship, for inspection, or for safety. Contractor shall pay for all power costs associated with the construction.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall notify Engineer and Owner 48 hours prior to bypassing or diverting flow in any pipelines.

3.2 PROTECTION

- A. The Contractor shall be responsible for all bypass flows.
- B. Contractor shall be responsible for prompt cleanup and disinfection of any spill as called for in bypass plan.
- C. Contractor shall compensate Owner for the cost of any fines levied as the result of a spill or unauthorized discharge.
- D. When the lag pump alarm system is activated, a three-tier alert system via telephone shall be used, with the first two calls going to the Contractor and the third call going to the Owner's collection system supervisor.

3.3 SOURCE QUALITY CONTROL**A. Testing:**

1. All components of pump station shall be given an operational test to check for excessive vibration, for leaks in piping or seals, and for correct operation of automatic control system and auxiliary equipment. Correct all deficiencies.
2. Couple pump suction and discharge lines to a reservoir and have the pumps recirculate water for at least 1 HR under simulated service conditions.
3. Adjust automatic control to start and stop pumps at approximate levels required by job conditions.

3.4 FIELD QUALITY CONTROL**A. Hydrostatic Pressure Test**

1. Prior to operation, test each section of discharge piping with maximum pressure equal to 2.0 times the maximum operation pressure of the system or 50 psi, whichever is greater.
2. Test run shall last for two (2) hours.
3. The Contractor shall fill the line with water
4. The line shall be sealed on the discharge end.
5. The line may be put in service if after the two (2) hour period the pressure has been maintained and there are no observable leaks.
6. Notify Engineer and Owner forty-eight (48) hours prior to testing.

B. Inspection

1. Contractor shall inspect temporary bypass pumping and piping system at a minimum of every day.
2. Inspection Log: Keep log of inspections for each pumping location.

3.5 CLEAN-UP**A. The bypass pumping system shall be cleaned and drained prior to removal at the end of the project.**

1. The Contractor shall alternate pigging and purging of the system to remove all material.

B. Disturbed areas.

1. Restore areas affected by pumping activities to equal or better than original conditions which existed prior to start of work.

3.6 SCHEDULING**A. The bypass system operation.**

1. A trained and qualified attendant shall be assigned to operate this system at all times.

END OF SECTION

SECTION 02200 EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Earthwork.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02270 - Soil Erosion and Sediment Control
 - 4. Section 02530 – Dewatering

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m)).
 - c. D3786, Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm.
 - e. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - f. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - g. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Certifications.
 - 4. Test reports:
- B. Samples:
 - 1. Submit samples and source of fill and backfill materials proposed for use.
 - 2. Submit samples and source of borrow materials proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Excavated On-Site Material: Soil free from roots, rocks larger than 3", and building debris meeting general requirements for off-site borrow material and having a maximum particle size of nine (9) inches.
- B. Off-site Borrow Material: "Uniform Soil Classification System", GW, GP, SW or SP which are free from debris, roots, wood, scrap materials, and other vegetal matter and refuse. Liquid limit shall not exceed 10 when tested in accordance with ASTM D423, non-plastic, no more than 10 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D1140. Off-site borrow material shall be tested for a laboratory CBR value not less than 12 in accordance with ASTM D1883. Results of the CBR test shall be provided to the Engineer. Engineer's written approval shall be mandatory prior to use of off-site borrow material.
- C. Unsatisfactory Material: Existing, in-place soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability. Unsatisfactory materials also include manmade inorganic materials, refuse, uncompacted backfills from previous construction, organic or compressible materials subject to decay or other deleterious or objectionable materials.
- D. Granular Fill Under Slabs-On-Grade: Clean, crushed gravel complying with SCDOT Standard Specification Appendix A-4 gradation size No. 789.
- E. Geotextile Filter Fabric:
 - 1. Nonwoven type.
 - 2. Equivalent opening size: 50-100 (U.S. Standard Sieve).
 - 3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.

4. Grab strength: 90 LBS minimum in either direction in accordance with ASTM D4632 requirements.
5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

PART 3 - EXECUTION

3.1 PROTECTION

- A. ALL EARTHWORK OPERATIONS SHALL BE IN COMPLIANCE WITH CURRENT OSHA REQUIREMENTS.
- B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 3. Verify location of utilities.
 - a. Omission or inclusion of utility items does not constitute non-existence or definite location.
 - b. Secure and examine local utility records for location data.
 - c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
 - d. Repair damages to utility items at own expense.
 - e. In case of damage, notify Engineer at once so required protective measures may be taken.
 4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - b. All repairs to be made and paid for by Contractor.
 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.
- C. Salvageable Items: Carefully remove items to be salvaged by the Owner, and store on Owner's premises unless otherwise directed.
- D. Dispose of waste materials, legally, off site.
 1. Burning, as a means of waste disposal, is not permitted.

3.2 SITE EXCAVATION AND GRADING

- A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.
- B. Excavation and Grading: Perform as required by the Contract Drawings.
 1. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
 - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
 - b. Perform other layout work required.
 - c. Replace property corner markers to original location if disturbed or destroyed.
 2. Preparation of ground surface for embankments or fills:
 - a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
 - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
 3. Protection of finish grade:
 - a. During construction, shape and drain embankment and excavations.
 - b. Maintain ditches and drains to provide drainage at all times.
 - c. Protect graded areas against action of elements prior to acceptance of work.
 - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
 1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
 2. Include cost of all borrow material in original proposal.

3. Fill material to be approved by Soils Engineer prior to placement.
- D. Construct embankments and fills as required by the Contract Drawings:
 1. Construct embankments and fills at locations and to lines of grade indicated.
 - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
 - a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
 - b. Do not place material in layers greater than 8 IN loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
 3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - a. Control moisture for each layer necessary to meet requirements of compaction.

3.3 FIELD QUALITY CONTROL

- A. Include in bid price the cost of inspection and testing services and indicated herein as being performed by the Soils Engineer.
- B. Moisture density relations, to be established by the Soils Engineer required for all materials to be compacted.
- C. Extent of compaction testing will be as necessary to assure compliance with Specifications.
- D. Give minimum of 24 HR advance notice to Soils Engineer when ready for compaction or subgrade testing and inspection.
- E. Should any compaction density test or subgrade inspection fail to meet Specification requirements, perform corrective work as necessary.
- F. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.4 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from Soils Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove loose, wet, or soft material and replace with approved material as directed by Soils Engineer.
- D. Stabilize subgrade with well graded granular materials as directed by Soils Engineer.
- E. Assure by results of testing that compaction densities comply with the following requirements:
 1. Sitework:

LOCATION	COMPACTION DENSITY
Under Paved Areas, Sidewalks and Piping:	
Cohesive soils	98 percent per ASTM D1557
Cohesionless soils	75 percent relative density per ASTM D4253 and ASTM D4254
Unpaved Areas:	
Cohesive soils	95 percent of ASTM D1557
Cohesionless soils	60 percent relative density per ASTM D4253 and ASTM D4254

2. Structures:

LOCATION	COMPACTION DENSITY
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	98 percent per ASTM D1557
Outside structures next to walls, piers, columns and any other structure exterior member	95 percent per ASTM D1557

3. Specific areas:

LOCATION	COMPACTION DENSITY
Outside structures under equipment support foundations	98 percent per ASTM D1557
Under void	92 percent per ASTM D1557
Granular fill under base slabs and under building floor slabs-on-grade	75 percent relative density per ASTM D4253 and ASTM D4254

3.5 NOT USED**3.6 SPECIAL REQUIREMENTS**

A. Erosion Control:

1. Conduct work to minimize erosion of site.
2. Construct stilling areas to settle and detain eroded material.
3. Remove eroded material washed off site.
4. Clean streets daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, trenching, backfilling and compacting for all underground utilities.
2. Water piping (potable, plant, process and non-potable).
3. Relocation of existing piping.
4. Surface drainage conduits and piping.
5. All related utility and process appurtenances.

B. Related Sections include but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 – General Requirements.
3. Section 02224 – Encased Pipeline Undercrossings.
4. Section 02515 – Precast Concrete Manhole Structures.
5. Section 02530 – Dewatering.
6. Section 02660 – Water Main Construction.
7. Section 02661 – Force Main and Gravity Line Construction.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T99, The Moisture-Density Relations of Soils Using a 5.5 LB Hammer and a 12 IN Drop.
 - b. T180, Moisture-Density Relations of Soils Using a 10 LB Hammer and an 18 IN Drop.
2. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - d. D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - e. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - f. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Contractor shall use an Owner-approved independent laboratory to perform soil compaction testing. The Contractor shall include the costs for all tests, including passing tests and retesting, in the appropriate bid item in the bid form.

C. Registered Professional Engineer licensed in the State of South Carolina for design of trench shoring systems or other trench safety plans.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
4. Submit sieve analysis reports on all granular materials.

B. Miscellaneous Submittals:

1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Trench shield (trench box) certification if employed:
 - a. Specific to Project conditions.
 - b. Re-certified if members become distressed.
 - c. Certification by registered professional structural engineer, registered in the State of South Carolina.
 - d. Owner/Engineer is not responsible, and will not review and approve trench shield certification.

1.5 PROJECT CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
 - 1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
- C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- D. Verify location of existing underground utilities.
- E. Notification of intent to excavate:
 - 1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
 - 2. Notification of intent to excavate may be given by calling this toll free number: 811.
- F. Take necessary precautions to protect existing utilities from damage due to construction activities. Repair damage to utility items at Contractor expense. There will be no cost to owner, Engineer, or auxiliary party for any damages.

1.6 WORK INCLUDED

- A. Prior to pipeline construction within locations suspected or known to have contaminated soils, testing shall be performed by an approved, qualified laboratory at the Owner's expense. Soil and/or groundwater testing shall be performed pursuant to an approved testing protocol to ascertain the nature of constituents and levels of contamination. A SCDHEC approved Plan shall be provided by the Owner for the excavation, handling, replacement of trench material and disposal of contaminated or surplus contaminated soil material in addition to other site-specific special conditions.
 - 1. Where the evidence of soil contamination is suspected and/or known to exist within the limits of construction before bidding and the start of construction, separate Unit Price Bid items shall be included in the "Bid Schedule" to accomplish applicable work. The SCDHEC approved Plan for pipeline construction within contaminated soils and approved testing protocols shall be incorporated into the Contract Documents as Attachments to the Technical Specifications.
 - 2. When unsuspected soil contamination is found during construction, immediate action shall be taken by the Owner, Engineer and Contractor jointly to determine the nature and extent of contamination. Work within the impacted area shall be halted until all parties, working jointly in good faith pursuant to the SCDHEC approved procedures, can resume pipeline construction subject to an approved Plan of Action. A negotiated Change Order shall be approved by the Owner, Engineer and Contractor prior to resuming work within the contaminated area. The approved Change Order shall encompass all special and precautionary procedures applicable to the additional Scope of Work for disposal and/or confinement of hazardous wastes and/or working within a site having confirmed contaminated soils.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Class I backfill:
 - 1. Flowable Fill (Controlled Density Fill)
 - a. Reference SCDOT requirements and construction details.
 - b. Materials for Flowable Fill shall be in compliance with applicable requirements for SCDOT "Standard Specifications for Highway Construction", Latest Edition.
 - 2. Fractured Limestone Base Course (FLBC)
 - a. Reference SCDOT requirements and construction details.
 - 3. Use Class I backfill at;
 - a. Open cut roadway crossings as directed by approved drawings, permits or as directed by MPW.
- B. Class II backfill (carefully compacted)
 - 1. Well graded coarse granular materials free of roots, branches, stumps, debris or other organic matter exceeding 1 IN.
 - 2. Sands, silty sands or clayey sands.
 - 3. Soils having more than 25 percent weight passing No. 200 sieve shall not be used.
 - 4. Moisture content @ time of placement: 3 percent plus/minus optimum moisture content per ASTM D1557.

5. Use Class II backfill at driveways, parking lots, utility crossings, water services, or similar conditions as directed by Engineer.
- C. Class III backfill (common trench)
 1. Excavated material removed from trench.
 - a. As approved by Engineer.
 - b. Free of roots, sod or other organic matter.
 - c. Moisture content at time of placement: 3 percent plus/minus of optimum moisture content per ASTM D1557.
- D. Imported backfill
 1. Where Soils removed from trench are not suitable for backfill as outlined above, Contractor shall import suitable backfill material as directed by Owner/Engineer.
- E. Gravel trench backfill materials:
 1. #57 stone containing no slag or as approved by soils engineer.
- F. Subgrade Stabilization Materials: Provide subgrade stabilization material consisting of #57 washed, crushed stone, where required.
- G. Bedding Materials:
 1. As approved by the Soils Engineer.
 - a. Pipe embedment materials shall be coarse grain soils sufficiently granular to be readily worked under the sides of the pipe to meet the required compaction specifications.
 2. Well-graded crushed stone per SCDOT specification 406.08.
 3. Granular bedding materials:
 - a. ASTM C33, gradation 57 as defined below or by latest ASTM C33 Standard:

Sieve Size	1-1/2"	1"	1/2"	No. 4	No. 8
Percent Passing by Weight	100	95-100	25-60	0-10	0-5

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and dispose of unsuitable materials as directed by Soils Engineer to site provided by Contractor.
- B. Contaminated Areas: All water mains shall be located out of contaminated areas without exception.
- C. Obstructions: Remove obstructions within the trench area such as, but not limited to, tree roots, stumps, abandoned buildings, structures, logs, debris etc. Properly dispose of obstructions removed from the excavation in accordance with local municipality requirements.
- D. Pavement, Curb, and Sidewalk Removal: Saw cut all bituminous and concrete pavements, regardless of thickness, and all curbs and sidewalks, prior to excavation of the trenches. (Width of the pavement shall be twelve (12") inches greater (on each side) than the required width of the trench at ground surface). Saw cut lines shall be straight, even, and parallel. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill. When encroachment permits are required by SCDOT, Charleston County or the Town of Mount Pleasant additional requirements may be necessary.

3.2 EXCAVATION

- A. Unclassified Excavation:
 1. All excavation shall be considered unclassified.
 2. Remove clay, silt, gravel, hard pan, loose shale, and loose stone as required for proper installation and bedding of utility. No additional payment will be considered regardless of material encountered. The unit price bid for pipe shall include all excavation, trenching and backfilling with the exception of subgrade stabilization material as approved by Owner/Engineer.
- B. Dewatering:
 1. Refer to Section 02530 – Dewatering.
- C. Trench Excavation:
 1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
 - a. Support existing utility lines where proposed work crosses at a lower elevation.
 - 1) Stabilize excavation to prevent undermining of existing utility.
 2. Open trenches:
 - a. No more than 100 LF of trench shall be open at one time.
 - b. Field adjust limitations as weather conditions dictate.
 - c. No trenches shall be left open overnight.

3. Observe following trenching criteria:
 - a. Trench size:
 - 1) Excavate width to accommodate free working space.
 - 2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility line by more than the following dimensions:

PIPE DIAMETER	MIN TRENCH SIZE
4" to 6"	12" each side
8" to 15"	15" each side
16" to 30"	18" each side
36" and larger	24" each side

- 3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
- 4) Keep trenches free of water and surface water runoff.
 - a) Include cost in appropriate unit price bid item. There will not be a separate payment for dewatering.
- 5) Brace and sheet trenches in full compliance with OSHA requirements and all applicable codes and as required to protect existing roadways and utilities.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

- A. A continuous and uniform bedding shall be provided in the trench for all buried pipe. Stones, other than crushed bedding, shall not come into contact with the pipe and shall not be within six (6) inches of the pipe.
- B. Over-Excavation:
 1. Backfill and compact to 95 percent of maximum dry density per ASTM D698.
 2. Backfill with granular bedding material with no slag as option.
- C. Dewatering
 1. The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of any and all water entering the excavation or other parts of the Work and keep all excavations dry until such time as pipe laying and grading is complete and structures to be built therein are completed.
 2. No water shall be allowed to rise around the pipe in trenches that are not backfilled. All water pumped or drained from the Work shall be disposed of in such a manner as to prevent siltation and erosion to adjacent property or other construction.
- D. Shoring and Shielding:
 1. The Contractor shall comply with OSHA trenching and excavation regulations as revised in Subpart P of Part 1926 in the Federal Register. Shoring and/or shielding systems shall be used as specified in Subpart P to prevent caving of trench banks and to provide a safe excavation.
 2. The Contractor will be responsible for excavation safety and shall designate his "competent person" (as defined in Subpart P) for the determination of proper shielding/shoring systems.
- E. Subgrade Stabilization:
 1. Stabilize the subgrade as required or when directed by the Owner/Engineer.
 2. Observe the following requirements when unstable trench bottom materials are encountered.
 - a. Notify Owner/Engineer when unstable materials are encountered.
 - 1) Define by drawing station locations and limits.
 - b. Remove unstable trench bottom caused by Contractor's failure to dewater, rainfall, or Contractor operations.
 - 1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

- A. Base Course:
 1. Base course is to be placed in six (6) inch lifts or less with each layer being thoroughly tamped and compacted.
 2. Care should be exercised to thoroughly compact the material around and over the pipe.
 3. Each layer shall be compacted to a density of 95% density as determined by AASHTO Method T-99.
 4. Compaction tests shall be provided to SCDOT and/or MPW prior to final acceptance.
- B. Flowable Fill:
 1. Furnish where indicated on drawings and/or as required by SCDOT or Engineer.
 2. Comply with the following:
 - a. Place such that no dirt or foreign material becomes mixed with flowable fill.
 - b. Allow flowable fill to achieve initial set before additional backfill material is placed.
 - c. Flowable fill shall not come in contact with water main.

3. Controlled Density Fill (CDF) shall be placed at specific locations indicated on the Drawings and to the depth(s) also indicated.
 - a. Trench conditions shall include the consideration of higher fill loads on formed walls, bedding gravel placement and compaction and adequate permanent blocking of conduit(s) to prevent movement during CFD placement.
 - b. Finishing shall be with a square shovel $\pm 1/2$ " in four (4) feet where CFD is placed to the bottom of a subsequent pavement surface course or a float finish level with adjacent saw cut pavement edges where CDF is to be used as a temporary driving surface prior to placement of a subsequent pavement overlay.
 - c. Bleed Water shall be allowed to drain from the finished CDF surface without ponding during initial curing.
 - d. Full traffic loads shall be allowed only after 24 hours curing.
 - e. Controlled Density Fill placement shall extend a minimum of three (3) feet beyond edges of existing roadway pavements unless indicated otherwise.
- C. Carefully Compacted Backfill:
 1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
 2. Comply with the following:
 - a. Place backfill in lifts not exceeding 8 IN (loose thickness).
 - b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
 - c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - d. Compact each lift to specified requirements.
- D. Common Trench Backfill:
 1. Perform in accordance with the following:
 - a. Place backfill in lift thicknesses capable of being compacted to densities specified.
 - b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
- E. Water flushing for consolidation is not permitted.
- F. Ensure all spaces beneath pipe are filled and compacted.

3.5 COMPACTION

A. General:

1. Place and assure bedding, backfill, and fill materials achieve an equal or "higher" degree of compaction than undisturbed materials adjacent to the work.
2. In no case shall degree of compaction below "Minimum Compactions" specified be accepted.

B. Compaction Requirements:

1. Unless noted otherwise on Drawings or more stringently by other sections of these Specifications, comply with following trench compaction criteria:

MINIMUM COMPACTIONS			
MATERIAL	LOCATION	SOIL TYPE	DENSITY
Bedding Material	All locations	Cohesionless soils	75% of maximum relative density by ASTM D4253 and ASTM D4254
Carefully Compacted Backfill	Within SCDOT Right-of-Way	Cohesive soils	95% of maximum dry density by ASTM D698
		Cohesionless soils	75% of maximum relative density by ASTM D4253 and ASTM D4254
Common Trench Backfill	Under turf, sodded, plant seeded, non-traffic areas	Cohesive soils	90% of maximum dry density by ASTM D698
		Cohesionless soils	75% of maximum relative density by ASTM D4253 and ASTM D4254

3.6 FIELD QUALITY CONTROL

A. Testing:

1. Perform in-place moisture-density tests to ensure minimum compaction requirements.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Perform additional tests as directed until compaction meets or exceeds requirements.

4. All costs associated with re-testing shall be paid by Contractor.
 5. Reference to Engineer in this section will imply Soils Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
 6. Assure Owner has immediate access for testing of all soils related work.
 7. Ensure excavations are safe for testing personnel.
- B. Settlement:
1. Any backfill settlement noted within the warranty period shall be corrected by Contractor at no cost to MPW, including structures or paved surfaces damaged by the settlement.

END OF SECTION

SECTION 02224

ENCASED PIPELINE UNDERCROSSINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction of encased pipeline undercrossings.

B. Related Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.
4. Section 02660 - Water Main Construction.
5. Section 02661 - Force Main and Gravity Line Construction

1.2 SUBMITTALS

A. Shop Drawings:

1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Compliance with submittal requirements of authority or agency having jurisdiction over undercrossing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Casing Pipe (SCP) for crossings.

1. SCP shall have a minimum yield strength of 35,000 psi and have wall thicknesses sized in accordance with thicknesses listed below. Install undercrossing cased full lengths. Provide casing pipe conforming to fabricated steel pipe meeting ASTM A139, Grade B. Protective coating of hot coal tar enamel at a dry film thickness of 40 mils minimum.
2. Minimum wall thickness (SCDOT):

Nominal Thickness (Inches)	Nominal Diameter (Inches)
0.250	Under 14
0.313	14, 16, 18
0.344	20
0.375	22
0.407	24
0.500	30
0.563	36

3. Diameter: Minimum of 4 IN larger than outside diameter of carrier pipe's jointing system.
4. Comply with any special requirement of SCDOT.
5. Joints: Welded pressure tight or factory machined joint manufactured by Permalok or equal.

B. Casing Spacers

1. Casing spacers shall be a bolt on style all 316L stainless steel.
2. Approved manufacturers:
 - a. Cascade Waterwork Mfg. Co.;
 - b. Pipeline Seal and Insulation, Inc.;
 - c. Or Approved Equal.

C. Casing End Seals

1. Cascade Waterworks Mfg, Model CCES;
2. Pipeline Seal and Insulation, Inc. Model C;
3. Or Approved Equal.

PART 3 - EXECUTION**3.1 INSTALLATION****A. General:**

1. Install undercrossing to meet requirements of authority or agency having jurisdiction over undercrossing
2. Observe work requirements stipulated in any permit condition.
3. Consult Contract Drawings for limitation of construction right-of-way.
4. The Contractor shall inspect the location where the undercrossing is to be installed and familiarize himself with the conditions under which the work will be performed, any possible obstruction to be avoided, and with all detail necessary for the orderly prosecution of the work. The omission herein of any details necessary for the satisfactory installation of the work in its entirety shall not relieve the Contractor of the responsibility to familiarize himself with the actual conditions under which this work is to be performed.
5. Prior to initiating construction, the Contractor shall submit to the Engineer for approval, proposed methods for performance of operations as follows:
 - a. Site plan of the undercrossing entrances showing excavation limits.
 - b. Quality control methods including, but not limited to, procedure for checking line and grade.
 - c. Safety procedures including, but not limited to, monitoring for oxygen and gases.
 - d. Dewatering techniques and equipment to be employed.
6. Any damage to the road or highway caused by construction operations shall be immediately repaired by the Contractor to the satisfaction of the authority or agency having jurisdiction over the undercrossing at no additional cost to the Owner.

B. The following will be required unless more rigid requirements are specified by the authority or agency having jurisdiction over the crossing:

1. Location of jacking and boring pits:
 - a. Confine outside of pit to at least five (5) feet clear of termination of fill slope.
 - b. Ensure pits are in full compliance with OSHA Regulations.
 - c. Ensure pits are adequately marked and protected per requirements.
2. Diameter of the hole: Not exceeding diameter of casing by more than 1 IN.
3. Pressure grout all voids outside of casing, including abandoned or misaligned holes.
4. Provide and install end seals with stainless steel bands at each end of casing.
5. Undercrossing casing:
 - a. Full lengths.
 - b. Weld pressure tight.
6. After casing is installed, attach casing spacers to each length of pipe (minimum of 2 per pipe section) to prevent displacement and pull pipe into place. Pipe must be straight and centered in casing when in place.
7. Coordinate connections to system with authority or agency having jurisdiction over the crossing.

C. Backfill:

1. Compact backfill in accordance with trench compaction criteria specified in Section 02221.

D. Vegetation and Cover:

1. Topsoil disturbed area and replace ground cover material comparable to preconstruction conditions.

E. Welded Joints: Ensure that welds are sound and free from embedded scale or slag, and that tensile strength across weld is not less than that of thinner connected sections. Provide watertight joints.**END OF SECTION**

SECTION 02230

STORMWATER POLLUTION AND PREVENTION

PART 1 - GENERAL

1.1 CONTRACTOR DESIGNATED AS HAVING OPERATIONAL CONTROL

- A. The Contractor shall be designated as the Operator having “operational control over day-to-day activities” as defined in the definition of Operator in Appendix A of NPDES General Permit for Storm Water Discharges from Large and Small Construction Activities, Permit No. SCR100000, latest edition. As the designated Operator, the Contractor shall assume all applicable Operator duties, functions, and responsibilities as set forth in the NPDES General Permit. The Contractor shall also furnish the services of a qualified Inspector who shall perform all services and duties as delineated in Subpart 3.10 of the NPDES General Permit.
- B. The Project Engineer-of-Record shall not be designated as the Operator having “operational control over construction plans and specifications” pursuant to Subpart 3.1.A of the NPDES General Permit.
- C. Notice of Termination (NOT) shall be issued by the Engineer-of-Record pursuant to Part 5.1B of the NPDES General Permit according to Section 122.41(l)(3) of S.C. Regulation 61-9 (Appendix C of the General Permit). Transfer of “Operational Control over construction plans and specifications” shall be accomplished pursuant to R-61.9-122.61, Transfer of Permit.

1.2 STORMWATER POLLUTION PREVENTION PLAN

- A. An approved and Agency certified copy of the Project Stormwater Pollution Prevention Plan (SW3P) shall be maintained on-site which addresses the site, specific type of work, soil conditions, season, use of temporary ground covers and all ancillary actions by the Contractor periodically required to maintain erosion control facilities during the duration of construction.
- B. The Contractor shall maintain a current Notice of Intent (NOI) for the work over which he maintains operational day-to-day control and be identified as such in the SW3P.
- C. The Stormwater Pollution Prevention Plan shall include the following (the majority of which may be indicated on the Project Drawings and/or contained in a Hydrology Engineering Study prepared for the work):
 - 1. Site Evaluation and Design Development:
 - a. Existing Conditions Site Map
 - b. Soils Information
 - c. Runoff Water Quality Restrictions
 - d. Name of Receiving Waterbody
 - e. Rainfall Data for Season and Location
 - f. Nature of Construction Activity
 - g. Sequence of Activities
 - h. Complete Stormwater Facilities Design Documents including drainage patterns, final grades and land slopes, tabulated distribution areas, location of control measures and discharge points.
 - i. A complete copy of the Preconstruction Conference Agenda, Attendees List, and Minutes.
 - j. Copies of all Contractor Co-Permittee Certification Statements and Subcontractor Certification Statements (if not designated as co-permittees).
 - 2. Stormwater Assessment:
 - a. Total Site Area
 - b. Disturbed Site Area
 - c. Drainage Basin/Sub basins (on-site and off-site)
 - d. Post-Construction Runoff Characteristics and Runoff Coefficients (Rational “C” or SCS “CN”).
 - 3. Control Selection and Plan Design:
 - a. Temporary Control Practices
 - b. Permanent Management Practices
 - c. Site-Specific Hardscape and Landscape Controls
 - d. Location and Descriptive Functions of Control Structures
 - e. Construction Phase Inspection and Maintenance Procedures
 - f. Applicable State and Local Management Practices (by specific reference or as attachments).
 - g. Contractor’s designated Inspector(s), Training and Qualifications
 - h. Inspection and Reporting Requirements
 - 4. Contractor Certifications and Notifications:
 - a. Maintain SW3P on-site for agency review upon request.
 - b. Record of Agency Inspections
 - c. Copies of all contractor certifications as required by the NPDES General Permit and Project SW3P.

- d. Copies of all periodic stormwater inspection reports complete with a record of all remedial actions taken and documented.
- 5. Construction and Implementation:
 - a. Modify SW3P as applicable to reflect on-going revisions in scope-of-work, schedule, progress of work or methodology.
 - b. Maintain Control features in appropriate operable condition.
- 6. Final Stabilization and Termination:
 - a. File Notice-of-Termination (NOT) when applicable.
 - b. Stabilization completion must include removal of temporary controls, placing completed permanent controls in full operation and attaining at least seventy percent (70%) viable (green and growing) permanent vegetated ground covers.
 - c. Record keeping and internal reporting procedures on-site must include complete and up-to-date SW3P, copy of NOI and all other notices, inspection records, maintenance reports, construction activity reports, spill and cleanup report and copy of NOT.
 - d. Maintain all records three (3) years after General Permit coverage ends and maintain SW3P for public agency access.

1.3 QUALITY ASSURANCES

- A. Erosion control measures for construction shall conform to the SW3P required pursuant to Part 1 above, and as indicated on the Drawings; these Specifications and applicable local and state regulations for erosion and sediment control.
- B. General requirements shall be as specified in Section 01568, ENVIRONMENTAL PROTECTION.
- C. Specific requirements shall be as specified in Section 02270, SOIL EROSION AND SEDIMENT CONTROL

1.4 RELATED WORK

Section 01530: Tree Protection
Section 01560: Environmental Protection and Special Controls
Section 02200: Earthwork
Section 02270: Soil Erosion and Sediment Control
Section 02930: Seeding, Sodding, and Landscaping

PART 2 - PRODUCTS

2.1 SLOPE DRAINS

- A. Slope drains shall be flexible plastic pipe, as manufactured for the intended purpose.

2.2 FILTER CLOTH

- A. Filter cloth for silt fences shall be a pervious sheet of synthetic polymer filament forming a stable network so that fibers retain their relative positions. Filter cloth shall be of the type recommended by its manufacturer for the intended application and shall be subject to the Engineer's approval prior to installation.
- B. Silt fences shall be constructed in accordance with the details shown on the drawings or may be a prefabricated type with prior approval of the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. Temporary erosion control shall be directed toward and have the purpose of controlling soil erosion at its potential source. Downstream sediment entrapment measures shall be employed, but only as a backup to primary control at the source.
- B. A continuing program of installation and maintenance of sediment control shall be employed during the construction period.

3.2 TEMPORARY EROSION CONTROL DURING CONSTRUCTION

- A. Erosion and sedimentation control shall be employed during the construction period and shall include all necessary temporary measures required to prevent soil erosion from the site until permanent erosion control and finished surfaces are installed.
- B. Erosion and sedimentation control measures shall be considered incidental to all construction involving land disturbing activities.
- C. Temporary ground cover and temporary grassing shall be considered incidental to all areas disturbed by construction activities.
- D. Temporary erosion control construction shall be employed until such time as permanent paving, planting, and restoration of natural areas is effective in control of erosion from the site.

- E. Sediment Traps
 - 1. Sediment traps shall be installed at locations shown on the Drawings in accordance with the details indicated.
 - 2. Sediment traps shall be maintained until other erosion control methods can be sustained for them. Other sediment traps at locations other than shown may be required by construction operations.
 - 3. Sediment traps shall be cleaned, backfilled and eliminated from the construction area when their use is no longer required by construction under this Contract.
- F. Silt Fences
 - 1. Temporary silt fences shall be located at all points where surface water can leave the construction area whenever the construction area is subject to soil erosion.
 - 2. Silt fences shall be constructed along lines of nearly constant elevation (contour lines) to remove sediments from flowing water through filtration and sedimentation without concentrating flow at low points.
 - 3. Silt fences shall be arranged to create linear ponding without concentrated points. Provision shall be made for removing accumulated sediments and maintaining ponding capacity and silt removal efficiency.
 - 4. Silt fences shall be removed and the area restored when permanent erosion control measures are effective.
 - 5. Silt fences must be maintained or replaced whenever necessary and as directed by the Engineer.
- G. Grading Operations
 - 1. Grading operations shall be scheduled so that the ground surface will be disturbed for the shortest possible time before permanent ground cover is installed. Large areas shall be maintained as flat as possible to minimize soil transport through surface flow.
 - 2. Wherever steeper slopes or abrupt changes in grade are required, a diversion or berm shall be constructed at the top of the slope to cause the surface water to flow along the diversion to a control point to be transported down slope in a slope drain. In no case shall surface water be allowed to flow uncontrolled down slopes.
- H. Slope Drains
 - 1. Temporary slope drains shall be provided to convey surface water down slopes. Slope drains shall be provided with an apron at their tops to anchor them and properly direct water into them. Stone or rubble shall be placed at slope drain outlets to prevent scour at these points.
- I. Storm Drainage System
 - 1. As much of the permanent storm drainage system as is practicable shall be initially installed and surface water diverted into the system. The remainder of the storm drainage system shall be installed as soon as conditions will allow.
 - 2. Temporary sediment barriers shall be maintained around drainage structures until final subgrade preparation is begun.
- J. Temporary Ground Cover
 - 1. All grade break slopes shall be protected by application of temporary ground cover and, if required, terracing until construction of permanent surfaces begins or an acceptable stand of grass is established.
 - 2. Temporary ground cover shall consist of an approved erosion prevention treatment including, but not limited to, straw or other mulches, stone base, plastic sheets, fiber mats, fiber blankets, temporary plantings, etc.
 - 3. All permanent grassing or planting operations shall include mulching as stabilization until permanent ground cover by planting is effective.
 - 4. Biodegradable natural fiber erosion control blankets, Landlok S1 or approved equal, shall be placed on all erodable slopes steeper than 4:1 (four (4) feet horizontal to one (1) foot vertical).
- K. Temporary Grassing
 - 1. Unless specifically indicated otherwise on the Drawings, Temporary Grassing shall be provided as specified in Section 810.04 "Seeding Schedule" of the SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, Latest Edition, for Permanent Vegetation - Lower State, Schedule Number 3 or 4 (as planting date dictates), Urban Rate (No Pensacola Bahia) except that the rate of application for Annual Ryegrass shall be twice the indicated rate, i.e. 30 vs 15 pounds per acre for Schedule 4 and Sericea Lespedeza shall be applied at 80 pounds per acre for both Schedules.
 - 2. Where areas disturbed by construction activities are to receive final landscaping or permanent cover within six (6) months after clearing activities are completed, "Temporary Vegetation" Schedule 2 or 3 shall be used as applicable.
 - 3. The Contractor shall be required to reseed and/or recultivate and reseed as required in order to maintain acceptable temporary grassing for the duration of the work until permanent ground cover is in place and approved. Placement and maintenance of temporary grassing shall be considered incidental to all land disturbing activities.

- L. Grassing Within Public Right-of-Way
 - 1. Grassing within public rights-of-way shall be as specified in Section 810 of the SCDOT STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, Latest Edition, exclusive of Pensacola Bahia unless indicated otherwise or specifically modified by applicable agency encroachment permits issued for work within public rights-of-way.
 - 2. Temporary grassing shall not be required within public rights-of-way; install permanent ground cover as required above.
 - 3. Sodding, if required, within public rights-of-way shall be as specified elsewhere in Section 02483 and as indicated on the Drawings.

3.3 CLEANUP AND REMOVAL

- A. At the time that permanent erosion control is effective, temporary devices and their accumulated sediments shall be removed.

END OF SECTION

SECTION 02260

TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Topsoiling and finished grading.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02110 - Site Clearing.
 - 4. Section 02270 - Soil Erosion and Sediment Control.
 - 5. Section 02930 - Seeding, Sodding and Landscaping.
- C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Project Data: Test reports for furnished topsoil when required.

1.3 PROJECT CONDITIONS

- A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 - 1. Original surface soil typical of the area.
 - 2. Existing topsoil stockpiled under Section 02110.
 - 3. Capable of supporting native plant growth.

2.2 TOLERANCES

- A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 SUBGRADE SOILS PREPARATION

- A. Rough grade subgrade soils and compact as specified elsewhere. Eliminate uneven areas and low spots. Remove debris, roots, branches. Stones, etc. in excess of 1-1/2 inches in size. Remove subgrade soils which have been contaminated with unacceptable materials.
- B. Cut out areas to subgrade soils elevation which are to receive sand and/or stabilizing base for paving and sidewalks.
- C. Bring subgrade soils to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- D. Slope grade away from existing buildings minimum 6 inches in 10 feet unless indicated otherwise.
- E. Cultivate subgrade soils to a depth of six (6) inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subgrade soils.

3.2 ROUGH GRADE REVIEW

- A. Reviewed by Engineer in Section 02110, Site Clearing.

3.3 PLACING TOPSOIL

- A. Do not place when subgrade is wet or frozen enough to cause clodding.
- B. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.
- C. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.
- D. Provide finished surface smooth and true to required grades. Special attention shall be given to maintaining all trenches in lawn type areas.
- E. Restore stockpile area to condition of rest of finished work.
- F. Grade all areas for positive drainage.
- G. Place topsoil in areas where seeding, sodding, and planting are to be performed. Place to the following depths, up to finished grade elevations:
 - 1. 6-inches for seeded areas

2. 6-inches for sodded areas
 3. 24-inches for shrub beds
 4. 18-inches for flower beds
- H. Use topsoil in relatively dry state.
- I. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contour subgrades.
- J. Manually spread topsoil around tree, plants and structures to prevent damage which may be caused by grading equipment.
- K. Leave construction areas and entire job site clean and raked, ready to receive landscaping.

3.4 ACCEPTANCE

- A. Upon completion of topsoiling, obtain Owner/Engineer's acceptance of grade and surface.
- B. Make test holes where directed to verify proper placement and thickness of topsoil.

3.5 SURPLUS MATERIALS

- A. Remove all surplus topsoil from the site and properly dispose of without additional compensation.

END OF SECTION

SECTION 02270

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil erosion and sediment control.
- B. Related Sections include but are not necessarily limited to:
 - 2. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 3. Division 1 - General Requirements.
 - 4. Section 02230: Stormwater Pollution and Prevention
 - 5. Section 02930: Seeding, Sodding and Landscaping.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. The South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities.
 - 2. The DHEC OCRM Stormwater Management BMP Handbook.

1.3 DEFINITIONS

- A. Temporary Diversions: A temporary ridge or excavated channel or combination ridge and channel constructed across sloping land on a predetermined grade.
- B. Excavated Drop Inlet Protection (Temporary): An excavated area in the approach to a storm drain drop inlet or curb inlet.
- C. Fabric Drop Inlet Protection (Temporary): A temporary fabric barrier placed around a drop inlet.
- D. Sediment Tubes: Elongated tubes of biodegradable materials placed in front of catch basins or along contours or drainage conveyance swales to filter concentrated flows.
- E. Temporary Sediment Trap: A small, temporary ponding basin formed by an embankment or excavation to capture sediment.
- F. Sediment Fence (Silt Fence): A temporary sediment barrier consisting of filter fabric buried at the bottom, stretched, and supported by posts.
- G. Rock Dam: A rock embankment located to capture sediment.
- H. Check Dam: Small temporary stone dams constructed across a drainage way.
- I. Seeding: Preparation of topsoil and planting of vegetation to prevent soil erosion.
- J. Temporary Gravel Construction Entrances/Exit: A graveled area or pad located at points where vehicles enter and leave a construction site.
- K. Rock Pipe Inlet Protection: Rock embankment located to prevent a drainage pipe inlet from becoming blocked by sediment.
- L. d50: A mixture of stones in which 50% of the stone by weight would be smaller than the diameter specified.

1.4 BORROW AREAS, SPOIL AREAS AND OTHER AREAS DISTURBED BY CONSTRUCTION

- A. Design, install and maintain erosion control measures in accordance with referenced standards, these specifications and construction drawings.

1.5 NONCOMPLIANCE

- A. Implement any corrective actions when directed by OWNER.
- B. Failure to comply with this Section is grounds for temporary suspension of the Work.
 - 1. Temporary suspension will be effective until satisfactory installation of erosion control measures.
- C. Pay any cost of fines or penalties levied from DHEC/OCRM for erosion control violations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary Diversion: Use soil available at site, apply seed, lime, and fertilizer.
- B. Excavation Drop Inlet Protection: Use gravel available at site.
- C. Fabric Drop Inlet Protection:
 - 1. Synthetic Fabric. Nylon polyester, or ethylene yarn with tensile strength of 50 lb/in minimum. The cloth should contain ultraviolet ray inhibitors and stabilizers. Burlap (9.0 ounces/sq.yd.) is acceptable if it is replaced after 60 days.
 - 2. 4' long steel post with minimum weight of 1.33lb/ft.

- D. Sediment Tubes:
1. Elongated tubes of compacted geotextiles, curled excelsior wood, natural coconut fiber or hardwood mulch. All materials except netting must be biodegradable. Netting consists of seamless, high-density polyethylene photodegradable materials treated with UV stabilizers or seamless, high-density polyethylene non-degradable materials.
 2. Sediment tubes come in 10 ft. lengths that can be sewn together end-to-end in the field.
- E. Temporary Sediment Trap: Class B stone with d50 of 9 inches and a maximum size of 14 inches.
- F. Sediment Fence (Silt Fence):
1. Using a synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the requirements shown in Table 1. Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees Fahrenheit.
- Table 1:
- | Physical Property | Requirements |
|--|---|
| Filtering Efficiency | 85% (min.) |
| Tensile Strength at 20% Elongation (max) | Standard Strength: 30 lb./linear in. (min.)
Extra Strength: 50lb/linear in. (min.) |
| Slurry Flow Rate | 0.3 gal/sq.ft./minute (min.) |
2. Cut filter fabric to a minimum width of 36 inches.
 3. Use only fabric meeting the requirements of the most current edition of the SCDOT Standard Specifications for Highway Construction.
 4. Ensure that posts for sediment fences are 1.33 lb/linear ft. steel with a minimum length of 4 ft. Make sure that steel posts have projections to facilitate fastening the fabric.
 5. Except when heavy clay soils are present onsite, steel posts will have a metal soil stabilization plate with a minimum cross-section area of 17 square inches attached near the bottom. Soil plate shall be composed of minimum 15 gauge steel.
 6. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.
- G. Rock Dam:
1. Well graded rock and gravel (# 57).
 2. Extra strength filter fabric of the following specifications:
 - a. 15% minimum elongation
 - b. 400 psi minimum burst strength
 - c. 80 lb. minimum punctures strength
 - d. 30/130 apparent opening size – max./min.
 - e. 140 lb. minimum ultraviolet exposure strength retention
 - f. “No growth” rating for Fungus Resistance Testing
- H. Check Dam: SCDOT Class A or B erosion control stone.
- I. Seeding: See Section 02930.
- J. Temporary Gravel Construction Entrance/Exit: 2-3” coarse aggregate.
- K. Rock Pipe Inlet Protection: No. 5 or No. 57 Class A sediment control stone.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to General Stripping Topsoil and Excavating:
1. Install perimeter dikes and swales.
 2. Excavate and shape sediment basins and traps.
 3. Construct pipe spillways and install stone filter where required.
 4. Machine compact all berms, dikes and embankments for basins and traps.
- B. Construct sediment traps where indicated on Drawings during rough grading as grading progresses.
- C. Temporarily seed basin slopes and topsoil stockpiles:
5. Rate: 1/2 LB/1000 SF.
 6. Reseed as required until good stand of grass is achieved.
 7. Establish temporary vegetation of critical areas immediately after any land disturbing activity.
- D. Ditch Lines: Restabilize all disturbed or relocated ditch lines by installing a temporary ditch liner of jute or geotextile fabric on the ditch bottom and side slopes.

3.2 INSTALLATION

- A. Temporary Diversions:
 1. Remove and dispose of vegetation or other objectionable material.
 2. Excavate parabolic, trapezoidal, or V-shaped channel with a side slope of 2:1 or flatter, 3:1 where vehicles cross.
 3. A permanent vegetative cover is required for diversion channels with grades between 0.2 and 3%.
 4. Ensure that the minimum cross-section meets all design requirements and that the top of the dike is not lower at any point than the design elevation plus the specified settlement.
 5. Provide sufficient room around diversions to permit regrading and clean-out.
 6. Vegetate the ridge immediately after construction, unless it will remain in place less than 30 working days.
- B. Excavated Drop Inlet Protection (Temporary):
 1. Clear the area of all debris that may hinder excavation.
 2. Grade the approach to the inlet uniformly.
 3. Maintain side slopes around the excavation no steeper than 2:1.
 4. Keep the minimum volume of excavated area around the drop inlet at approximately 35 cu.yd./acre disturbed.
 5. Shape the basin to fit site conditions, with the longest dimension oriented toward the longest inflow area to provide maximum trap efficiency.
 6. Protect weep holes by gravel.
 7. When the contributing drainage area has been permanently stabilized, seal weep holes, fill the basin with stable soil to final grading elevations, compact it properly, and stabilize.
- C. Fabric Drop Inlet Protection (Temporary):
 1. Space stakes evenly around the perimeter of the inlet a maximum of 3 feet apart, and securely drive them into the ground, approximately 18 inches deep. They should be driven close to the drop inlet so that overflow will fall directly into the structure.
 2. Fasten fabric securely to the stakes and frames. Joints must be overlapped to the next stake. The bottom 12 inches of the fabric should be entrenched with at least 4 inches of crushed stone or 12 inches of compacted soil as backfill.
 3. Ensure that both fabric and supporting stakes are sufficiently strong to hold a 1.5 ft. head of water without failures.
 4. The top of the frames and fabric must be well below the ground elevation downslopes from the drop inlet to keep runoff from bypassing the inlet.
 5. It may be necessary to build a temporary site on the down slope side of the structures to prevent bypass flow. Improved performance and sediment storage volume can be obtained by excavating the area.
- D. Sediment Tubes:
 1. Use twelve-inch diameter sediment tubes in front of catch basins to filter run-off going into catch basin weep hole.
 2. Sediment tubes can be placed on the subgrade, graded aggregate base or the asphalt plant mix. Sediment tubes must be staked or stabilized.
 3. Use twenty-inch diameter sediment tubes for ditch protection.
 4. Remove all rocks, clogs, vegetation or other obstructions so that the installed Sediment Tubes will have direct contact with the underlying soil or surface.
 5. Install by laying Sediment Tubes flat on the ground.
 6. Construct a small trench to a depth that is 20% of the sediment tube diameter. Lay the sediment tube in the trench and compact the upstream sediment tube soil interface. Do not completely bury sediment tubes during installation. Install all sediment tubes so no gaps exist between the soil and the bottom of the sediment tube. Lap the ends of adjacent sediment tubes a minimum of 6-inches to prevent flow and sediment from passing through the field joint. Never stack sediment tubes on top of one another.
 7. Install sediment tubes in swales or drainage ditches perpendicular to the water flow and extend them up the side slopes a minimum of 1-foot above the design flow depth. Space sediment tubes according to the following table:

Slope	Maximum Sediment Tube Spacing
Less than 2%	150-feet
2%	100-feet
3%	75-feet
4%	50-feet
5%	40-feet
6%	30-feet
Greater than 6%	25-feet

8. Install sediment tubes using wooden stakes (1-inch x 1-inch) or steel posts (1.25 lbs/ linear ft.) a minimum of 4-feet in length placed on 2-foot centers. Intertwine the stakes with the outer mesh on the downstream side, and drive the stakes in the ground to a minimum depth of 2.0-feet leaving less than 1-foot of stake above the exposed sediment tube.
 9. An acceptable alternative installation is driving stakes on 2-foot centers on each side of the sediment tube and connecting them with natural fiber twine or steel wire to inhibit the non-weighted sediment tube from moving vertically. Sediment tubes can also be secured by installing the stakes on 2-foot centers in a crossing manner ensuring direct soil contact at all times.
 10. Install sediment tubes for ditch checks over bare soil, mulched areas, or erosion control blankets. Keep sediment tubes for ditch checks in place until fully established vegetation and root systems have completely developed and can survive on their own.
- E. Temporary Sediment Trap:
1. Clean, grub and strip the area under the embankment of all vegetation and root mat before construction begins. Remove all surface soil containing high amounts of organic matter.
 2. Ensure that fill material for the embankment is free of roots, woody vegetation, organic matter, and objectionable material. Place the fill in lifts not to exceed 9 inches and machine compact it. Over fill the embankment 6 inches to allow for settlement.
 3. Construct the outlet section in the embankment. Protect the connection between the riprap and the soil from piping by using filter fabric or a keyway cutoff trench between the riprap structure and the soil.
 - a. Place the filter fabric between the riprap and soil. Extend the fabric across the spillway foundation and sides to the top of the dam; or
 - b. Excavate a keyway trench along the centerline of the spillway foundation extending up the sides to the height of the dam. The trench should be at least 2 ft. deep and 2 ft. wide with 1:1 side slopes.
 4. Clear the pond area below the elevation of the crest of the spillway to facilitate sediment cleanout.
 5. All cut and fill slopes should be 2:1 or flatter.
 6. Ensure that the stone (drainage) section of the embankment has a minimum bottom width of 3 ft. and maximum side slopes of 1:1 that extend to the bottom of the spillway section.
 7. Construct the minimum finished stone spillway bottom width with 2:1 side slopes extending to the top of the overfilled embankment. Keep the thickness of the sides of the spillway outlet structure at a minimum of 21 inches. The weir must be level and constructed to grade to assure design capacity.
 8. Material used in the stone section should be a well-graded mixture of stone with a d50 size of 9 inches (class B erosion control stone is recommended) and a maximum stone size of 14 inches. The stone may be machine placed and the smaller stones worked into the voids of the larger stones. The stone should be hard, angular, and highly weather-resistant.
 9. Ensure that the stone spillway outlet section extends downstream past the toe of the embankment until stable conditions are reached and outlet velocity is acceptable for the receiving stream. Keep the edges of the stone outlet section flush with the surrounding ground and shape the center to confine the outflow stream.
 10. Direct emergency bypass to natural, stable areas. Locate bypass outlets so that flow will not damage the embankment.
 11. Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the trap immediately after construction.
 12. Ensure that the spillway crest is level and 1.5 feet below the top of the dam at all points.
 13. Remove sediment and restore capacity to original trap dimensions when sediment has accumulated to $\frac{1}{2}$ design depth.
- F. Sediment Fence (Silt Fence):
1. Construct the sediment barrier of the specified synthetic filter fabrics.
 2. Ensure that the height of the sediment fence does not exceed 24 inches above the ground surface. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)
 3. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with overlap to the next post.
 4. Support standard strength filter fabric by wire mesh fastened securely to the upslope side of the posts using the wires. Extend the wire mesh support to the bottom of the trench.
 5. When a wire mesh support fence is used, space posts a maximum of 8 ft. apart. Support posts should be driven securely into the ground to a minimum of 18 inches.
 6. Extra strength filter fabric with 6-foot post spacing does not require wire mesh support fence. Staple or wire the filter fabric directly to posts.
 7. Excavate a trench approximately 4 inches wide and 8 inches deep along the proposed line of posts and upslope from the barrier.
 8. Backfill the trench with compacted soil or gravel placed over the filter fabric.
 9. Do not attach filter fabric to existing trees.

G. Rock Dam:

1. Clear the areas under the embankment and strip it of its roots and other objectionable material. Clear the reservoir area to facilitate sediment removal.
2. Excavate a cutoff trench a minimum of 2 feet deep and 2 feet wide with 1:1 side slopes under the total length of the dam at its centerline. Line the trench with extra-strength filter fabric at its centerline. Line the trench with extra-strength filter fabric before backfilling with rock. Apply filter fabric under the rock fill embankment, from the upstream edge of the keyway to the downstream edge of the apron. Overlap the material a minimum of 1 foot at all joints, with the upstream strip laid over the downstream strip.
3. Construct the embankment with well-graded rock and gravel. It is important that rock abutments be at least 2 feet higher than the spillway crest and at least 1 foot higher than the downstream face of the dam, all the way to the toe, to prevent scour and erosion at the abutments.
4. Sediment-laden water from the construction site should be diverted into the basin reservoir at the furthest area from the dam.
5. Construct the rock dam before the basin area is cleared to minimize sediment yield from construction of the basin. Stabilize immediately all areas disturbed during the construction of the dam except the sediment pool.
6. Safety. Sediment basins should be considered dangerous because they attract children. Steep side slopes should be avoided. Fences with warning signs may be needed if trespassing is likely. All state and local requirements must be followed.

H. Check Dams:

1. Place stone to the lines and dimensions shown in the plan on a filter fabric foundation.
2. Keep the center stone section at least 9 inches below natural ground level where the dam abuts the channel banks.
3. Extend stone at least 1.5 feet beyond the ditch banks to keep overflow water from undercutting the dam as it re-enters the channel.
4. Set spacing between dams to assure that the elevation at the top of the lower dam is the same as the toe elevation of the upper dam.
5. Protect the channel downstream from the lowest check dam, considering that water will flow over and around the dam.
6. Make sure that the channel reach above the most upstream dam is stable.
7. Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.

I. Seeding: See Section 02930.**J. Temporary Gravel Construction Entrance/Exit:**

1. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
2. Place the gravel to the required grade and dimensions and level.
3. Provide drainage to carry water to a sediment trap or other suitable outlet.
4. Use geotextile fabrics because they improve stability of the foundation in locations subject to seepage or high water.

K. Rock Pipe Inlet Protection:

1. Clear the pipe inlet area of all vegetation, roots, and other objectionable material.
2. Place stone to full height of pipe. Place filter fabric under stone.

3.3 MAINTENANCE**A. Temporary Diversions:**

1. Inspect weekly and, after every rainfall, remove sediment from the flow area and repair the diversion ridges. Also check and maintain outlets.
2. When the protected area is permanently stabilized, remove the ridges and the channel to blend with the natural ground level and appropriately stabilize.

B. Excavated Drop Inlet Protection (Temporary):

1. Inspect, clean, and properly maintain the excavated basin after every storm until the contributing drainage area is stabilized.
2. Remove sediment from the basin when the basin volume has been reduced by one-half.
3. Spread excavated material evenly over the surrounding land or stockpile and stabilize it appropriately.

C. Fabric Drop Inlet Protection (Temporary):

1. Inspect the fabric barrier after each rain and make repairs as needed.
2. Remove sediment from the pool area as necessary to provide adequate storage area for the next rain.
3. When the contributing drainage area has been adequately stabilized, remove all materials and any unstable sediment and dispose of them properly. Bring the disturbed area to the grades of the drop inlet and smooth and compact it. Appropriately stabilize all bare areas around the inlet.

- D. Sediment Tubes:
1. Inspect sediment tubes after installation for gaps under the sediment tubes and for gaps between the joints of adjacent ends of sediment tubes.
 2. Inspect sediment tubes every 7-days and within 24-hours of a rainfall event of 0.5-inches or greater.
 3. Repair all rills, gullies and undercutting near sediment tubes.
 4. Remove all sediment deposits that impair the filtration capability of sediment tubes when the sediment reaches one-third (0.33) the height of the exposed sediment tube.
 5. Remove and/or replace installed sediment tubes as required to adapt to changing construction site conditions.
 6. Remove sediment tubes from the site when the functional longevity is exceeded as determined by the Engineer, Inspector or Manufacturer's Representative. Gather sediment tubes and dispose of them in regular means as non-hazardous, inert material.
 7. Prior to final stabilization, backfill all trenches, depressions and other ground disturbances caused by the removal of sediment tubes.
- E. Temporary Sediment Trap:
1. Inspect temporary sediment traps after each period of significant rainfall. Remove sediment and restore the trap to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Place the sediment that is removed in the designated disposal area and replace the contaminated part of the gravel facing.
 2. Check the structure for damage from erosion or piping. Periodically check the depth of the spillway to ensure it is a minimum of 1.5 feet below the low point of the embankment. Immediately fill any settlement of the embankment to slightly above design grade. Any riprap displaced from the spillway must be replaced immediately.
 3. After all sediment-producing areas have been permanently stabilized, remove the structure and all unstable sediment. Smooth the area to blend with the adjoining areas and stabilize properly.
- F. Sediment Fence (Silt Fence):
1. Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.
 2. Should the fabric of a sediment fence collapse, tear, decompose, or become ineffective, replace it promptly. Replace fabric every 60 days or as directed by Inspector.
 3. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanup.
 4. Remove all fencing materials and unstable sediment deposits and bring the area to grade. Stabilize it after the contributing drainage area has been properly stabilized.
- G. Rock Dam:
1. Check sediment basins after each rainfall. Remove sediment and restore original volume when sediment accumulates to about one-half the design volume.
 2. Check the structure for erosion, piping, and rock displacement after each significant rainstorm and repair immediately.
 3. Remove the structure and any unstable sediment immediately after the construction site has been permanently stabilized. All water and sediment should be removed from the basin prior to dam removal. Sediment should be placed in designated disposal areas and not allowed to flow into streams or drainageways during structure removal.
 4. Smooth the basin site to blend with the surrounding area and stabilize.
- H. Check Dam:
1. Inspect check dams and channels for damage after each runoff event.
 2. Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam. Correct all damage immediately. If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel.
 3. Remove sediment accumulated behind the dams as needed to prevent damage to channel vegetation, allow the channel to drain through the stone check dam and prevent large flows from carrying sediment over the dam. Add stones to dams as needed to maintain design height and cross section.
- I. Seeding. See Section 02930.
- J. Temporary Gravel Construction Entrance/Exit: Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2-inch stone. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.
- K. Rock Pipe Inlet Protection:
1. Inspect stone arrangement weekly and after every rainfall event.
 2. Maintain specified dimensions and remove sediment buildup when the sediment level is $\frac{1}{2}$ the height of the rocks.

3.4 DURING CONSTRUCTION PERIOD

- A. Maintain Basins, Dikes, Traps, Stone Filters:
 - 1. Inspect regularly especially after rainstorms.
 - 2. Repair or replace damaged or missing items.
- B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.
- C. Construct inlets as soon as possible
 - 1. Excavate and tightly secure inlet protection completely around inlets as detailed on Drawings.
- D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.
- E. Do not disturb existing vegetation (grass and trees).
- F. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
 - 1. Remove sediment from behind bales to prevent overtopping.
- G. Topsoil and Fine Grade Slopes and Swales, Etc.:
 - 1. Seed and mulch as soon as areas become ready.

3.5 NEAR COMPLETION OF CONSTRUCTION

- A. Eliminate basins, dikes, traps, etc.
- B. Grade to finished or existing grades.
- C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION

SECTION 02271

STONE REVETMENT (RIP RAP)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stone revetment (rip rap) for protection of slopes against erosion.
 - a. Drainage outflow area.
 - b. Slope rip rap.
 - c. Other areas indicated and shown on the Drawings.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.
 - 4. Section 02270 - Soil Erosion and Sediment Control.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - 2. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - 3. C127, Standard Test Method for Density , Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - 4. Army Corps of Engineers (COE):
 - 5. CRD-C100, Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing.
 - 6. Occupational Safety and Health Administration (OSHA)

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - 3. Acknowledgement that products submitted meet requirements of standards referenced.
 - 4. Certifications.
 - 5. Test reports.
 - 6. Submit all tests and certification in a single coordinated submittal. Partial submittals will not be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stone:
 - 1. Durable broken quarry run stone.
 - 2. Does not disintegrate on exposure to water or weathering.
 - 3. Free from structural fractures and defects.
 - 4. Not containing shale, unsound sandstone, or other material which will disintegrate.
 - 5. Graded within limits specified.
 - 6. Breadth and thickness of any stone: Not less than one-third of its length.
 - 7. Ensure that dirt and fines accumulated from interedge layers or from blasting or handling operation is less than 2 percent by weight.
 - 8. Gradation of the material: Furnish and install Class 2 rip rap which complies fully with the requirements of current SCDOT standard specifications.

2.2 SOURCE QUALITY CONTROL

- A. Perform all tests at an approved independent laboratory.
- B. Obtain samples in conformance with COE CRD-C100.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Trim and dress all areas to required cross sections.
- B. Bring areas that are below allowable minus tolerance limit to grade by filling with material similar to adjacent material.
- C. Compact to density specified for backfill.
- D. Do not place any stone material on prepared base prior to inspection by Engineer.

3.2 PLACING

- A. Place rip rap material on prepared foundation, including one layer of mirati 600X or approved equal, within limits indicated.
- B. Place on prepared base to produce a well-graded mass of stone with minimum percentage of voids.
- C. Place to required thickness and grades.
- D. Place to full thickness in a single operation to avoid displacing the underlying material.
- E. Distribute entire mass to conform to gradation specified.
- F. Do not place stone by dumping into chutes or by similar method likely to cause segregation.
- G. Keep finished stone revetment free from objectionable pockets of small stones or clusters of larger stone.
- H. Hand place as necessary to obtain a well-graded distribution.
- I. Ensure a final tolerance of within 3 IN from indicated slope and grade lines.
- J. Place stone revetment in conjunction with embankment construction to prevent mixture of embankment and stone revetment materials.
- K. Maintain stone revetment until accepted.
- L. Replace any displaced material to lines and grades shown.

END OF SECTION

SECTION 02400 SHEETING AND SHORING

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes the furnishing of all labor, materials, tools and equipment necessary to prevent cave-in of excavations and trench walls or settlement of areas adjacent to excavations and trench walls.
- B. No additional compensation shall be made for sheeting and shoring required under this contract. Applicable costs for sheeting and shoring shall be included in the aggregate cost of the work items to which the sheeting and shoring are incidental or appurtenant.

1.2 GENERAL REQUIREMENTS

- A. The Contractor shall provide and install such sheeting and shoring as may be required to support the sides of any excavation to prevent earth movement that could endanger the work or workmen, or any existing structures, or to confine the construction within a specified, permitted and/or indicated typical trench cross-section or to within specific construction limits including defined easements or street rights-of-way.
- B. It shall be the Contractor's responsibility to furnish, place and maintain sheeting and shoring when and where required by applicable federal, state and local laws and regulations.
- C. Neither the presence nor observation by the Engineer or Owner shall excuse the Contractor in any way from his responsibility to provide required sheeting and shoring necessary for the protection of life and property during construction. Job and site safety shall be and remain the sole responsibility of the Contractor for the duration of the Construction Contract.
- D. All sheeting and shoring systems must be sealed by a South Carolina Licensed Professional Engineer.

1.3 RELATED WORK

Section 02200: Earthwork

Section 02221: Trenching, Backfilling and Compacting for Utilities

Section 02260: Topsoiling and Finished Grading

Section 02530: Dewatering

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel or wood sheeting may be used at the Contractor's option. Sheeting shall be of adequate strength for the purpose intended.
- B. Steel drag shields or trench boxes may also be used subject to the written approval of the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall provide and install all sheeting and shoring as required by applicable regulatory authority, i.e. OSHA, etc. Such sheeting and shoring will be considered as being for Contractor's convenience and benefit; all costs for furnishing, installing and removing same shall be borne by the Contractor.
- B. Steel sheeting may be completely removed when sufficient backfill has been placed to prevent damage to the work and/or existing structures. Care shall be exercised to prevent opening of voids during the extraction process.
- C. Unless approved otherwise in writing by the Engineer, all timber sheeting shall be cut off 30 inches below grade and left in place with proper bracing to provide lateral support.

END OF SECTION

SECTION 02513

ASPHALTIC CONCRETE VEHICULAR PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphaltic concrete vehicular paving.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Construction standards: South Carolina Department of Transportation (SCDOT), Standard Specifications for Highway Construction, as amended to date.
- B. Miscellaneous:
 - 2. Should conflicts arise between standard specifications of government agencies mentioned herein and Contract Documents, Contract Documents shall govern.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Asphalt design mix.
 - 4. Field Quality Control Test Results.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphaltic Concrete: In accordance with the referenced SCDOT specification Division 400. Surface course to be Type CM for primary roads and Type C for secondary roads. Intermediate course to be Type B for primary roads and Type C for secondary roads.
- B. Aggregate Base Course: In accordance with the referenced SCDOT specification Division 300.
- C. Pavement Markings: In accordance with the reference SCDOT specification Division 600.
- D. Flowable Fill: In accordance with the reference SCDOT Supplemental Technical Specification SC-M-210. Compressive strength shall be 100 psi minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Construct to line, grade and section as shown on Drawings and in accordance with SCDOT Specifications.
- B. Paving within the Right-of-Way:
 - 1. All Work within the Right-of-Way shall be done in strict accordance with SCDOT and/or the Town of Mount Pleasant requirements. Contractor shall familiarize himself with all such requirements. Contractor shall obtain from the Owner a copy of all required encroachment permits, and shall conform to all requirements and stipulations therein. In case of conflict between the plans and encroachment permits, the encroachment permits will govern if stricter.
- C. For driveways and other non-SCDOT paved roads:
 - 1. Install 6" SABC
 - 2. Spread a uniform prime coat at 0.25 GAL per yd² of prime coat
 - 3. Install 2IN surface course Type C in accordance with Section 403 of state specification.
- D. Tolerance of Finished Grade: +/- 0.10 FT from required elevations.
- E. Pavement Markings:
 - 1. Thoroughly clean surfaces which are to receive paint.
 - 2. Make completely dry before paint is applied.
 - 3. Do not paint until minimum of 5 days has elapsed from time surface is completed. A longer period may be required if directed by Engineer.
 - 4. Do not apply paint over wet surfaces, during wet or damp weather, or when temperature is below 40° F.

5. Lay out markings and striping in accordance with SCDOT requirements.
6. Line paint meeting SCDOT specifications shall be used for temporary traffic markings.
7. Thermoplastic installed per manufacturer's recommendations and SCDOT standards shall be used for permanent markings or striping.

END OF SECTION

SECTION 02530 DEWATERING

PART 1 - GENERAL

1.1 SCOPE

- A. In general, the work specified in this section of the specifications shall consist of supplying labor, materials, and equipment and performing all work necessary to lower and control surface water, impounded water bodies, lagoons, lakes, canals and groundwater levels and hydrostatic pressures to protect all excavations and construction specified under this Contract to be performed in the dry.
 - 1. Work shall include providing all labor, materials, pumps and appurtenances to dewater utility trenches excavated pursuant to Section 02221.

1.2 EXAMINATION OF THE SITE

- A. The Contractor shall take all steps that he considers necessary to familiarize himself with the site conditions, the ground conditions and the groundwater conditions.
- B. Review soils investigation when available, before beginning excavation and determine where groundwater is likely to be encountered during excavation.
- C. It is expressly understood that neither the Owner nor the Engineer will be held responsible for any interpretations or conclusions drawn by the Contractor.

1.3 RELATED WORK

Section 02200:	Earthwork
Section 02221:	Trenching, Backfilling and Compacting
Section 02230:	Stormwater Pollution and Prevention
Section 02270:	Soil Erosion and Sediment Control
Section 02400:	Sheeting and Shoring

PART 2 - PRODUCTS

2.1 METHOD AND EQUIPMENT

- A. All dewatering operations shall be in accordance with the Town of Mount Pleasant's Stormwater Quality and Dewatering/Well Point Operations.
- B. It is the intent of these specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction of structures and the placement of the fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water-bearing strata above and below the bottom of the foundations, the drains, all water and wastewater pipelines, and all other excavations.
- C. An adequate weight of fill material shall be in place prior to discontinuing operation of dewatering to prevent buoyancy of the structure.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall be solely responsible for the arrangement, location and depths of the dewatering system necessary to accomplish the work described under this section of the specifications.
- B. The dewatering shall be accomplished in a manner that will reduce the hydrostatic head below any excavation to the extent that the water level and piezometric water levels in the construction area are below the prevailing excavation surface; will prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation strata; will maintain stability of the sides and bottom of the excavation; and will result in all construction operation being performed in the dry.
- C. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
- D. Employ dewatering specialist for selecting and operating dewatering system.
- E. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
- F. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
- G. Cost of groundwater dewatering shall be included in the linear foot unit price of the pipe installation.

3.2 DISPOSAL OF WATER

- A. The Contractor shall promptly dispose of all water removed from the excavations in accordance with the Town of Mount Pleasant's requirement and in such a manner as will not endanger public health, damage public or private property, or affect adversely any portion of the work under construction or completed by him or any other Contractor. Contractor shall obtain written permission from the Owner of any property involved before digging ditches or constructing water courses for the removal of water.
- B. The Contractor shall not block off storm drainage during construction and shall be responsible for all temporary rerouting of storm water.

3.3 INADEQUATE SYSTEM

- A. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata, or instability of the slopes, or damage to the materials, and plant, and the performance of all work necessary to carry out additional work for reinstatement of the structure of foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor to the approval of the Engineer, and at no additional expense to the Owner.

END OF SECTION

SECTION 02660

WATER MAIN CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation of new water mains.
 - 2. Coordination and interface with existing facilities and utilities.
 - 3. Connections to existing watermains.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 – General Requirements.
 - 3. Section 01560 – Environmental Protection and Special Controls.
 - 4. Section 02110 – Site Clearing.
 - 5. Section 02221 – Trenching, Backfilling, and Compacting for Utilities.
 - 6. Section 02224 – Encased Pipeline Undercrossings.
 - 7. Section 02260 – Topsoiling and Finished Grading.
 - 8. Section 03002 – Concrete.
 - 9. Section 15060A – Pipe and Pipe Fittings: Basic Water Main Requirements.
 - 10. Section 15062 – Ductile
 - 11. Section 15063 – Copper
 - 12. Section 15064 – Plastic
 - 13. Section 15099 – Water System Appurtenances
 - 14. Section 15100 – Valves: Basic Requirements.
 - 15. Section 15101 – Gate Valves.
 - 16. Section 15114 – Miscellaneous Valves.
 - 17. Section 15510 – Fire Hydrant.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 ACCESS TO WORK

- A. The Contractor shall be responsible for accessing all areas necessary to perform the specified work. All costs associated with access shall be included in the various unit prices bid. No separate payment will be made.
- B. The Contractor shall maintain all construction activities within the road right-of-way and/or utility easements unless specifically approved otherwise by the Engineer and/or Owner.
- C. The Contractor shall coordinate all work with property owners and/or utility providers impacted by the work and shall negotiate access through property as necessary.
- D. The Contractor shall remove and re-install fences, mailboxes, signs, other moveable objects, etc. to perform the specified work at no additional cost.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install water main with no less than 3 FT of cover and no greater than 4 FT of cover unless special conditions apply and approved by MPW.
- C. Field verify depth of utilities that will be crossed well ahead of pipe laying operations.
 - 1. Adjust water main elevation as required during construction.
 - 2. No separate payment will be made for field verification or adjustment of main depths as required.
 - 3. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines. (R.61-58.4.D.(1))

3.3 INTERRUPTION OF SERVICE

- A. Planned interruption of service to water users shall not exceed 4 HRS, unless previously approved by MPW. Contractor must notify MPW of a planned interruption a minimum of 3 days in advance.

3.4 UNDERGROUND SERVICES

- A. Notify utility representative prior to construction to obtain available information on location of existing utilities. The Contractor shall be responsible for locating all utilities.
- B. Damage to existing water service is to be repaired, using copper or PE pipe and union the same size as existing service. All crimped lines shall be "pre-repaired" with a 3-part brass union over crimped locations.

3.5 DRIVEWAY REMOVAL AND REPLACEMENT

- A. All Portland cement concrete and asphalt noted for removal and replacement shall be cut prior to removal. Cut by sawing, vertical cut to be 1 IN minimum. The remaining depth of section may be broken out in a manner subject to Engineers approval. Width of section removed to be either a width not greater than the outside diameter of the water main plus 4 FT-0 IN or broken out to the nearest joint.
- B. Replace Portland cement concrete (minimum 4 IN) and asphalt (minimum 2 IN) equal to or better than original paving.
- C. Debris resulting from the above operations shall be removed and properly disposed by the Contractor.

3.6 GRAVEL SURFACED DRIVES AND ROADWAYS

- A. The Contractor shall restore all damaged gravel surfaced drives and roadways to a condition equal to or better than original.

3.7 PROTECTION OF EXISTING UTILITIES

- A. Contractor to verify the location, material and size of all underground utilities. Omission from, or the inclusion of utility locations on the plans is not to be considered as the nonexistence of or a definite location of existing underground utilities.
- B. The Contractor shall be responsible for coordinating with utility providers for the removal, replacement, relocation or repair of existing structures, facilities, or services.
- C. A representative of the underground utilities shall be notified 24 HRS in advance of crossings.

3.8 CONNECTIONS TO EXISTING WATERMAINS

- A. Make connections to existing watermain as shown on Drawings, by attaching to existing or changed fitting. Cost for making connections shall include cost of all fittings including flexible couplings.
- B. Where the connection is made to an existing water main which can be adequately isolated from the distribution system, it shall be termed a "dry connection."
- C. Contractor is responsible for controlling and disposing of water in the trench at no additional cost to the Owner.

3.9 SEWER CROSSINGS

- A. Watermain crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a vertical separation of at least 18 IN between the bottom of the water main and the top of the sewer, whenever possible. A water main may be laid closer than 10 FT if the crown of the sewer is at least 18 IN below the water main invert. In the event 18 IN of vertical separation cannot be provided at a sewer crossing, the sewer shall be removed for a distance of 10 FT on each side of the water main and replaced with one 20 FT length of ductile iron pipe of the same size.
- B. Concrete collars shall be provided at each end of the ductile iron pipe to connect to the existing sewer pipe as shown on the Drawings.

3.10 WATER CROSSINGS

- A. Watermain crossing other watermain shall be laid to provide a vertical separation of at least 18 IN, whenever possible. In the event 18 IN of vertical separation cannot be provided at a crossing, one 20 FT section of ductile iron pipe shall be installed on both watermain on center at the point of the crossing. Any deviations must be approved by MPW.

3.11 TREES

- A. Refer to Section 01560 for tree protection and removal requirements.

3.12 FENCES, SIGNS, MAILBOXES, ETC.

- A. Restore all damaged fences, signs, driveway culverts, headwalls, mailboxes, etc., to their original conditions. No separate payment will be made for these items.

3.13 TRAFFIC CONTROL

- A. Warning signs and flagmen must be provided in accordance with the SCDOT's Uniform Traffic Control Devices". Traffic control will be strictly enforced in order to provide fire and police protection, maintain efficient traffic patterns and access to drives while construction is in progress.
- B. The Contractor shall provide all appropriate signage, barricades and detours, and shall provide flag persons at all times and places necessary. Occupants must be notified a minimum of 2 hours in advance of private drive closing. Closure time will be limited to a maximum of 2 hours. Where businesses have only one means of access, the Contractor shall provide an alternative means of access or perform work during hours when the business is closed.

3.14 FIELD QUALITY CONTROL**A. Hydrostatic Testing: (See Section 15060-A):**

1. All valves, hydrants, pipe and fittings shall be hydrostatically tested.
2. Furnish all necessary apparatus to run hydrostatic test, including necessary taps into the pipe.

B. Sealing, Flushing, and Disinfection of Potable Water Systems (See Section 15060-A):

1. Maintain interior of all pipes, fittings and other accessories free from dirt and foreign material at all times. If, in the opinion of the Engineer, the pipe contains dirt that will not be removed by flushing, the pipe interior shall be cleaned and swabbed with bactericidal solution. At close of day's work or whenever workmen are absent from jobsite, plug, cap or otherwise provide watertight seal from open ends of pipe to prevent ingress of foreign material. If water is in trench, seal shall remain in place until trench is pumped dry.
2. The Owner will provide the water required to fill the main initially and will pay for the water required to flush the main once. Filling and flushing shall be performed during periods of low usage, between the hours of midnight and 4:00 AM, or as directed by MPW. Flushing water will be based on a maximum of 8 HRS total. Any additional re-filling or re-flushing to be at the Contractor's expense at MPW's commercial water rates.

3.15 RESIDUAL DISPOSAL

- A. The State limits the amount of chlorinated water that may be allowed to enter a live stream, creek, etc. or other body of water (lake, pond, etc.). The Contractor is responsible for reducing the residual chlorine to the acceptable level (less than 0.2 parts per million). The Contractor may dechlorinate the water onsite and discharge on the adjacent ground. The Contractor shall provide erosion control measures at no additional cost. The discharge shall be tested by the Contractor at 15-minute intervals to confirm the discharge is less than the acceptable level. Discharge shall be immediately stopped if any elevated chlorine readings are observed. The dechlorination system shall be the Pallard LPD-250 Diffuser and Dechlorination system or an approved equal. The dechlorination agent and process shall be as approved by the Engineer.

END OF SECTION

SECTION 02781

HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Furnish and install underground utilities using the horizontal directional drilling (HDD) method of installation of pipe, commonly referred to as directional boring or guided horizontal boring. This work includes all services, equipment, materials, and labor necessary for a complete and proper installation, testing, restoration of underground utilities, environmental protection and restoration.
- B. Related sections include but are not necessarily limited to:
 - 1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 – General Requirements.
 - 3. Section 15060 A – Pipe and Pipe Fittings: Basic Water Main Requirements.
 - 4. Section 02660 – Water Main Construction.

1.2 QUALITY ASSURANCE

- A. Provide extended five (5) year warranty for all work within SCDOT rights-of-way.
- B. 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.
- C. Requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence is required under specifically covered conditions outlined in these specifications. Adherence to these specifications or the Engineer's approval of any aspect of any directional bore operation in no way relieves the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- C. Work plan: Prior to beginning work, Contractor must submit to the Engineer a work plan detailing the procedure and schedule to be used to execute the project. The work plan should be based on actual working conditions for this particular project and include the following:
 - 1. Description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience, list of subcontractors, and a schedule of work activity.
 - 2. Safety plan.
 - 3. Traffic control plan (if applicable).
 - 4. Environmental protection plan.
 - 5. Contingency plans for possible problems.
- D. Equipment: Contractor will submit specifications on directional drilling equipment to be used to ensure that the equipment is adequate to complete the project. Equipment shall include, but not be limited to, the following:
 - 1. Drilling rig.
 - 2. Mud system.
 - 3. Mud motors (if applicable).
 - 4. Down-hole tools.
 - 5. Guidance system.
 - 6. Rig safety systems.
 - 7. Calibration records for guidance equipment.
 - 8. Specifications for any drilling fluid additives that might be used.
- E. Material: Submit to Engineer specifications on any materials such as pipe, fittings or any other item to be an installed component of the project.

PART 2 - EQUIPMENT REQUIREMENTS

2.1 GENERAL

- A. Directional drilling equipment to consist of the following:
 - 1. Directional drilling rig of sufficient capacity to perform the bore and pull-back the pipe.
 - 2. Drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the crossing.

3. Drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used.
4. Guidance system to accurately guide boring operations.
5. Vacuum truck of sufficient capacity to handle the drilling fluid volume.
6. Trained and competent personnel to operate the system.
7. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2.2 DRILLING SYSTEM

A. Drilling rig:

1. Hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head.
 - a. Anchor the machine to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing.
 - b. Hydraulic power system to be self-contained with sufficient pressure and volume to power drilling operations and to be free of leaks.
 2. Rig to have a system to monitor and record maximum pull-back pressure during pull-back operations.
 3. Electrically ground the rig during drilling and pull-back operations.
- B. Construct drill pipe of high quality 4130 seamless tubing, Grade D, or better, with threaded box and pins. Toll joints should be hardened to 32-36 RC.

2.3 GUIDANCE SYSTEM

A. Provide a guidance system of a proven, accurate type with an interface meeting the following requirements:

1. Must provide a continuous and accurate determination of the location of the drill head during the drilling operation.
2. Must be capable of tracking at all depths up to 100' in any soil condition (including hard rock).
3. Probe must provide immediate information on the tool face, azimuth (horizontal direction) and inclination (vertical direction) and must be accurate to $\pm 2\%$ of the vertical depth of the bore hole at sensing position at depths up to 100' and accurate within 1.5 meters horizontally.
4. System must be setup and operated by personnel trained and experienced. Operator must be aware of any geo-magnetic anomalies and must consider such influences in the operation of the guidance system if using a magnetic system.

2.4 DRILLING FLUID (MUD) SYSTEM

A. Mixing system:

1. Provide self-contained, closed drilling fluid mixing system of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives.
2. Mixing system must be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing.
3. System to continually agitate the drilling fluid during drilling operations.

B. Fluids:

1. Fluids to be composed of clean water, bentonite clay and approved additives.
2. Use water from an authorized source with a pH of 8.5 - 10.
3. Water of a lower pH or with excessive calcium to be treated with the appropriate amount of sodium carbonate, or equal.
4. Mix water and bentonite clay thoroughly, absent of any clumps or clods.
5. No additional material may be used in drilling fluid without prior approval from the Engineer.

2.5 OTHER EQUIPMENT

A. Pipe rollers:

1. Provide pipe rollers of sufficient size to fully support the weight of the pipe during pull-back operations.
2. Provide a sufficient number of rollers to meet the pipe manufacturer's recommended spacing to prevent excess sagging of pipe.

B. Pipe rammers: Use hydraulic or pneumatic pipe rammers only if necessary and with the authorization of the Engineer.

2.6 PIPE

A. Polyethylene (PE) pipe:

1. Comply with AWWA C-906, DR 11 and working pressure of 160.
2. Provide SDR high performance, high molecular weight, high density polyethylene pipe, and shall conform to ASTM D 1248 (Type III C, Category 5, P34).
3. Minimum cell classifications values shall be 345434C as referenced in ASTM D 3350 - latest edition.

4. Provide fittings molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe.
5. All fittings supplied under this to be of the same manufacture as the pipe being supplied.
6. Physical properties:

PROPERTY	TEST METHOD	UNIT	VALUE
Density	ASTM Method	gms/cc	0.955
Melt Index	ASTM D-1238 (190/2.16)	gms/10 min	
ENVIRONMENTAL STRESS CRACKING RESISTANCE:			
Condition A, B, & C, F-0	ASTM D 1693	hrs	>5000**
Compressed Ring, F-60	ASTM F 1248	hrs	>1500
Tensile Strength, Yield	ASTM D 638	psi	3200
Type IV Specimen	(2"/min)		
Elongation at Break	ASTM D 638	%	>750
Type IV Specimen	(2"/min)		
Victate Softening Temp	ASTM D 1525	°F	257
Brittleness Temp	ASTM D 746	°F	180
Flexural Modulus	ASTM D 790	psi	135,000
Modulus of Elasticity	ASTM D 638	psi	130,000
Hardness	ASTM D 2240	Shore D	65
Expansion Coef.	ASTM D 696	in./in./°F	1.2x10-4
Thermal Conductivity	Dynatech-Colora BTU, In./Thermoconductor ft./2hrs/°F		
LONG TERM STRENGTH:			
73° F	ASTM D 2837	psi	1600
UV Stabilizer	ASTM D 1603	%C	2.5
Material Cell Classification	ASTM D 1248		345434C
Material Description	PPI Recommendation		PE 3408

2.7 TRACER WIRE

- A. Install Tric-Tech wire CO-10 gauge HDPE high flex stainless steel directional boring tracer cable on all HDPE pipe. Installed pipe will not be accepted by MPW until in receipt of an acceptable conductivity test.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Engineer must be notified 48 hours in advance of starting work. Directional bore shall not begin until the Engineer's representative is present at the job site.

3.2 PERSONNEL REQUIREMENTS

A. General:

1. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety.
2. A competent and experienced supervisor representing the Contractor and drilling subcontractor shall be present at all times during the actual drilling operations.
3. A responsible representative, thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times.
4. Supervisor must be continually present at the job site during the actual directional bore operation at all times.
5. A sufficient number of competent workers must be provided at all times to ensure the directional bore is made in a timely and satisfactory manner.

3.3 DRILLING PROCEDURE

A. Site preparation:

1. Contractor to provide photograph or video tape of the entire work area, including entry and exit points prior to any alterations to work site, including:

- a. Provide Engineer with one copy of photograph or video tape.
 - b. One copy to remain with Contractor for a period of one year following the completion of the project.
- B. Drill path survey: Accurately survey the entire drill path with entry and exit stakes placed in the appropriate locations. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.
- C. Environmental protection:
 1. Place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations.
 2. Install berms, liners, turbidity curtains and any other measures necessary to contain any hydraulic or drilling fluid spills for additional environmental protection.
 3. Adhere to all applicable environmental regulations.
 4. Do not store fuel in bulk containers within 20' of any water-body or wetland.
- D. Pipe: If possible, weld/fuse pipe together in one length prior to placing in bore hole. When recommended by the pipe manufacturer or shown on the approved plans, place pipe on rollers before pulling into bore hole. Space rollers must meet pipe manufacturer guidelines and be close enough to prevent excessive sagging of pipe.
- E. Pilot hole:
 1. Drill pilot hole on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', the Engineer may require to pull-back and re-drill from the location along bore path before the deviation.
 2. In the event that a drilling fluid fracture, inadvertent returns, or returns loss, occurs during pilot hole drilling operations, cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, cease operations and notify Engineer.
- F. Pull-back:
 1. After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and barrel reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole.
 2. Do not apply more than the maximum safe pipe pull force as determined by the pipe manufacturer during pull-back operations.

3.4 QUALITY CONTROL

- A. Resin:
 1. Manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality.
 2. All ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable.
- B. Pipe:
 1. The HDPE pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.
 2. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index, and other physical properties.
- C. Testing:
 1. Owner may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing.
 2. Test results from manufacturer's testing or random sampling by the Engineer that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing.
 3. Tests to include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.
 4. Provide certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.
- D. Rejection:
 1. The Owner reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.
- E. Pipe dimensions:
 1. Pipe supplied under this specification shall have a nominal DIP (ductile iron pipe) size O.D. unless otherwise specified. The DR (Dimension Ratio) of the pipe supplied shall be as specified.
- F. Join sections of polyethylene pipe into continuous lengths on the job site above ground.
 1. Use the butt fusion method performed in accordance with the manufacturer's recommendations.

2. Equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.
 - a. Each joint shall be logged with a datalogger that will provide a report and graph showing required pipe data, pressures, times, etc. for each joint in accordance with the pipe supplier's recommendation to include the following:
 - 1) Pipe size and thickness
 - 2) Machine size
 - 3) Fusion technician identification
 - 4) Fusion, heating, and drag pressure settings
 - 5) Heat plate temperature
 - 6) Time stamp
 - 7) Heating and cool down time of fusion
 - 8) Ambient temperature
 3. Prior approval of equipment and personnel shall be obtained before fusion begins.
 4. Pipe fusion technician shall have a current training qualification from the pipe manufacturer/supplier for the material and pipe size being installed.
 5. The completed pipe joints shall be guaranteed for five years in writing to the Owner and its Contractor.
- G. Provide restrained joint mechanical joint adapters for each end of the P.E. pipeline.
1. Include any special end configuration and polyethylene ring to hold a standard mechanical joint.

3.5 HYDROSTATIC TESTING

- A. The pipe shall be hydrostatically tested before final acceptance after being pulled through the bore hole.
- B. The test procedure consists of initial expansion, and test phases. For the initial expansion phase, make-up water is added as required to maintain the test pressure (150 psi) for four (4) hours. For the test phase, the test pressure is reduced by 10 psi. If the pressure remains steady (within 5% of the target value) for an hour, no leakage is indicated.

3.6 SITE RESTORATION

- A. De-mobilize equipment to restore the work site to original condition once drilling operations are terminated.
- B. Backfill and compact all excavation to 98% of original density.

3.7 RECORD KEEPING AND AS-BUILTS

- A. Maintain a daily project log of drilling operations and a guidance system log with a copy given to Engineer at completion of project.
- B. Plan & profile as-builts are required and must be completed and certified by a professional surveyor.
- C. Contractor shall provide CCTV video of the installed HDD force main for verification of the as-built profiles to ensure that any unplanned/unvented high points are identified.

END OF SECTION

SECTION 02930

SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seeding, sodding and landscape planting:
 - a. Soil preparation.
 - b. Lawn-type seeding.
 - c. Sodding.
 - d. Plants and planting.
 - e. Maintenance of new and transplanted materials.
 - f. Pruning and repairing existing trees.
 - g. Replacement of dead or impaired materials at the end of the first growing season.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02260 - Topsoiling and Finished Grading.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):
 - a. Z60.1, American Standard for Nursery Stock.
 - 2. AOAC International (AOAC).
 - 3. ASTM International (ASTM):
 - b. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
 - c. United States Department of Agriculture (USDA): Federal Seed Act.
- B. Quality Control:
 - 1. Fertilizer:
 - a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
 - b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
 - c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.
- C. Qualifications:
 - 1. Pruning work to be performed by a licensed arborist.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
 - d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
 - e. Source and location of sod, plants, and plant material.
 - 3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.
- B. Miscellaneous Submittals:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Furnish seed in sealed standard containers labeled with producer's name and seed analysis.
 - 1. Remove from the site seed which has become wet, moldy, or otherwise damaged in transit.

- B. Furnish fertilizer uniform in composition, free flowing and suitable for application with approved equipment, delivered to site in bags or other containers, each fully labeled and bearing the name, and warranty of the producer.

1.5 SEQUENCING AND SCHEDULING

A. Installation Schedule:

1. MPW will meet with impacted property owners prior to construction to develop a restoration plan to include a restoration schedule, sod/shrub/tree replacement type, limits of disturbance, maintenance responsibilities, etc.
2. MPW will provide the Contractor written documentation outlining all restoration requirements.

B. Pre-installation Meeting:

1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed Quality:

1. Fresh, clean, new-crop seed labeled in accordance with USDA Rules and Regulations under the Federal Seed Act in effect on date of bidding.
2. Provide seed of species, proportions, and minimum percentages of purity, germination and maximum percentage of weed seed as specified.

B. Lawn-Type Seed Mixture:

1. Schedule No. 1 - Planting dates March 1 to August 15:

Common Name of Seed	Rate A	Rate B
Rye Grain	1.0	1.0
Common Bermuda (hulled)	0.0	1.5
Sericea Lespedeza	1.0	0.0
Weeping Love Grass (sandy soils)	1.0	0.0

2. Schedule No. 2 – Planting dates August 16 – February 28:

Common Name of Seed	Rate A	Rate B
Rye Grain	0.0	1.0
Common Bermuda (hulled)	0.0	1.5
Brown Top Millet	5.0	0.0
Common Bermuda (unhulled)	0.0	2.0

C. Sod: Viable, dense, strongly rooted, not less than 2 years old.

1. Centipede Grass or match existing type as required.
2. Free of weeds and undesirable native grasses.
3. Strips 12 to 18 IN wide.
4. Mow prior to stripping from field.
5. Cut so 3/4 IN of soil is firmly attached to roots.
6. Not frozen or dormant.

D. Mulch:

1. For seeded areas:
 - a. Clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, peanuts, or other locally available mulch material which does not contain an excessive quantity of matured seeds of noxious weeds or other species that will grow or be detrimental to seeding, or provide a menace to surrounding land.
 - b. Do not use material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.
2. Trees and shrubs: Hardwood chips, shredded bark, or other material as approved by the Engineer.

E. Fertilizer:

1. Commercial fertilizer meeting applicable requirements of State and Federal law.
2. Cyanic compound or hydrated lime not permitted in mixed fertilizers.
3. For lawn-type seeding and sod: 5-10-5 analysis.

F. Limestone: Agricultural grade ground limestone containing not less than 88 percent of combined calcium and magnesium carbonates, 100 percent passing a 10-mesh sieve, 90 percent passing a 20-mesh sieve, and 60 percent passing a 100-mesh sieve.

- G. Asphalt Binder: Emulsified asphalt per State specifications.
- H. Water:
 - 1. Water free from substances harmful to grass or sod growth.
 - 2. Provide water from source approved prior to use.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. General:
 - 1. Limit preparation to areas which will be planted soon after.
 - 2. Provide facilities to protect and safeguard all persons on or about premises.
 - 3. Protect existing trees designated to remain.
 - 4. Verify location and existence of all underground utilities.
 - a. Take necessary precaution to protect existing utilities from damage due to construction activity.
 - b. Repair all damages to utility items at Contractor's expense.
 - 5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
 - a. Contractor to be responsible for vandalism until acceptance of work in whole or in part including all costs to completely repair the damaged restoration work.
 - 6. Work to be performed in compliance with these specifications unless a local nursery recommends otherwise.
- B. Seed these areas immediately upon completion of grading or construction and clean-up operations.
 - 1. Slopes greater than four horizontal to one vertical.
 - 2. Utility rights-of-way adjacent to stream banks.
- C. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for planting Schedule No. 1, the turf shall be destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.
- D. Use Rate A lbs. per 1000 sq. ft. on slopes over 5' horizontal to 1' vertical in height and use Rate B lbs. per 1000 sq. ft. on slopes less than 5' horizontal to 1' vertical.
- E. Preparation for Lawn-Type Seeding, Sprigging, Plugging or Sodding:
 - 1. Loosen surface to minimum depth of 4 IN.
 - 2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
 - 3. Spread limestone uniformly over designated areas at a rate of 50 LBS per 1000 SF.
 - a. Thoroughly mix and till through topsoil layer.
 - 4. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
 - 5. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
 - 6. Distribute fertilizer uniformly over areas to be seeded:
 - a. For lawn-type seeding: 30 LBS per 1000 SF.
 - b. For pasture seeding: 200 LBS per acre.
 - 7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
 - 8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
 - a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
 - b. Limit fine grading to areas which can be planted soon after preparation.
 - 9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

- A. Lawn-Type and Pasture Seeding:
 - 1. Do not use seed which is wet, moldy, or otherwise damaged.
 - 2. Perform seeding work from March 1 to August 15 for spring planting, and August 16 to February 28 for fall planting, unless otherwise approved by Engineer.
 - 3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
 - 4. Distribute seed evenly over entire area at rate of application not less than 4 LBS (PLS) of seed per 1000 SF, 50 percent sown in one direction, remainder at right angles to first sowing.
 - 5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
 - a. Resume work only when favorable conditions develop.
 - 6. Lightly rake seed into soil followed by light rolling or cultipacking.
 - 7. Immediately protect seeded areas against erosion by mulching.

- a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
 - a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a Wheatland land packer having wheels with V-shaped edges to force mulch into soil surface, or apply evenly distributed emulsified asphalt at rate of 10-13 GAL/1000 SF.
 - a. SS-1 emulsion in accordance with ASTM D5276 or RC-1 cutback asphalt in accordance with ASTM D2028 are acceptable.
 - b. If mulch and asphalt are applied in one treatment, use SS-1 emulsion with penetration test range between 150-200.
 - c. Use appropriate shields to protect adjacent site improvements.
10. If hydroseeding is used, machinery must be approved, modern, properly equipped and operated by an experienced operator.
 - a. Seed and fertilize at the rate specified.
 - b. Use appropriate shields to protect adjacent site improvements.
- B. Sodding
 1. Moisten prepared surface immediately prior to laying sod.
 2. Lay sod within 48 hours of being cut and within 24 hours after topsoil is prepared and fertilized.
 3. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12-inches minimum. Do not stretch or overlap sod species.
 4. Lay sod smooth aligning with adjoining grass areas.
 5. Place top elevation of sod 1/2-inch below adjoining pavement.
 6. On slopes 6-inches per foot or steeper, lay sod perpendicular to slope and secure every row with wooden pegs at a maximum 2-feet on center. When using "big roll", lay sod parallel to slope. Drive pegs flush with soil portion of sod.
 7. Do not place sod when temperature is lower than 32 degrees F.
 8. Water sodded areas immediately after installation. Saturate soil to 4 inches.
 9. Contractor to provide and pay for all water and will not use any customer's water.
 10. After sod and soil have dried, roll sodded areas to bond soil and to remove minor depressions and irregularities. Roll sodded areas with a lawn roller not exceeding 120 pounds.

3.3 PLANTING TREES, SHRUBS, AND GROUND COVERS

- A. Notification:
 1. Notify Engineer of source of plants and plant materials at least 30 days prior to planting to permit Engineer's inspection of source qualifications.
- B. Preparation:
 1. Handle plants so that roots or balls are adequately protected from breakage of balls, from sun or drying winds.
 - a. Ensure tops or roots of plants are not permitted to dry out.
 2. During transportation, protect materials from wind and sun to prevent tops and roots from drying out.
 3. Protect tops of plants from damage.
 - a. Plants with damaged tops will be rejected.
 4. For purpose of inspection and planting identification, attach durable, legible labels to bundle or container of plant material delivered at the planting site.
 - a. State correct plant name and size of each plant in weather-resistant ink on labels.
 5. Do not prune trees and shrubs at nursery.
 6. Perform all work as recommended by a local nursery.
- C. Planting Season:
 1. Plant deciduous shade trees and shrubs any time the ground is suitable between October 15 and June 1.
 2. Plant evergreen material between September 1 and June 1.
 3. Plant ground covers between March 15 to June 1.
 4. In the event the Contractor is not able to plant during the planting season, at MPW's discretion, retainage may be held until the Contractor can return during the planting season to complete the restoration.
- D. Planting Procedure:
 1. Indicate locations of plants for approval by Engineer before excavating plant locations.
 2. In event underground construction, utilities, obstructions, or rock are encountered in excavation of plantings, secure alternate locations from Engineer.
 - a. Make said changes without additional compensation.
 - b. Where tree locations fall under existing overhead wires, or crowd existing trees, adjust locations as directed by Engineer.
 3. Excavate pits and beds as necessary and in accordance with ANLA/ANSI Z60.1.

- a. Loosen bottom of pits prior to planting.
 - b. Excavation is unclassified, excavate all materials without additional cost.
4. Tree and shrub pits to be circular in shape with vertical sides at least 1 FT greater in diameter than ball diameter.
 - a. Pit to be of sufficient depth to provide 6 IN of planting soil under ball when set to natural grade.
5. Shrub and ground cover beds:
 - a. Plant shrubs used in mass plantings in individual holes of required size.
 - b. Strip all sod from among mass planting.
 - c. For ground cover beds, remove sod from within limits of bed.
 - d. Add soil amendments as specified and mix or rototill with existing topsoil to a depth of 6 IN.
6. Set plants straight or plumb, in locations when indicated and at such level that after settlement they bear same relationship to finished grade as they did in their former setting.
 - a. Carefully tamp planting soil under and around base of balls to prevent voids.
 - b. Remove burlap, rope and wires from top of balls.
 - c. Do not remove burlap from sides and bottom of balls.
7. Backfill plants with planting soil.
 - a. Tamp to 1/2 depth of pit and thoroughly water and puddle before bringing backfill to proper grade.
 - b. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.
8. After planting is complete, form a level saucer 3 IN high around each tree extending to limit of plant pit for watering purposes.
9. Mulch plant pit after saucer has been shaped.
 - a. Mulch to limits of pit and uniformly over ground cover beds to a depth of 3 IN.
 - b. In mass plantings of shrubs, mulch entire area uniformly among shrubs to a depth of 3 IN.
 - c. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.
10. Staking: Stake trees immediately after planting as detailed on Drawings or in accordance with Nursery Standards.
11. Wrap deciduous trees 2 IN or more in caliper by neatly overlapping wrapping material between ground line and second branch.
 - a. Place ties at top and bottom of wrapping material and not more than 12 IN apart between top and bottom ties.
12. Remove dead or damaged branches.
 - a. Thin deciduous material to about two-thirds of initial branching.
 - b. Remove only dead or damaged branches from evergreens.
13. Water plants during planting operations.
 - a. Water each plant a minimum of once each week until final acceptance.
 - b. Apply sufficient water to moisten backfill about each plant so that moisture will extend into the surrounding soil.
- E. Pruning and Repairing Existing Trees:
 1. All pruning and repairing of existing trees must be approved by the Town of Mount Pleasant and MPW prior to performing the work. The Contractor shall hire a certified arborist to advise on all pruning and repairs and all work shall meet the Town of Mount Pleasant requirements.
 2. Remove dead or dying limbs, repair and treat wounds, remove limbs that interfere with construction or with vehicular traffic and repair, rotted or decayed areas specifically noted on Drawings.
 3. Procedure:
 - a. To prevent stripping the bark, stub cut branches that are too large to be supported by hand.
 - b. Coat branch cuts over 1 IN in diameter with an asphaltic varnish containing an antiseptic.
 - c. Where existing trees interfere with construction, prune the limb back flush to the main trunk.
 - 1) Maintain 7 FT vertical clearance where evergreens overhang new sidewalks.
 - d. Provide 10 FT vertical clearance along the main access road where the existing trees are subjected to vehicular traffic.
 - e. Repair bark wounds by removing injured bark, shaping the wound to an elongated ellipse, disinfecting it and applying antiseptic paint.
 - f. Repair all rotten areas.

3.4 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated in paragraph B below, whichever is the longer.
2. Contractor shall provide and pay for all water and shall not use the property owner's water source.
3. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.

4. Protection of new materials:
 - a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
 - b. Repair and pay for all damaged items.
 5. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.
- B. Seeded or Sodded Lawns:
1. Maintain seeded and sodded lawns: 90 days, minimum, after installation and review of entire project area to be planted.
 2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
 3. Engineer will review seeded or sodded lawn area after installation for initial acceptance.
 4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
 5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
 - a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
 6. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
 - a. Repeat mowing as required to maintain height.
 - b. Do not delay mowing until grass blades bend over and become matted.
 - c. Do not mow when grass is wet.
 - d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 IN.
 - e. Do not mow lower than 1-1/2 IN.
 7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
 - a. Anchor as required to prevent displacement.
 8. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
 9. Replant bare areas using same materials specified.
 10. Owner/Engineer will review final acceptability of installed areas at end of maintenance period.
 11. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION

SECTION 03002 CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete and grout.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 116R, Cement and Concrete Terminology.
 - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - c. 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
 - d. 212.3R, Chemical Admixtures for Concrete.
 - e. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - f. 304.2R, Placing Concrete by Pumping Methods.
 - g. 305R, Hot Weather Concreting.
 - h. 306R, Cold Weather Concreting.
 - i. 318, Building Code Requirements for Structural Concrete.
 - j. 347R, Recommended Practice for Concrete Formwork.
 - 2. ASTM International (ASTM):
 - a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - c. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - d. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - f. C33, Standard Specification for Concrete Aggregates.
 - g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - h. C94, Standard Specification for Ready-Mixed Concrete.
 - i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
 - k. C150, Standard Specification for Portland Cement.
 - l. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
 - m. C172, Standard Practice for Sampling Freshly Mixed Concrete.
 - n. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - p. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - q. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
 - r. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - s. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - t. C494, Standard Specification for Chemical Admixtures for Concrete.
 - u. C496, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - v. C567, Standard Test Method for Determining Density of Structural Lightweight Concrete.
 - w. C595, Standard Specification for Blended Hydraulic Cements.
 - x. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - y. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - z. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - aa. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - bb. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

- cc. E329, Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- 3. Corps of Engineers (COE):
 - a. CRD-C572, Specifications for Polyvinylchloride Waterstops.
 - b. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).
- B. Quality Control:
 - 1. Concrete testing agency:
 - a. Contractor to employ and pay for services of a testing laboratory to:
 - 1) Perform materials evaluation.
 - 2) Design concrete mixes.
 - 3) Perform testing of concrete placed during construction.
 - b. Concrete testing agency to meet requirements of ASTM E329.
 - 2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
 - a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
 - 3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
 - a. Do not use revised concrete mixes until submitted to and approved by Engineer.
 - 4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
- C. Qualifications:
 - 1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).
 - 2. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the State of South Carolina.

1.3 DEFINITIONS

- A. Per ACI 116R except as modified herein:
 - 1. Concrete fill: Non-structural concrete.
 - 2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
 - 3. Exposed concrete: Exposed to view after construction is complete.
 - 4. Indicated: Indicated by Contract Documents.
 - 5. Lean concrete: Concrete with low cement content.
 - 6. Nonexposed concrete: Not exposed to view after construction is complete.
 - 7. Required: Required by Contract Documents.
 - 8. Specified strength: Specified compressive strength at 28 days.
 - 9. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Concrete mix designs proposed for use.
 - a. Concrete mix design submittal to include the following information:
 - 1) Sieve analysis and source of fine and coarse aggregates.
 - 2) Test for aggregate organic impurities.
 - 3) Test for deleterious aggregate per ASTM C289.
 - 4) Proportioning of all materials.
 - 5) Type of cement with mill certificate for cement.
 - 6) Type of fly ash with certificate of conformance to specification requirements.
 - 7) Slump.
 - 8) Air content.
 - 9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
 - 10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
 - 11) Shrinkage test results.
 - 12) Standard deviation value for concrete production facility.
 - 3. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Manufacturers and types:
 - 1) Joint fillers.

- 2) Curing agents.
- 3) Chemical sealer.
- 4) Bonding and patching mortar.
- 5) Construction joint bonding adhesive.
- 6) Non-shrink grout with cure/seal compound.
- 7) Waterstops.
- 8) Form releasing agents
4. Reinforcing steel:
 - a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
 - b. In sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
 - c. Obtain approval of Shop Drawings by Engineer before fabrication.
 - d. Mill certificates.
5. Strength test results of in place concrete including slump, air content and concrete temperature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:

1. Cement and fly ash:
 - a. Store in moistureproof, weathertight enclosures.
 - b. Do not use if caked or lumpy.
2. Aggregate:
 - a. Store to prevent segregation and contamination with other sizes or foreign materials.
 - b. Obtain samples for testing from aggregates at point of batching.
 - c. Do not use frozen or partially frozen aggregates.
 - d. Do not use bottom 6 IN of stockpiles in contact with ground.
 - e. Allow sand to drain until moisture content is uniform prior to use.
3. Admixtures:
 - a. Protect from contamination, evaporation, freezing, or damage.
 - b. Maintain within temperature range recommended by manufacturer.
 - c. Completely mix solutions and suspensions prior to use.
4. Reinforcing steel: Support and store all rebars above ground.

B. Delivery:

1. Concrete:
 - a. Prepare a delivery ticket for each load for ready-mixed concrete.
 - b. Truck operator shall hand ticket to Mount Pleasant Waterworks (MPW) Representative at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification mark.
 - 2) Quantity delivered.
 - 3) Amount of each material in batch.
 - 4) Outdoor temp in the shade.
 - 5) Time at which cement was added.
 - 6) Numerical sequence of the delivery.
 - 7) Amount of water added.
 - 8) PSI Strength
2. Reinforcing steel:
 - a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
 - b. Mark numbers to match Shop Drawing mark number.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: Conform to ASTM C150 Type I/II.

B. Fly Ash:

1. ASTM C618, Class F.
2. Non-staining.
 - a. Hardened concrete containing fly ash to be uniform light gray color.
3. Maximum loss on ignition: 4 percent.
4. Compatible with other concrete ingredients.
5. Obtain proposed fly ash from a source approved by the SCDOT for use in concrete for roads and bridges.
6. Do not use for precast construction

C. Admixtures:

1. Air entraining admixtures: ASTM C260.
2. Water reducing, retarding, and accelerating admixtures:
 - a. ASTM C494 Type A through E.
 - b. Conform to provisions of ACI 212.3R.
 - c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to MPW.
 - d. Follow manufacturer's instructions.
 - e. Use chloride free admixtures only.
3. Maximum total water soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials and admixtures by weight percent of cement:
 - a. 0.10 all concrete.
4. Do not use calcium chloride.
5. Pozzolan admixtures: ASTM C618.
6. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water: Potable, clean, free of oils, acids and organic matter.

E. Aggregates:

1. Normal weight concrete: ASTM C33, except as modified below.
2. Fine aggregate:
 - a. Clean natural sand.
 - b. No manufactured or artificial sand.
3. Coarse aggregate:
 - a. Crushed rock, natural gravel, or other inert granular material.
 - b. Maximum amount of clay or shale particles: 1 percent.
4. Gradation of coarse aggregate:
 - a. Lean concrete and concrete topping: Size #7.
 - b. All other concrete: Size #67.
5. Concrete Grout:
6. Nonshrink nonmetallic grout:
 - a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
 - b. Grout to produce a positive but controlled expansion.
 - c. Mass expansion not to be created by gas liberation.
 - d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
 - e. In accordance with COE CRD-C621.
7. Epoxy grout:
 - a. 3-component epoxy resin system.
 - 1) Two liquid epoxy components.
 - 2) One inert aggregate filler component.
 - b. Each component packaged separately for mixing at jobsite.

F. Reinforcing Steel:

1. Reinforcing bars: ASTM A615, Grade 60.
2. Welded wire reinforcement: ASTM A185.
 - a. Minimum yield strength: 60,000 psi.
3. Column spirals: ASTM A82.

G. Forms:

1. Prefabricated or job built.
2. Wood forms:
 - a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
 - b. Built-in-place or prefabricated type panel.
 - c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.
 - d. When approved, plywood may be reused.
3. Metal forms:
 - a. Metal forms excluding aluminum may be used.
 - b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
4. Chamfer strips: Clear white pine, surface against concrete planed.
5. Form ties:
 - a. Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.
 - b. Cone diameter: 3/4 IN minimum to 1 IN maximum.

- c. Embedded portion 1-1/2 IN minimum back from concrete face.
- d. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.
- e. Provide ties with built-in waterstops at all walls that will be in contact with process liquid during plant operation.
- 6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.
- 7. Nontoxic 30 days after application.
- H. Waterstops:
 - 1. Plastic: COE CRD-C572.
 - 2. Serrated.
 - 3. Thickness: 1/2 IN. min.
 - 4. Length (general use): 6 IN unless indicated otherwise.
 - 5. Expansion joints:
 - a. Length: 9 IN.
 - b. Center bulb: 1 IN OD x 1/2 IN ID.
 - 6. Provide hog rings or grommets spaced at maximum 12 IN OC along the length of the water stop.
 - 7. Provide factory made waterstop fabrications at all changes of direction, intersections and transitions leaving only straight butt splices for the field.
- I. Chairs, Runners, Bolsters, Spacers, and Hangers:
 - 1. Stainless steel, epoxy coated, or plastic coated metal.
 - a. Plastic coated: Rebar support tips in contact with the forms only.
- J. Membrane Curing Compound:
 - 1. ASTM C309, Type I-D.
 - 2. Resin based, dissipates upon exposure to UV light.
 - 3. Curing compound shall not prevent bonding of any future coverings, coatings or finishes.
 - 4. Curing compounds used in water treatment plant construction to be nontoxic and taste and odor free.
- K. Bonding Agent:
 - 1. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
 - 2. Euclid Chemical Co. "Flex-Con."
 - 3. BASF Admixtures, Inc. "Acryl-Set."
 - 4. L & M Construction Chemicals "Everbond."
 - 5. Thoro System Products "Acryl 60."
- L. Expansion Joint Filler:
 - 1. In contact with water or wastewater:
 - a. Closed cell neoprene.
 - b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
 - 2. Exterior driveways, curbs and sidewalks:
 - a. Asphalt expansion joint filler.
 - b. ASTM D994.
 - 3. Other use:
 - a. Fiber expansion joint filler.
 - b. ASTM D1751.

2.2 CONCRETE MIXES

- A. General:
 - 1. All concrete to be ready mixed concrete conforming to ASTM C94.
 - 2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
 - 3. All concrete to be normal weight concrete unless noted otherwise.
- B. Strength:
 - 1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
Concrete fill/Lean concrete	Normal weight	4000 psi
Precast concrete	Normal weight	5000 psi
All other general use concrete	Normal weight	4000 psi

* Minimum 28-day compressive strength.

C. Air Entrainment:

1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:

MAX AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 IN or 3/4 IN	6% +/- 1.5%
< 3/4 IN	7% +/- 1.5%

2. Air content to be measured in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump - 4 IN maximum, 1 IN minimum:

1. Measured at point of discharge of the concrete into the concrete construction member.
2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. Pumped concrete:
 - a. Provide additional water at batch plant to allow for slump loss due to pumping.
 - b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
4. Determine slump per ASTM C143.

E. Selection of Proportions:

1. General:
 - a. Proportion ingredients to:
 - 1) Produce proper workability, durability, strength, and other required properties.
 - 2) Prevent segregation and collection of excessive free water on surface.
2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	MIN. CEMENT & POZZOLAN, LB/CY	MAXIMUM WATER CEMENT RATIO BY WEIGHT
4000	564	0.45
5000	611	0.40

3. Substitution of fly ash: Maximum of 25 percent by weight of cement at rate of 1 LB fly ash for 1 LB of cement.
4. Sand cement grout:
 - b. Three parts sand.
 - c. One part Portland cement.
 - d. Entrained air: Six percent plus or minus one percent.
 - e. Sufficient water for required workability.
 - f. Minimum 28-day compressive strength: 3,000 psi.
5. Normal weight concrete:
 - g. Proportion mixture to provide desired characteristics using one of methods described below:
 - 1) Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein.
 - a) Air content within range specified above.
 - b) Record and report temperature of trial mixes.
 - c) Proportion trial mixes per ACI 211.1.
 - 2) Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:
 - a) Field test records must be acceptable to Engineer to use this method.
 - b) Test records shall represent materials, proportions and conditions similar to those specified.
6. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraph 5.3.1 of ACI 318.

PART 3 - EXECUTION**3.1 FORMING AND PLACING CONCRETE**

A. Formwork:

1. Contractor is responsible for design and erection of formwork.

2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
 3. Allowable tolerances: As recommended in ACI 347R.
 4. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
 - a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
 - b. Do not place floor drains through beams.
 5. Openings: Provide openings in formwork to accommodate work of other trades.
 - a. Accurately place and securely support items built into forms.
 6. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
 7. Clean and adjust forms prior to concrete placement.
 8. Tighten forms to prevent mortar leakage.
 9. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.
- B. Reinforcement:
1. Position, support and secure reinforcement against displacement.
 2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
 3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
 4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
 5. Extend reinforcement to within 2 IN of concrete perimeter edges.
 - a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
 6. Minimum concrete protective covering for reinforcement:
 - a. Unless otherwise indicated, provide minimum concrete cover as follows:
 - 1) Concrete deposited against earth: 3 IN.
 - b. Formed surfaces exposed to weather or in contact with earth:
 - 1) 2 IN for reinforcing bars #6 or larger;
 - 2) 1-1/2 IN for reinforcing bars less than #6.
 - c. Formed surfaces exposed to or located above any liquid: 2 IN.
 - d. Interior surfaces: 1-1/2 IN for beams, girders and columns; 3/4 IN or bar diameter, whichever is greater, for slabs, walls and joists.
 7. Do not weld reinforcing bars.
 8. Welded wire reinforcement:
 - a. Install welded wire reinforcement in maximum practical sizes.
 - b. Splice sides and ends with a splice lap length measured between outermost cross wires of each fabric sheet not less than:
 - 1) One spacing of cross wires plus 2 IN.
 - 2) 1.5 x development length.
 - 3) 6 IN.
 - c. Development length: ACI 318 basic development length for the specified fabric yield strength.
- C. Construction, Expansion, and Contraction Joints:
1. Provide at locations indicated.
 2. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal construction joints at 10 FT maximum centers.
 3. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
 4. Locate construction joints in columns and walls:
 - a. At the underside of beams, girders, haunches, drop panels, column capitals, and at floor panels.
 - b. Haunches, drop panels, and column capitals are considered part of the supported floor or roof and shall be placed monolithically therewith.
 - c. Column base need not be placed monolithically with the floor below.
 5. Locate construction joints in beams and girders:
 - a. At the middle of the span, unless a beam intersects a girder at that point.
 - b. If the middle of the span is at an intersection of a beam and girder, offset the joint in the girder a distance equal to twice the beam width.
 - c. Provide satisfactory means for transferring shear and other forces through the construction joint.
 6. Locate construction joints in suspended slabs:
 - a. At or near the center of span in flat slab or T-beam construction.
 - b. Do not locate a joint between a slab and a concrete beam or girder unless so indicated on Drawings.
 7. In pan-formed joists:

- a. At or near span center when perpendicular to the joists.
- b. Centered in the slab, midway between joists, when parallel to the joists.
8. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
9. At least 48 HRS shall elapse between placing of adjoining concrete construction.
10. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
11. Before new concrete is placed, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.
- D. Embedments:
 1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
 2. Use setting diagrams, templates and instructions for locating and setting.
 3. Secure waterstops in correct position using hog rings or grommets spaced along the length of the waterstop and wire tie to adjacent reinforcing steel.
- E. Placing Concrete:
 4. Place concrete in compliance with ACI 304R and ACI 304.2R.
 5. Place in a continuous operation within planned joints or sections.
 6. Begin placement when work of other trades affecting concrete is completed.
 7. Place concrete by methods which prevent aggregate segregation.
 8. Do not allow concrete to free fall more than 4 FT.
 9. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.
- F. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.
- G. Protection:
 1. Protect concrete from physical damage or reduced strength due to weather extremes.
 2. In cold weather comply with ACI 306R except as modified herein.
 - a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
 - b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF

- c. Do not place heated concrete that is warmer than 80 DegF.
- d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
- e. Do not allow concrete to cool suddenly.
3. In hot weather comply with ACI 305R except as modified herein.
 - f. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.
 - g. Do not allow concrete temperature to exceed 85 DegF at placement.
 - h. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
 - i. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.
- H. Curing:
 1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
 2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
 3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
 4. Provide curing for minimum of 7 days.
 5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
 6. In hot weather follow curing procedures outlined in ACI 305R.
 7. In cold weather follow curing procedures outlined in ACI 306R.
 8. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.

9. Curing vertical surfaces with a curing compound:
 - a. Cover vertical surfaces with a minimum of two coats of the curing compound.
 - b. Allow the preceding coat to completely dry prior to applying the next coat.
 - c. Apply the first coat of curing compound immediately after form removal.
 - d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.
- I. Form Removal:
 1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
 2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.
 3. Where reshoring is planned, supporting formwork may be removed when concrete has sufficient strength to safely support its own weight and loads placed thereon.
 - a. While reshoring is underway, no superimposed loads shall be permitted on the new construction.
 - b. Place reshores as soon as practicable after stripping operations are complete but in no case later than the end of working day on which stripping occurs.
 - c. Tighten reshores to carry their required loads.
 - d. Leave reshores in place until concrete being supported has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

- A. Tolerances:
 1. Class A: 1/8 IN in 10 FT.
 2. Class B: 1/4 IN in 10 FT.
- B. Surfaces Exposed to View:
 1. Ground slabs and structure surfaces:
 - a. Provide a medium broom swept finish.
 - b. Provide a 1/2" chamfer on all exposed edges.
 2. Provide a smooth finish for exposed concrete surfaces and surfaces that are:
 - a. To be covered with a coating or covering material applied directly to concrete.
 - b. Scheduled for grout cleaned finish.
 3. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
 4. Fill tie holes with nonshrink nonmetallic grout.
- C. Surfaces Not Exposed to View:
 1. Patch voids, air pockets and honeycomb areas with cement grout.
 2. Fill tie holes with nonshrink nonmetallic grout.
- D. Grout Cleaned Finish:
 1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient bonding agent/water mixture to produce a grout with the consistency of thick paint.
 - a. White Portland cement shall be substituted for gray Portland cement to produce a color that matches color of surrounding concrete as determined by trial patch for areas not to be painted.
 2. Wet surface of concrete to prevent absorption of water by grout and uniformly apply grout with brushes or spray gun.
 3. Immediately scrub the surface with a cork float or stone to coat and fill air bubbles and holes.
 4. While grout is still plastic, remove all excess grout by working surface with rubber float, sack or other approved means.
 5. After the surface whitens from drying, rub vigorously with clean burlap.
 6. Keep final finish damp for a minimum of 36 HRS after final rubbing.
- E. Slab Float Finish:
 1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
 2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
 3. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
 4. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
 5. Refloat slab immediately to a uniform sandy texture.
- F. Troweled Finish:
 1. Float finish surface.
 2. Next power trowel, and finally hand trowel.

3. Produce a smooth surface which is relatively free of defects with first hand troweling.
 4. Perform additional trowelings by hand after surface has hardened sufficiently.
 5. Final trowel when a ringing sound is produced as trowel is moved over surface.
 6. Thoroughly consolidate surface by hand troweling.
 7. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
 8. On surfaces intended to support floor coverings remove any defects of sufficient magnitude that would show through floor covering by grinding.
- G. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.

3.3 GROUT

A. Preparation:

1. Nonshrinking nonmetallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
2. Epoxy grout: Apply only to clean, dry, roughened, and sound surface.

B. Application:

1. Nonshrinking nonmetallic grout:
 - a. Mix in a mechanical mixer.
 - b. Use no more water than necessary to produce flowable grout.
 - c. Place in accordance with manufacturer's instructions.
 - d. Completely fill all spaces and cavities below the bottom of baseplates.
 - e. Provide forms where baseplates and bedplates do not confine grout.
 - f. Where exposed to view, finish grout edges smooth.
 - g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
 - h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
 - i. Wet cure grout for 7 days, minimum.
2. Rock anchors:
 - a. See Item 1 above.
 - b. If rodded:
 - 1) Fill each hole so that it overflows when anchor bar is inserted.
 - 2) Force anchor bars into place.
 - c. If pressure placed, set anchor bar before grouting.
 - d. Take special care to avoid any movement of anchors that have been placed.
3. Epoxy grout:
 - a. Mix and place in accordance with manufacturer's instructions.
 - b. Completely fill all cavities and spaces around dowels and anchors without voids.
 - c. Obtain manufacturer's field technical assistance as required to ensure proper placement.

3.4 FIELD QUALITY CONTROL

A. Contractor will employ and pay for services of an MPW approved concrete testing laboratory to perform testing of concrete placed during construction.

1. Contractor to cooperate with laboratory in obtaining and testing samples.

B. Tests During Construction:

1. Strength test - procedure:
 - a. Four cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and ASTM C31.
 - b. Cylinders will be tested per ASTM C39:
 - 1) One at 7 days.
 - 2) Two at 28 days.
 - 3) One held in reserve.
2. Strength test - frequency:
 - a. Not less than one test each day concrete placed.
 - b. Not less than one test for each 50 CY or major fraction thereof placed in one day.
 - c. Not less than one test for each type of concrete poured.
 - d. Not less than one test for each concrete structure exceeding 2 CY volume.
3. Slump test:
 - a. Per ASTM C143.
 - b. Determined for each strength test sample.
 - c. Additional slump tests may be taken.

4. Air content:
 - a. Per ASTM C231, ASTM C173, and ASTM C138.
 - b. Determined for each strength test sample.
5. Temperature: Determined for each strength test sample.
- C. Evaluation of Tests:
 1. Strength test results:
 - a. Average of 28-day strength of two cylinders from each sample.
 - 1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testings, strength of remaining cylinder will be test result.
 - 2) If both cylinders show any of above defects, test will be discarded.
- D. Acceptance of Concrete:
 1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
 - a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
 - b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
 2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
 - c. Perform additional tests and/or corrective measures at no additional cost to MPW.

3.5 SCHEDULES

- A. Form Types:
 1. Surfaces exposed to view:
 - a. Prefabricated or job-built wood forms.
 - b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
 - c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
 - d. Construct forms sufficiently tight to prevent leakage of mortar.
 2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.
 3. Other types of forms may be used:
 - a. For surfaces not restricted to plywood or lined forms.
 - b. As backing for form lining.
- B. Grout:
 1. Nonshrinking nonmetallic grout: General use.
 2. Epoxy grout:
 - a. Grouting of dowels and anchor bolts into existing concrete.
 - b. Other uses indicated on Drawings.
 3. Sand cement grout: Keyways of precast members.
- C. Concrete:
 1. Precast concrete: Where indicated on Drawings.
 2. Concrete fill: Where indicated on Drawings.
 3. Normal weight concrete: All concrete.
 4. General use concrete: All other locations.
- D. Concrete Finishes:
 1. Grout cleaned finish: Where indicated on Drawings.
 2. Slab finishes:
 - a. Use following finishes as applicable, unless otherwise indicated:
 - 1) Floated finish: Surfaces intended to receive roofing, concrete topping, lean concrete, concrete fill and waterproofing.
 - 2) Troweled finish: Interior floor slabs, exposed roof slabs and base slabs of structures, equipment bases, and column bases.
 - 3) Broom finish: Sidewalks, docks, concrete stairs, and ramps.

END OF SECTION

SECTION 15060A

PIPE AND PIPE FITTINGS: BASIC WATER MAIN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Potable Water Piping.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.
 - 4. Section 02660 – Water Main Construction
 - 5. Section 15062 – Pipe: Ductile.
 - 6. Section 15063 – Pipe: Copper
 - 7. Section 15064 – Pipe: Plastic
 - 8. Section 15099 – Water System Appurtenances.
 - 9. Section 15100 - Valves: Basic Requirements.
- C. The Contractor shall furnish labor, materials, tools, equipment, and perform work and services necessary for, or incidental to, the furnishing, installation, and completion, of piping with full observation of proper construction techniques, handling, testing procedures, attachments, supports, disinfection and miscellaneous as shown on drawings and as specified, in accordance with provisions of the Contract Documents, and completely coordinated with work of other trades.
- D. Furnish piping systems with specific material selections included in any schedules within these specifications and in accordance with notations or schedules on drawings.
- E. All such work may not be specifically shown or specified. Supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete, and compatible installation shall be furnished and installed as part of this work.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - 2. American Iron and Steel Institute (AISI).
 - 3. American Society of Mechanical Engineers (ASME):
 - 4. ASTM International (ASTM):
 - 5. American Water Works Association (AWWA):
 - 6. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - 7. Chlorine Institute, Inc. (CI):
 - 8. International Plumbing Code (IPC).
 - 9. National Fire Protection Association (NFPA):
 - 10. Underwriters Laboratories, Inc. (UL).
- B. Specifications Reference. Verify drawings for pipe designations and descriptions.
- C. Coordinate flange dimensions and drillings between piping, valves and equipment.
- D. All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute.
- E. All pipe fittings, packing, and jointing materials, shall conform to Section C of the AWWA Standards.
- F. Comply with rules, regulations and policies of the South Carolina Department of Health and Environmental Control.
- G. Any pipe, solder, or flux which is used in the installation or repair of any public water system, used in any plumbing which provides water through connection to a public water system, for human consumption, shall be lead free. ‘Lead Free’ means not more than 0.2 % lead when used with respect to solder and flux and not more than a weighted average of 0.25% when used with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures. The weighted average lead content of a pipe and pipe fitting, plumbing fitting and fixture shall be calculated by using the following formula:

The percentage of lead content within each component that comes into contact with water shall be multiplied by the percent of the total wetted surface of the entire pipe and pipe fitting, plumbing fitting, or fixture represented in each component containing lead. These percentages shall be added and the sum shall constitute the weighted average lead content of the pipe and pipe fitting, plumbing fitting, or fixture.

- H. Water mains which have been previously used for conveying potable water may be reused provided they meet applicable criteria from AWWA Section C, ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original condition. (R.61-58.4.D.(2))

1.3 SUBMITTALS

A. Shop Drawings:

1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout drawings: (when required by Engineer)
 - a. Include the following information:
 - 1) Dimensions of piping lengths.
 - 2) Invert or centerline elevations of piping crossings.
 - 3) Acknowledgement of bury depth requirements.
 - 4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
 - 5) Acknowledge designated valve numbers.
 - 6) Schedule of interconnections to existing piping and method of connection.
 - b. Product technical data including:
 - 1) Certification that products submitted meet requirements of standards referenced.
 - 2) Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
 - 3) Separate schedule sheet for each piping system scheduled in the Section showing compliance of all system components
 - 4) Attach technical product data on gaskets, pipe, fittings, and other components.

B. Miscellaneous Submittals:

1. Test reports:
 - a. Copies of pressure test results on all piping systems.
 - b. Disinfection test report.
 - c. Notification of time and date of piping pressure tests.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe coating during handling using methods recommended by manufacturer.
1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit.
1. Repair abrasions, scars, and blemishes.
 2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 PIPING SPECIFICATION SCHEDULES

- A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Section.

2.2 COMPONENTS AND ACCESSORIES

A. Insulating Components:

1. Dielectric flange kits:
 - a. Flat faced.
 - b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
 - c. Suitable for 175 psi, 210 °F.
 - d. 1/32 IN wall thickness bolt sleeves.
 - e. 1/8 IN thick phenolic insulating washers.
2. Dielectric unions:
 - a. Screwed end connections.
 - b. Rated at 175 psi, 210 °F.
 - c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

B. Reducers:

1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

C. Protective Coating and Lining:

1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
2. Field paint pipe in accordance with manufacturers' recommendation.

- D. Underground Warning Tape
 - 1. All underground piping shall have electronically detectable warning tape.
 - 2. Approved Manufacturer
 - 3. 3M Electronic Marking System (EMS) Caution Tape, 7613XR.
 - 4. Maximum bury depth is 2 feet from final grade.
 - 5. Color to be Blue.
 - 6. Wording on tape to indicate "**CAUTION WATER LINE BURIED BELOW**"
- E. Water Main, Service Lateral and Valve Identification
 - 1. Where the water main is installed in the road shoulder, blue marking flags (pin flags) shall be installed at intervals not greater than twenty (20) feet. Where the water main is installed under concrete or asphalt, blue marking paint shall be used. Where concrete curb is installed, the location of all valves and water service laterals shall be marked on the curb using a pipe saw or other suitable tool. A small "V" shall be ground into the curb adjacent to the valve or service.
- F. Valves:
 - 1. See Section 15100.
- G. Restrained Joint Pipe:
 - 1. Provide restrained joint piping for preventing movement of piping caused by forces in or on buried piping tees, branches, plugs, or bends.
 - 2. Install restrained joint piping as shown on Drawings.
 - 3. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - a. Pipe
 - 1) American (Flex-Ring or Lok-Ring)
 - 2) US Pipe (TR-Flex)
 - 3) Griffin (Snap-Lock)
 - 4) Approved Equal
 - b. MJ Fittings, "Megalugs"
 - 1) EBAA
 - 2) Ford
 - 3) Sigma
 - 4) Star Pipe
 - 5) SIP Industries
 - 6) Tyler-Union
 - 7) Approved Equal
 - c. Fast grip gaskets
 - 1) Minimum pressure rating of 350 psi for push on pipe required
 - d. PVC Bell Restraints
 - 1) EBAA
 - 2) Sigma
 - 3) Star Pipe
 - 4) Approved Equal
- H. Bolts, Nuts and all-thread rod
 - 1. All bolts and all-thread rod used in buried application shall be Type 316 stainless steel or better.
 - 2. All nuts shall be 316 stainless steel heavy wall with fluorocarbon coating.
 - 3. All threads shall be coated with a suitable anti-seize compound (such as "Never Seez" or similar)
- I. All rubber parts shall be made of Ethylene Propylene Diene Monomer (EPDM).
- J. Lubricants that support microbiological growth shall not be used for slip-on joints. The use of vegetable shortening as a lubricant is prohibited.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

- A. Inspect materials thoroughly upon arrival. Examine materials for damage. Damaged, rejected, or non-spec materials must be immediately removed from site. MPW reserves the right to immediately shut down construction activities until removal is verified.
- B. Observe manufacturer's directions for delivery and storage of materials and accessories.
- C. Each joint shall be redundantly chocked at each end to prevent movement or rolling.
- D. Vehicular traffic shall not be unduly inconvenienced in placing of material along the streets or rights-of-way.
- E. Comply with South Carolina Department of Transportation requirements for storing pipe and fittings within highway rights-of-way.

3.2 HANDLING OF PIPE

- A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks metal bars or narrow skids in contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.
- C. Erect piping to accurate lines and grades and support as required on drawings or described in specifications. When temporary supports are used, insure that sufficient rigidity is provided to prevent shifting or distortion of pipe. Install expansion devices as necessary to allow expansion and contraction movements.

3.3 CONNECTIONS WITH EXISTING PIPING

- A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered. Make connections in thorough and workmanlike manner. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation. Undertake connections in fashion which will disturb system as little as possible.
- B. No bend/tee/valve shall be placed directly on existing pipe. Must sleeve in new pipe if a bend/tee/valve is to immediately follow the existing line.
- C. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.
- D. Where connections to existing systems necessitates employment of past installation methods not currently part of trade practice, utilize necessary special piping components.
- E. Where connection involves potable water systems, provide disinfection methods as required.
- F. Once tie-in is initiated, work continuously until complete and tested.
- G. If an offset is installed, a minimum 3 FT piece of Ductile Iron Pipe (DIP) is required and must reconnect with a sleeve into the existing main.

3.4 LAYING PIPE IN TRENCH

- A. Excavate and backfill trench in accordance with Section 02221.
- B. Unless otherwise shown on the drawing, provide a minimum of 3 FT and a maximum of 4 FT earth cover over exterior buried piping systems and appurtenances' unless otherwise given written approval from MPW.
- C. Clean each interior of pipe length thoroughly and inspect for compliance to specifications. Maintain pipe in clean condition during installation.
- D. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
- E. Except for first two joints, before making final connections of joints, two (2) full sections of pipe shall have been previously installed with earth tamped alongside of pipe or final bedding material placed.
- F. Lay pipe in only suitable weather with good trench conditions. Never lay pipe in water except where approved by MPW.
- G. Seal open end of line with watertight plug if pipe laying is stopped. Remove water in trench before removal of plug.
- H. Lining Up Push-On Joint Piping:
 - 1. Lay piping on route lines shown on Drawings.
 - 2. Before joining piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
 - 3. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
 - 4. Observe maximum deflection values stated in manufacturer's written literature.
 - 5. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
 - 6. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.
 - 7. Provide polyethylene encasement where indicated on Drawings, and install in accordance with AWWA C105.
- I. Anchorage and Blocking: (Shall only be used when restrained joints are not practical)
 - 1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
 - 2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
 - a. Concrete blocks shall not cover pipe joints or be in direct contact with pipe.
 - 3. Provide bearing area of concrete in accordance with drawing detail.
- J. Install underground warning tape as indicated in Section 2.2.D above and plan details.

3.5 RESTRAINED JOINT REQUIREMENTS

- A. Restrained joint lengths shall be shown on the plans.

3.6 EMBEDMENT REQUIREMENTS

- A. Ensure that piping is adequately supported. Provide pipe bedding incorporated in Section 02221.

3.7 ACCESS PROVISIONS

- A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping and piping appurtenances requiring service.
- B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 IN size.
- C. Fabricate door and frame of minimum 14 GA, stretcher leveled stock, cadmium plated or galvanized after fabrication and fitted with screw driver lock of cam type.
- D. Provide with key locks, keyed alike, in public use areas.
- E. Furnish panels with prime coat of paint.
- F. Style and type as required for material in which door installed.
- G. Where door is installed in fire-rated construction, provide door bearing UL label required for condition.

3.8 PRESSURE GAUGES

- A. Provide at locations shown on the Drawings and specified.
- B. All pressure gauges shall be calibrated in one (1) psi increments and sized so that the specified test pressure falls within the upper half of the gauge's range.

3.9 FIELD QUALITY CONTROL

- A. Pipe Testing - General:
 - 1. Utilize pressures, media and pressure test durations as specified on Piping Specification Schedules.
 - 2. Isolate equipment which may be damaged by the specified pressure test conditions.
 - 3. Perform pressure test using calibrated pressure gauges and calibrated volumetric measuring equipment to determine leakage rates.
 - a. Notify the Engineer, and/or MPW 24 HRS prior to each test.
 - 4. Completely assemble and test new piping systems prior to connection to existing pipe systems.
 - 5. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
 - 6. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.
 - 7. Install backflow preventers as shown on the drawings.
- B. Hydrostatic Pressure Testing:
 - 1. Tests shall be conducted in accordance with AWWA C600 and SC Regulations except where modified herein. The pipe shall be tested between each valved section. The pressure shall be measured at the point of testing.
 - 2. After the pipe is laid, the joints completed, and all appurtenances permanently installed, the piping system or any valved sections of piping system shall be subjected for two hours to a hydrostatic pressure test of a minimum of 150 psi or equal to or greater than 1.5 times the working pressure.
 - 3. Air Removal. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of MPW.
 - a. Where any section of main is provided with concrete reaction blocking for fittings or hydrants, the hydrostatic pressure test shall not be made until at least five days after installation of the concrete reaction blocking, unless otherwise approved.
 - b. Do not paint or insulate exposed piping until successful performance of pressure test.
 - c. Repair defective joints, welds, pieces of pipe, jointing material, valves or other defective areas, and repeat pressure testing until pipe system meets test criteria. Pay for any additional costs associated with retesting and repairs.
- C. Leakage Test. A leakage test shall be conducted concurrently with the pressure test and recorded on the forms included in Section 3.13.
 - 1. Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

2. Allowable Leakage. No pipe installation will be acceptable if the leakage exceeds the following:
 - a. Ductile Iron Pipe (DIP) per AWWA C600 or PVC Pipe per AWWA C605:
$$L = [SD (P)^{1/2}] / 148,000$$

Where:
L = Allowable Leakage (gallon/hour)
S = Length of pipe tested (feet)
D = Diameter of pipe (inches)
P = Average test pressure (psig)
 - b. HDPE pipe:
 - 1) The test procedure consists of initial expansion, and test phases. For the initial expansion phase, make-up water is added as required to maintain the test pressure (150 psi) for four (4) hours. For the test phase, the test pressure is reduced by 10 psi. If the pressure remains steady (within 5% of the target value) for an hour, no leakage is indicated.
3. Installation Acceptance.
 - a. Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is with the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.
4. Repair defective joints or other defective areas and repeat pressure testing until pipe system meets test criteria.
- D. Radio Frequency Marker Inspection: Prior to acceptance of the water main, the Contractor shall have the a MPW representative inspect the installation of radio frequency marker caution tape to verify placement, functionality and accuracy.
- E. Temporary Testing Stations:
 1. Temporary testing stations for pressure testing the pipeline shall be installed and removed by the contractor in accordance with the manufacturers' recommendations. These facilities must be approved by the Engineer. The station shall include temporary bulkheads, valves, fittings, pressure gauges, flanged outlets, and manways as necessary. All temporary bulkheads, valves, fittings, and gauges must be removed and all interior exposed metal cleaned, sanded, and coated with a smooth coating of mortar equivalent to the pipe lining mortar.

3.10 PIGGING AND DISINFECTION OF POTABLE WATER SYSTEMS

- A. Pigging:
 1. Pigging and disinfection shall be conducted and recorded on the form included in Section 3.14.
 2. All new main distribution lines 6" and larger are required to pigged prior to the disinfection process.
 3. Contractor shall submit pigging plan for approval at least 14 days prior to start of pigging to include the following:
 - a. Show launch and retrieval locations.
 - b. Show pigging routes.
 - c. Show valve locations and open/closed status to route pig.
 - d. Identify pig make, model, and size and submit manufacturer documentation.
 - e. Show launch and retrieval pipe and fitting configuration.
 - f. Identify propulsion source.
 4. Use new Type G1 Swab foam pigs by Pipeline Pigging Products, Inc. or approved equal.
 5. Size pig in accordance with manufacturer's recommendation based on line size.
 6. Configure launch and receiving attachments at ends to prevent contamination of line by soil, water, or other materials.
 7. Use only potable water to propel pig through the line. Use a backflow preventer if propelling pig using Mount Pleasant Waterworks system for potable water source, see MPW detail W-24.
 8. The pigging procedure for each route is to consist of the following steps:
 - a. Run a single "proving pig" to confirm correct routing and valving. Measure the time for the proving pig to travel the route and calculate the pig speed.
 - b. Perform a cleaning run consisting of five pigs inserted into the line at two-minute intervals. Adjust propulsion water source as required to achieve a 2-3 foot/second velocity in the line.
 - c. Observe water discharge at the retrieval location and pig condition on retrieval. Pigging will continue until discharge is free of any discoloration. MPW inspector to approve cleaning results. Pigs may be cleaned and re-used at MPW inspector discretion.
 9. No additional payment will be made for additional passes required to properly clean the line.

B. Disinfection:

1. After favorable performance of pressure test, pigging and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed. All water flowing into a new main shall pass through an approved back flow prevention device.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651-14.
3. Perform disinfection using calcium hypochlorite or sodium hypochlorite complying with AWWA B300.
4. Prior to chlorination flush each segment of system to provide flushing velocity of not less than 3.0 FT per second.
5. Drain flushing water to sanitary sewer.
 - a. Do not drain flushing water to receiving stream unless satisfactorily de-chlorinated.
6. Use continuous feed method of application.
 - a. Tag system during disinfection procedure to prevent use.
 - b. Introduce chlorine solution through a temporary water service installed on new main downstream of "air gap" or back-flow preventer.
 - c. Supply chlorine solution at one end of the main as water is being withdrawn from the other end, resulting in 25 ppm of free chlorine throughout the main.
7. After 24-hour contact period, residual chlorine concentration must be minimum 10 ppm throughout the main.
 - a. Two successive failures shall require additional pigging of the line.
8. When residual concentration of 10 ppm after 24 hours is achieved, continue contact time for another 24 hours.
9. Flush line until chlorine concentration at extremity of new system matches chlorine concentration of public water supply being used for flushing.
10. Drain flushing water to sanitary sewer unless satisfactorily de-chlorinated for release to storm drainage system.
11. Isolate system for another 24 hours.
12. No additional flushing of system is allowed prior to completion of bacteriological sampling.
13. Contact MPW inspector to verify chlorine residual is within acceptable limits.
 - a. MPW Inspector will contact MPW laboratory to collect bacteriological and chlorine residual samples on two consecutive days.
 - b. Sampling points to be spaced one every 1200-feet, one on every branch and one at the end.
 - c. Minimum of 2 samples to be collected from each sampling site a minimum of 24 hours apart.
 - d. Bacteriological samples shall not be taken from fire hydrants or blow-off hydrants.
 - e. If both samples do not pass, repeat entire disinfection procedures until satisfactory results obtained by MPW.
14. Contractor will be responsible for additional disinfection of system and payment of any fees in accordance with MPW Guidelines for Development if the system is not accepted for operation by MPW within 30 days of date of receipt of satisfactory bacteriological test results.
15. Contractor to ensure that all personnel involved in disinfection process are properly trained and provided with the required safety equipment.
16. Once line has passed bacteriological Testing, pressure testing, and is approved for operation, the contractor shall remove temporary water service by disconnecting the service line from the corporation stop and turn the corporation stop to the 'off' position.

3.11 LOCATION OF BURIED OBSTACLES

- A. Furnish exact location and description of buried utilities or buried structures encountered and thrust block placement.
- B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.
- C. Include such information as location, elevation, coverage, supports and additional pertinent information.
- D. Incorporate information on "As-Recorded" Drawings.
- E. 4 Inch by 4 Inch Concrete Marker to be installed on an as-needed basis and to be determined per Mount Pleasant Waterworks Engineer or Inspector.

3.12 APPLICATIONS OF SERVICE

- A. Type of pipe to be furnish
- B. Type of pipe to be furnished and installed by the Contractor where specified under description of use are categorized as follows:
 - 1. Type A: Ductile Iron Pipe, push-on or mechanical joint, lined with cement mortar and coated.
 - 2. Type D: Polyvinyl Chloride Pipe conforming to AWWA C900 with ductile iron pipe fittings.
 - 3. Type E: Copper Tubing
 - 4. Type F: Ductile Iron Pipe, restrained joint, cement mortar lined and coated.
 - 5. Type H: High Density Polyethylene Pipe (HDPE) conforming to AWWA C-906 and ASTM D1248.
 - 6. Type I: Polyethylene (PE) Tubing conforming to ASTM D2737 (AWWA C-901).
 - 7. Type J: Ductile iron flanged.
- C. The Contractor shall install the types of pipe specified above in compliance with the following listing:

<u>Description of Use</u>	<u>Pipe Type</u>	<u>Material</u>	<u>Minimum Class of Pipe</u>
4" - 12" water line buried	A or F	DI	Class 350
	D	PVC	Class 150 DR 18
14" or greater water line buried	A or F	DI	Class 250
	D	PVC	Class 235, DR18
Waterline, buried under creek crossing	H	HDPE	SDR11
Water service lines 2 inch and less (main to meter)	I	Polyethylene	PC160, DR9, PE3408
Water service lines 1 inch and less (meter to house)	E	Copper	Type K
	I	Polyethylene	PC160, DR9, PE3408

3.13 PRESSURE TEST FORM:

Project: _____

Contractor: _____

Date: _____

Engineer: _____

Pipe Diameter- "D" (inches)	Pipe Length- "S" (feet)	Test Pressure- "P" (PSIG)	Allowable Leakage (gal/hr) $L=(SD(P)^{0.3})\div 148,000$
Total Allowable Leakage (Gal/Hr):			

Test Start: _____

1/2 Hr: _____

Pressure: _____

Refill (gal): _____

1/2 Hr: _____

Pressure: _____

Refill (gal): _____

1/2 Hr: _____

Pressure: _____

Refill (gal): _____

1/2 Hr: _____

Pressure: _____

Refill (gal): _____

Total Leakage (GALS): _____

Pressure Test Passed: YES: _____ NO: _____

Asbuilt Drawings Received: YES: _____ NO: _____

Utility Locate Performed: YES: _____ NO: _____

Bac-Ts Sampling Scheduled: YES: _____ NO: _____

Comments: _____

MPW Inspector: _____

Copy to: _____ Pipes

_____ Engineer

_____ Project Manager

3.14 DISINFECTION TESTING FORM:

Project:

Contractor:

Date:

Engineer:

Table 4 Chlorine required to produce an initial 25-mg/L concentration in 100 ft (30.5 m) of pipe by diameter

Pipe Diameter		100% Chlorine		1% Chlorine Solution	
<i>in.</i>	<i>(mm)</i>	<i>lb</i>	<i>(g)</i>	<i>gal</i>	<i>(L)</i>
4	(100)	0.013	(5.9)	0.16	(0.6)
6	(150)	0.030	(13.6)	0.36	(1.4)
8	(200)	0.054	(24.5)	0.65	(2.5)
10	(250)	0.085	(38.6)	1.02	(3.9)
12	(300)	0.120	(54.4)	1.44	(5.4)
16	(400)	0.217	(98.4)	2.60	(9.8)

Flushing Completed: YES: ____ NO: ____

Pigging Completed: YES: ____ NO: ____

**The above noted activities must be completed prior to chlorine disinfection.*Chlorination Testing

Pipe Length (FT): _____ Pipe Dia (Inches): _____

Free Chlorine (PPM) @ _____ Free Chlorine (PPM)
Start: _____ @ 24 HRS: _____

Chlorine Residual (PPM) _____

(Day 1) Bac-Ts Test Passed: YES: ____ NO: ____

(Day 2) Bac-Ts Test Passed: YES: ____ NO: ____

Inspector: _____

Comments _____

CC: _____

PROJECT MANAGER
END OF SECTION

SECTION 15062

PIPE: DUCTILE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductile iron piping, fittings, and appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02221 – Trenching, Backfilling and Compacting for Utilities.
 - 4. Section 15060A - Pipe and Pipe Fittings: Basic Water Main Requirements.
 - 5. Section 15060B – Pipe and Pipe Fittings: Basic Force Main and Gravity Sewer Requirements

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
 - 2. ASTM International (ASTM):
 - a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 - b. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
 - c. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.
 - d. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - 3. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - b. C105/A21.5, Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids.
 - c. C110/A21.10, Ductile Iron and Gray Iron Fittings, 3 IN through 48 IN for Water and Other Liquids.
 - d. C111/A21.11, Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.
 - e. C150/A21.50, Thickness Design of Ductile Iron Pipe.
 - f. C151/A21.51, Ductile Iron Pipe, Centrifugally Cast-In-Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
 - g. C153/A21.53, Ductile-Iron Compact Fitting, 3 IN through 16 IN for Water and Other Liquids.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Certification of factory hydrostatic testing.
 - 3. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents the following manufacturers are acceptable:
 - 1. Ductile Iron Pipe:
 - a. American
 - b. US Pipe
 - c. McWane **from Clow, OH facility ONLY*
 - 2. Ductile Iron Fittings:
 - a. Sigma
 - b. Tyler Union
 - c. Star Pipe
 - d. SIP Industries
 - e. Or approved equal
 - 3. Compression sleeve coupling:
 - a. Rockwell (Style 431 (cast)).
 - b. Dresser (Style 153 (cast)).
 - c. Or approved equal.

4. Mechanical coupling:
 - a. Victaulic (Style 31).
 - b. Tyler.
 - c. Star Pipe.
 - d. Or approved equal.
 5. Insulating couplings:
 - a. Rockwell (Style 416).
 - b. Dresser (Style 39).
 6. Reducing couplings:
 - a. Rockwell (Style 415).
 - b. Dresser (Style 62).
 7. Transition coupling:
 - a. Rockwell (Style 413).
 - b. Dresser (Style 62).
 - c. Or approved equal.
 8. Polyethylene encasement tape:
 - a. Chase (Chasekote 750).
 - b. Kendall (Polyken 900).
 - c. 3 M (Scotchrap 50).
 - d. Or approved equal.
 9. Restrained joints:
 - a. Comply with Sections 15060A or 15060B.
- B. Submit request for substitution in accordance with Specification Section 01640.
- C. Only one product manufacturer shall be allowed for each material required.

2.2 MATERIALS

- A. Ductile Iron Pipe:
1. AWWA/ANSI C115/A21.15.
 2. AWWA/ANSI C150/AC21.50.
 3. AWWA/ANSI C151/A21.51.
 4. Pressure class as indicated in Section 15060A and Section 15060B.
 5. Joints:
 - a. Gravity: single rubber gasket, push on type.
 - b. Force Main or Water Main: Push on type or restrained joint where indicated on drawings.
- B. Fittings:
1. AWWA/ANSI C110/A21.10.
 2. AWWA/ANSI C116/A21.16-09
 3. AWWA/ANSI C153/A21.53.
- C. Nuts and Bolts:
1. Buried and exposed:
 - a. All bolts (including tee bolts for MJ fittings) and all thread rods shall be Type 316 stainless steel.
 - b. All nuts shall be 316 stainless steel, heavy wall.
 2. Heads and dimensions per ASME B1.1.
 3. Threaded per ASME B1.1.
 4. Project ends 1/4 to 1/2 IN beyond nuts.
- D. Gaskets: Gaskets shall be synthetic rubber – Ethylene Propylene Diene Monomer (EPDM). Natural rubber or other materials, which will support microbiological growth or does not resist chloramines, will not be acceptable.
- E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.
- F. Polyethylene Encasement: See AWWA/ANSI C105/A21.5.

2.3 LININGS AND COATINGS

- A. Interior lining
1. DIP conveying wastewater will be lined with the following:
 - a. Protecto 401 by Induron Protective Coatings, Inc. with a minimum dry film thickness of 40 mils.
 - b. ON TRIAL: Permox CTF with a minimum dry film thickness of 40 mils.
 - c. Or Approved Equal
 2. DIP conveying potable water shall be lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104, Portland cement mortar.
 3. Contractor shall strictly adhere to the lining manufacturer's handling requirements.
- B. The exterior of ductile iron pipe, shall be coated with a 1 mil asphaltic coating in accordance with AWWA C151.

- C. All metallic valves, fittings, restrainers, and appurtenances are to have Fusion Bonded Epoxy Coating on all interior and exterior surfaces in accordance with AWWA C116/A21.16-09.
- D. All metallic pipe, valves, fittings, restrainers, and appurtenances are to be wrapped in an 8-mil polyethylene film in accordance with ANSI Standard A21.5 (AWWA C105). Close all open ends and damaged areas securely with tape. If damaged polyethylene film cannot be repaired, replace with new film. Color for water is blue, wastewater is green, and reuse is purple.

2.4 QUALITY CONTROL

- A. Factory Test:
 - 1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.
- B. Pre-Installation Inspection:
 - 1. Contractor shall coordinate an inspection with Engineer and/or Owner prior to installing any pipe to verify the following items:
 - a. Pipe has been handled pursuant to manufacturer's requirements and there is no evidence of damage.
 - b. Pipe has not exceeded the manufacture's "shelf-life" restrictions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. DIP wastewater forcemain installation shall conform to AWWA C-600 at a minimum.
- B. Joining Method - Push-On Mechanical (Gland-Type) Joints:
 - 1. Install in accordance with AWWA/ANSI C111/A21.11.
 - 2. Assemble mechanical joints carefully according to manufacturer's recommendations.
 - 3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
 - 4. Do not overstress bolts.
 - 5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.
- C. Joining Method - Push-On Joints:
 - 1. Install in accordance with AWWA/ANSI C151/A21.51.
 - 2. Assemble push-on joints in accordance with manufacturer's directions.
 - 3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
 - 4. Assure the gasket groove is thoroughly clean.
 - 5. For cold weather installation, warm gasket prior to placement in bell.
 - 6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.
 - 7. Install fast grip gaskets in accordance with manufacturer's recommendations.
- D. Cutting:
 - 1. Do not damage interior lining material during cutting. If lining is damaged, Contractor submit a manufacturer approved field repair method to the Engineer and/or MPW for approval before applying.
 - 2. All cut surfaces will require a field applied coating to cover exposed surfaces. Field coating to match the original shop applied coating (internal and external surfaces).
 - 3. Make square cuts using abrasive wheel cutters or saws.
 - 4. Bevel and free cut ends of sharp edges after cutting.
- E. Support exposed pipe in accordance with Sections 15060A and /or 15060B.
- F. All taps on DI pipe shall be direct taps using tee or wye fittings and shall be coated to match the main sewer coating. Tapping saddles will not be accepted.
- G. Install polyethylene encasement on all DI pipe and fittings in full compliance to AWWA/ANSI C105/A21.5.
 - 1. Encase underground appurtenances required as part of installation.
 - 2. Where tapping polyethylene encased pipe, first wrap location of tap with three (3) layers of polyethylene adhesive tape. Make tap through tape.
 - 3. Make sections 2 FT longer than pipe section to be covered.
 - 4. Slip tube over pipe while pipe is suspended immediately before placing in trench.
 - 5. After installing in trench, pull tube ends over joint and overlap.
 - 6. Fasten securely in-place on each side of each joint with joint tape or strapping.
 - 7. Pull loose tube along pipe barrel up snugly around pipe and fasten in-place with joint tape at 3 FT intervals.
 - 8. Completely cover fittings and connections with film held snugly in-place with joint tape or strapping.
- H. Install buried piping in accordance with Sections 15060A and/or 15060B.

- I. Install restrained joint systems where specified in Sections 15060A and/or 15060B under specific piping system and where shown on the contract drawings.

3.2 WARNING TAPE AND TRACER WIRE

- A. See Sections 15060A and/or 15060B for specifications.

3.3 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Sections 15060A and/or 15060B.

END OF SECTION

SECTION 15063
PIPE: COPPER**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Copper piping, fittings, and appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.
 - 4. Section 02660 – Water Main Construction
 - 5. Section 15060A – Pipe and Pipe Fittings: Basic Water Main Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.18, Cast Bronze Solder - Joint Pressure Fittings.
 - b. B16.26, Cast Bronze Alloy Fittings for Flared Copper Tubes.
 - 2. ASTM International (ASTM):
 - a. B88, Standard Specification for Seamless Copper Water Tube.
 - 3. American Welding Society (AWS):
 - a. A5.8, Specification for Filler Metals for Brazing and Braze Welding.

1.3 SUBMITTALS

- A. See Section 01340 for requirements for the mechanics and administration of the submittal process.
- B. See Section 15060A.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Copper Tubing:
 - 1. Pressure buried: ASTM B88, Type K.
- B. Copper Pipe: ASTM B42, regular strength.
- C. Fittings:
 - 1. Pressure buried: ASME B16.22 or ASME B16.26.
- D. Soldering and Brazing:
 - 1. Buried: Silver solder per AWS A5.8.
- E. See Piping Schedules in Section 15060.
- F. Unions:
 - 1. Pipe sizes 2 IN and smaller: Copper, ground joint.

PART 3 - PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Comply with Section 15060A.

3.2 FIELD QUALITY CONTROL

- A. Test piping systems in accordance with Section 15060A.
- B. Utilize only annealed (soft) type tubing where flared joints are used and drawn temper (hard) type tubing where soldered or brazed joints are used.
- C. Support exposed piping in accordance with manufactures recommendations.
- D. Install buried piping in accordance with Section 02221 and Section 15060A.

END OF SECTION

SECTION 15064

PIPE: PLASTIC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic water main, force main, and gravity wastewater pipe.
- B. Related Sections include but are not necessarily limited to:
 - 2. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 3. Division 1 - General Requirements.
 - 4. Section 02221 – Trenching, Backfilling and Compacting for Utilities.
 - 5. Section 02660 – Water Main Construction
 - 6. Section 02661 – Force Main and Gravity Line Construction
 - 7. Section 15060A – Pipe and Pipe Fittings: Basic Water Main Requirements.
 - 8. Section 15060B – Pipe and Pipe Fittings: Basic Force Main and Gravity Wastewater Requirements

1.2 QUALITY ASSURANCE

- A. See Sections 15060A and /or 15060B.
- B. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. PVC (polyvinyl chloride) materials:
 - 1) D1784, Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.
 - 2) D1785, Standard Specification for Polyvinyl Chloride PVC Plastic Pipe, Schedules 40, 80 and 120.
 - 3) D2241, Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
 - 4) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 5) D2467, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 - 6) D2774, Standard Specification for Underground Installation of Thermoplastic Pressure Piping.
 - 7) D3034, Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
 - 8) D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 9) ASTM 2564, Solvent Cements for (PVC) Plastic Pipes, Tubing and Fittings.
 - b. Polyethylene (PE) materials:
 - 1) D2737, (PE) Plastic Tubing.
 - 2) D1248, Standard Specifications for Polyethylene Plastics Extrusion Materials for Wire and Cable
 - 2. American Water Works Association (AWWA):
 - a. PVC (polyvinyl chloride) materials:
 - 1) C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in. (100 mm Through 300 mm), for Water Distribution.
 - 2) C905, Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameter 14 IN through 36 IN.
 - b. Polyethylene (PE) materials:
 - 1) C901, Polyethylene (PE) Pressure Pipe Tubing and Fittings, 1/2 through 3 IN for Water.
 - 2) C906, Polyethylene Pressure Pipe and Fittings 4 IN through 63 IN for Water Distribution
 - 3. National Sanitation Foundation International (NSF).

1.3 SUBMITTALS

- A. See Section 01340 for requirements for the mechanics and administration of the submittal process.

PART 2 - PRODUCTS**2.1 PRESSURE PIPING (UNDERGROUND) - PVC**

A. Materials: Furnish materials in full compliance with following requirements:

1. 1 ¾ IN: ASTM D2241 PVC, Type I, Grade 1 (12454) with Pressure Class of 200 psi per Table XI, ASTM D2241.
2. 4" – 12" diameter:
 - a. Water: C900 Class 150 DR18.
 - b. Wastewater: C900 Class 235 DR18.
3. 14" or greater diameter:
 - a. Water: PVC may not be used
 - b. Wastewater: C900 Class 235 DR18
4. Joints for PVC pipe shall be the elastomeric-gasket type with a pressure rating not less than pipe pressure rating meeting performance requirements of ASTM D3139.
5. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454 as described in specification ASTM D1784 and D1785 for 3" and smaller. The pipe shall be approved for conveying potable water by the National Sanitation Foundation and shall bear its seal of approval on each component of the PVC piping system.
6. Fittings: All fittings shall be manufactured from ductile iron except for pipe sizes for which ductile iron fittings are not manufactured. The ductile iron fittings shall conform to Section 15062. All fittings for pipes sizes not available in ductile iron shall be brass fittings.
7. Length: Standard laying lengths shall be 20 feet for all sizes. At least 95 percent of the total footage of pipe of any class and size shall be furnished in standard lengths. The remaining 5 percent may be furnished in random lengths provided that random lengths are not less than 10 feet long. Each standard and random length of pipe shall be tested to four times the class pressure of the pipe for a minimum of 5 seconds. The integral bell must be tested with the pipe.
8. Installation: Field threading of PVC pipe will not be permitted. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.
9. Uniformity: Ensure that all piping and fittings are integrated into components of the finished system. Utilize products of a single manufacturer.
10. Supply to the Engineer all information and sample of joining method for his evaluation.
 - a. Only jointing methods acceptable to the Engineer will be permitted.
 - b. No solvent welded joints will be permitted.

2.2 PRESSURE PIPING (UNDERGROUND) – HDPE

A. High Density Polyethylene (PE) pipe:

1. Comply with AWWA C-906, DR 11 and working pressure of 160.
2. Provide SDR high performance, high molecular weight, high density polyethylene pipe, and shall conform to ASTM D 1248 (Type III C, Category 5, P34).
3. Minimum cell classifications values shall be 345434C as referenced in ASTM D 3350 - latest edition.
4. Provide fittings molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe.
5. All fittings supplied under this to be of the same manufacture as the pipe being supplied.
6. Physical properties:

PROPERTY	TEST METHOD	UNIT	VALUE
Density	ASTM Method	gms/cc	0.955
Melt Index	ASTM D-1238 (190/2.16)	gms/10 min	
ENVIRONMENTAL STRESS CRACKING RESISTANCE:			
Condition A, B, & C, F-0	ASTM D 1693	hrs	>5000**
Compressed Ring, F-60	ASTM F 1248	hrs	>1500
Tensile Strength, Yield	ASTM D 638	psi	3200
Type IV Specimen	(2"/min)		
Elongation at Break	ASTM D 638	%	>750
Type IV Specimen	(2"/min)		
Vicat Softening Temp	ASTM D 1525	°F	257

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PROPERTY	TEST METHOD	UNIT	VALUE
Brittleness Temp	ASTM D 746	°F	180
Flexural Modulus	ASTM D 790	psi	135,000
Modulus of Elasticity	ASTM D 638	psi	130,000
Hardness	ASTM D 2240	Shore D	65
Expansion Coef.	ASTM D 696	in./in./°F	1.2x10-4
Thermal Conductivity	Dynatech-Colora BTU, In./Thermoconductor ft./2hrs/°F		
LONG TERM STRENGTH:			
73° F	ASTM D 2837	psi	1600
UV Stabilizer	ASTM D 1603	%C	2.5
Material Cell Classification	ASTM D 1248		345434C
Material Description	PPI Recommendation		PE 3408

7. Quality control:
 - a. Resin:
 - 1) Manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality.
 - 2) Resin used shall have all ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable.
 - b. Pipe:
 - 1) The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.
 - 2) The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index, and other physical properties.
 - c. Testing:
 - 1) Owner may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing.
 - 2) Test results from manufacturer's testing or random sampling by the Engineer that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing.
 - 3) Tests to include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.
 - 4) Provide certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.
8. Rejection: The Owner reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.
9. Pipe dimensions: Pipe supplied under this specification shall have a nominal DIP (ductile iron pipe) size O.D. unless otherwise specified. The DR (Dimension Ratio) of the pipe supplied shall be as specified.
10. Join sections of polyethylene pipe into continuous lengths on the job site above ground.
 - a. Use the butt fusion method performed in accordance with the manufacturer's recommendations.
 - b. Equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.
 - c. Prior approval of equipment and personnel shall be obtained before fusion begins.
 - d. The completed pipe joints shall be guaranteed for five years in writing to the Owner and its Contractor.
11. Provide restrained joint mechanical joint adapters for each end of the P.E. pipeline if required.
 - a. Include any special end configuration and polyethylene ring to hold a standard mechanical joint.

2.3 POLYETHYLENE (PE) TUBING

- A. Provide PE tubing, PR160, DR9, 3408
- B. All tubing shall come with a 50-year material warranty.
- C. Markings on tubing shall include: nominal tubing size, type material (PE-3406), pressure rating, manufacturer's name, and seal of the National Sanitation Foundation (NSF).

2.4 GRAVITY WASTEWATER PIPING

A. Materials:

1. Furnish materials in full compliance to the following material specification.
2. PVC pipe shall be rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454 as described in specification ASTM D1784.
3. The requirements of this Specification are intended to provide for pipe and fittings suitable for non-pressure drainage of wastewater.
4. Joining systems shall consist of an elastomeric gasket joint meeting requirements of ASTM D3212.
5. Supply to the Engineer all information and sample of joining method for his evaluation.
 - a. Only joining methods acceptable to the Engineer will be permitted.
 - b. Provide pipe and fittings meeting or exceeding the following requirements:
 - 1) 4-12 IN DIA: ASTM D3034, SDR-26.
 - 2) 15-27 IN DIA: ASTM 679, PS115
 - 3) For bury depths 20' and greater: C900/C905
6. Ensure impact strengths and pipe stiffnesses in full compliance to these Specifications.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less.

1. Include manufacturer's name and trademark.
2. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications and NSF approvals when applicable.
3. All wastewater pipe shall be green or brown.

3.2 PRESSURE PIPING (UNDERGROUND) - PVC

A. Installation: Install pipe and fittings in accordance with ASTM D2774 and as recommended by the manufacturer.

1. Field threading of PVC pipe will not be permitted.
2. Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.

3.3 PRESSURE PIPING (UNDERGROUND) – HDPE

A. Weld/fuse pipe together in one length prior to placing in bore hole. Place pipe on rollers before pulling into bore hole. Space rollers close enough to prevent excessive sagging of pipe.

3.4 PE TUBING

A. Fittings:

1. Install tubing with compression fittings using stainless steel inserts only.
2. Provide fittings capable of withstanding temperatures from a -70 to 250 DegF.
3. Ensure fittings have the same pressure and temperature rating as the tubing.

3.5 GRAVITY WASTEWATER PIPING

A. Installation: Install pipe and fittings in accordance with ASTM D2321 and as recommended by the manufacturer.

1. Provide for a maximum deflection of not more than 3 percent.

3.6 WARNING TAPE AND TRACER WIRE

A. See Sections 15060A and/or 15060B for specifications.

3.7 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Sections 15060A and/or 15060B.

END OF SECTION

SECTION 15099

WATER SYSTEM APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish all labor, materials, tools, equipment, and perform all work and services necessary for or incidental to the furnishing and installation complete, of all water system appurtenances as shown on drawings as specified, in accordance with provisions of the Contract Documents, and completely coordinated with work of all other trades.
- B. Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete, and compatible installation shall be furnished and installed as part of this work.

1.2 QUALITY ASSURANCE

- A. See Section 15060A.
- B. Verify drawing location and arrangement of appurtenances.

1.3 SUBMITTALS.

- A. See Section 01340.
- B. Detailed information for all water meters including but not limited to size, manufacturers, parts list with exploded view of meter, name of service representative and instructions for installing and repairing meter.
- C. Details for all fittings, valves, piping, meter boxes, meter mountings, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Blow-off Hydrant:
 - 1. Where blow-off hydrants are called out on the drawings install a MainGuard Model #78 manufactured by Kupferle Foundry below grade in a 18"x 30"x 18" cast iron meter box.
- B. Water Service Meters:
 - 1. Water service meters will be provided by Mount Pleasant Waterworks (MPW) after project is accepted and fees are paid.
 - 2. All meters 1" and smaller will be installed by MPW. Meters larger than 1-1/2" will be installed by the Contractor.
 - 3. All meters to be installed pursuant to MPW specifications.
- C. Coppersettters:
 - 1. Coppersettters shall be installed for 1-1/2" and 2" meters only.
 - 2. Approved Manufacturers:
 - a. 1-1/2" Meters:
 - 1) Ford, Model VBHH76-12BHC-11-66-NL
 - 2) AY McDonald, Model E-2-11799
 - b. 2" Meters:
 - 1) Ford, Model VBHH77-12BHC-11-77-NL
 - 2) AY McDonald, Model E-2-11800
- D. Meter Boxes.
 - 1. Meter boxes for single meter installations less than one and one-half (1-1/2) inches (residential or commercial) will be provided and installed by the Contractor.
 - a. Approved Manufacturers:
 - 1) 3/4" Meter Box:
 - a) Ford, Model FLYLPRE-111
 - (1) Ford "Service Package" [Ford # HHCI33-322-3-5-PE-EC23-Set-NL] containing the brass spinner nut, dual check backflow and two (2) gaskets must be ordered separately and handled pursuant to 2.1.C.3 below.
 - b) AY McDonald, Model 776-208PP2P 435X008X208
 - c) Approved equal
 - 2) 1" Meter Box:
 - a) Ford, Model LYLBB111-444-T
 - b) AY McDonald, Model 776-409BBGG 443X303
 - c) Approved equal

2. Meter boxes for meters one and one-half (1-1/2) inches and larger, will be provided and installed by the Contractor.
 - a. Approved Manufacturers:
 - 1) 1-1/2" and 2" meter boxes: DFW Plastics Inc, Model DFW65C-14-1MT Deep
 - 2) 3" and larger meter boxes will be in accordance with MPW's standard detail.
- E. Service Connection:
 1. A completed water service connection shall include tapping of the water main and all other appurtenances shown in the applicable water service detail to provide MPW with an operable service connection approved by the Engineer. Coordinate with a MPW Representative and Property Owner for location of service.
- F. Curb Stops:
 1. Curb stops shall be brass and conform to AWWA C800. Curb stops shall be grip nut connections inlet and outlet. "Tighten to stop" style grip nuts shall not be accepted.
 2. Approved Manufacturers:
 - a. Mueller P-15209
 - b. Ford No. B44
 - c. AY McDonald
 - d. Approved equal
- G. Corporation Stops:
 1. Shall be brass with AWWA inlet and copper outlet.
 2. Approved Manufacturers:
 - a. 1" or less:
 - 1) Ford No. F1000
 - 2) AY McDonald
 - 3) Approved equal with AWWA/CC taper thread inlet and CTS pack joint outlet
 - b. 1-1/2" or larger:
 - 1) Ford No. FB1100
 - 2) AY McDonald
 - 3) Approved equal with male IPS thread inlet and CTS pack joint outlet
- H. Service Saddles:
 1. Service saddles shall be an all brass or all bronze body and meet all applicable AWWA C800 Standards with T-304 stainless steel wide band and double fasteners. One end of the saddle must have closed bolt holes for connection of the band.
 2. Saddle must have a BUNA-N rubber gasket. Saddles with O-ring style gaskets shall not be accepted.
 3. Saddle outlets up to 1.5" shall be AWWA/CC female thread. Saddle outlets 1.5" and greater shall be IPS female thread.
 4. Approved Manufacturers
 - a. Mains up to 3":
 - 1) Mueller, H-1300 Series
 - 2) Approved Equal
 - b. Mains 4" and greater:
 - 1) Ford, Style 202BS
 - 2) Smith-Blair, 325 Series
 - 3) Approved equal
- I. Service Piping:
 1. See Specification 15060-A for specific application of service piping.
 2. All service piping shall be buried a minimum of 2 feet deep except at the water meter box.
 3. Service piping shall be installed in accordance with state and local plumbing code.
 4. All service piping shall be marked in accordance with Specification 15060-A, Section 2.2.D.

END OF SECTION

SECTION 15100

VALVES: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Valving, actuators, and valving appurtenances.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 15060A - Pipe and Pipe Fittings: Basic Water Main Requirements.
 - 4. Section 15060B - Pipe and Pipe Fittings: Basic Force Main and Gravity Wastewater Requirements
 - 5. Section 15101 – Gate Valves.
 - 6. Section 15102 – Plug Valves
 - 7. Section 15106 – Check Valves
 - 8. Section 15114 – Miscellaneous Valves.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
 - b. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 3. American Water Works Association (AWWA):
 - a. C500, Gate Valves for Water and Sewerage Systems.
 - b. C509, Resilient-Seated Gate Valves 3 through 12 NPS, for Water and Sewage Systems.
 - c. C550, Protective Epoxy Interior Coatings for Valves and Hydrants.
 - 4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C111/A21.11, Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
 - b. C116/A21.16-09, Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
 - 5. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

1.3 DEFINITIONS

- A. The following are definitions of abbreviations used in this section or one (1) of the individual valve sections:
 - 1. CWP: Cold water working pressure.
 - 2. WWP: Water working pressure.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Valve pressure and temperature rating.
 - d. Valve material of construction.
 - e. Special linings.
 - f. Valve dimensions and weight.
 - g. Valve flow coefficient.
 - h. Wiring and control diagrams for electric or cylinder actuators.
 - 3. Test reports.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to individual valve Specification Sections.

2.2 MATERIALS

A. Refer to individual valve Specification Sections.

2.3 VALVE ACTUATORS

A. Valve Actuators - General:

1. The actuator manufacturer shall be E.I.M only (model no. varies based on individual project requirements)
2. Provide actuators as shown on Drawings or specified.
3. Counter clockwise opening as viewed from the top.
4. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
5. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
6. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
7. Extension Stem:
 - a. Install where shown or specified.
 - b. Solid stainless steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
 - c. Pin all stem connections.
 - d. Center in valve box or grating opening band with guide bushing.

B. Buried Valve Actuators:

1. Provide screw type cast iron valve box, 5¼ IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover.
2. Box base to enclose buried valve gear box or bonnet.
3. Provide 2 IN standard actuator nuts complying with Section 3.16 of AWWA C500.
4. Provide at least two (2) tee handle keys for actuator nuts, with 5 FT extension between key and handle.
5. Extension Stem:
 - a. Provide for buried valves greater than 4 FT below finish grade.
 - b. Extend to within 6 IN of finish grade.
6. Provide concrete pad encasement of valve box as shown for all buried valves unless shown otherwise.

C. Exposed Valve Manual Actuators:

1. Provide for all exposed valves not having electric or cylinder actuators.
2. Provide handwheels for gate valves.
 - a. Size handwheels for valves in accordance with AWWA C500.
3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
 - a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
 - b. Provide at least two (2) levers for each type and size of valve furnished.
4. Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger.
5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
 - a. Cadmium-plated chain looped to within 3 FT of finish floor.
 - b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.
8. Provide cast iron floor stands where shown on Drawings.
 - a. Stands to be furnished by valve manufacturer with actuator.
 - b. Stands or actuator to include thrust bearings for valve operation and weight of accessories.

D. Submerged Actuators:

1. The valve actuator shall be mounted on top of an extension bonnet, 3 FT above any adjacent personnel access.
2. The valve and bonnet connection shall be flanged and watertight.
3. Provide a top brace support for the bonnet.
 - a. Mount the brace 6 IN below the top of the wall as shown.
4. Materials:
 - a. Extension bonnet: Cast iron ASTM A126 or steel.
 - b. Brace and anchor bolts: Type 304 stainless steel.

2.4 FABRICATION

A. End Connections:

1. Provide the type of end connections for valves buried to be restrained joint MJ and exposed to be flanged unless approved by MPW or as shown on the Drawings.

2. Comply with the following standards:
 - a. Threaded: ASME B1.20.1.
 - b. Flanged: ASME B16.1 Class 125 unless otherwise noted or AWWA C207.
 - c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
 - d. Soldered: ASME B16.18.
 - e. Grooved: Rigid joints per Table 5 of AWWA C606.
- B. Refer to individual valve sections for specifications of each type of valve on Project.
- C. Nuts, Bolts, and Washers:
 1. Type 316 Stainless Steel.
- D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.
- E. Epoxy Coating:
 1. Provide Fusion Bonded Epoxy coating on all interior and exterior surfaces in accordance with AWWA/ANSI C116/A21.16-09.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Painting Requirements:
 1. Refer to Section 09905 – Painting and protective coatings.
- C. Setting Buried Valves:
 1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
 2. Set valves and valve boxes plumb.
 3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
 4. Install in closed position.
 5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
 6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.
 7. All ductile iron or cast iron valves, and all related joint restraints, shall be wrapped in 8.0 mil polyethylene encasement.
- D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.
- E. Install valves accessible for operation, inspection, and maintenance.

END OF SECTION

SECTION 15101 GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gate valves.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. American Water Works Association (AWWA):
 - a. C500, Metal-Seated Gate Valves for Water Supply Service.
 - b. C509, Resilient-Seated Gate Valves for Water and Sewerage Systems.
 - c. C550, Protective Epoxy Interior Coatings for Valves and Hydrants.
 - 3. Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
 - a. SP-9, Spot Facing for Bronze, Iron and Steel Flanges.
 - b. SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - c. SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 DEFINITIONS

- A. NRS: Non-rising Stem.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. See Section 15100.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01640.

2.2 VALVES:

- A. Resilient Seat Gate Valves:
 - 1. Comply with AWWA C515 or C509.
 - 2. Materials:
 - a. Stem and stem nut: Copper alloy.
 - b. Body, gate: ductile iron.
 - c. Resilient seat: Ethylene Propylene Diene Monomer (EPDM) rubber.
 - 3. Design requirements:
 - a. 250 psi working pressure.
 - b. NRS O-ring stem seal.
 - c. Counter clockwise open rotation.
 - 4. Fusion bonded epoxy coating interior and exterior except stainless steel and bearing surfaces complying with AWWA C550.
 - 5. All exposed bolts, washers and connections to other components to be 316 stainless steel. All nuts to 304 stainless steel with fluorocarbon coating.
 - 6. NSF Standard 61 certified

B. Acceptable Manufacturers:

1. Mueller.
2. American Flow Control.
3. U.S. Pipe
4. Approved equal.

2.3 ACCESSORIES

1. Refer to Drawings and valve schedule for type of actuators.
2. Furnish actuator integral with valve.
3. Provide 2-IN operating nut for buried valves and handwheel for exposed valves unless otherwise shown on drawings.
4. Refer to Section 15100 for actuator requirements.

2.4 FABRICATION

1. General:
2. Provide valves with clear waterways the full diameter of the valve.
3. Spot valves in accordance with MSS SP-9.
4. Epoxy coat interior per section 15100.

2.5 SOURCE QUALITY CONTROL

- A. Perform following tests, in accordance with AWWA C500, on valves constructed in accordance with AWWA C500:
 1. Operation test.
 2. Hydrostatic test.
- B. Perform following tests, in accordance with AWWA C509, on valves constructed in accordance with AWWA C509:
 1. Operation test.
 2. Shell test.
 3. Seal test.
 4. Hydrostatic test.
 5. Torque test.
 6. Leakage test.
 7. Pressure test.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. See Section 15100.
- B. All gate valves must be installed with stem perpendicular to the pipe and ground surface. If unique conditions require any other orientation, it must be reviewed and approved by MPW prior to installation.

END OF SECTION

SECTION 15114

MISCELLANEOUS VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Air release and vacuum relief valves.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 15100 - Valves: Basic Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Cast Iron Pipe Flanges and Flanged Fittings - Classes 25, 125 and 250.
 - 2. American Water Works Association (AWWA):
 - a. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
 - b. C550, Protective Epoxy Interior Coatings for Valves and Hydrants.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. See Section 15100.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01640.

2.2 AIR RELEASE VALVES (WATER MAINS)

- A. General: Conform to AWWA C512.
- B. Air Release Valve:
 - 1. Acceptable manufacturers:
 - a. Vent-O-Mat Model #025RBX2521
 - 2. Materials:
 - a. Body and cover: Stainless steel
 - b. Float: Stainless steel
 - c. Linkage and trim: Stainless steel.
 - 3. Design Requirements:
 - a. Size: 1 IN.
 - b. Working pressure: 150 psi
 - 4. 2" Service saddle per section 15099
 - 5. 2" 316L Stainless Steel pipe and ball valve.

2.3 AIR RELEASE VALVES (WASTEWATER FORCE MAINS)

- A. General: Conform to AWWA C512.
- 1. Air Release Valve:
 - a. Acceptable manufacturers:
 - 1) ARI, Model #D-025TPV02
 - 2) H-Tec, Model #986-01
 - b. Materials:
 - 1) Body and cover: Epoxy coated steel, Stainless Steel or Plastic
 - 2) Float and linkage: Stainless steel or Plastic Composite Material
 - 3) Seat: Viton or Buna-N.

c. Design requirements:

- 1) Working pressure: 150 psi.
- 2) Release 10 cfm at 10 psi differential at 75 psi line pressure.
- 3) Inlet 2 IN NPT, outlet 1/2 IN NPT.
- 4) Provide isolation valve, type as shown.

2.4 ACCESSORIES

- A. Furnish any accessories required to provide a completely operable valve.

2.5 FABRICATION

- A. Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.
- B. Provide internal epoxy coating for all iron body valves in accordance with AWWA C550.

2.6 SOURCE QUALITY CONTROL

- A. Shop hydrostatically test to piping system test pressure.

2.7 MAINTENANCE MATERIALS

- A. Provide one (1) set of any special tools or wrenches required for operation or maintenance for each type valve.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: See Section 15100.
- B. Air Release Valves:
1. Pipe exhaust to gravity manhole, if available, or a suitable disposal point.
 2. Where exhausted to a trapped floor drain, terminate exhaust line 6 IN minimum above floor.
- C. An inlet isolation gate valve (type 316 stainless steel) shall be provided.

3.2 FIELD QUALITY CONTROL

- A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.
- B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

SECTION 15366

FUSIBLE POLYVINYL CHLORIDE (PVC) PIPE FOR PRESSURE MAINS INSTALLED BY DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This Section shall be applicable to all fusible PVC pipe required for pressure mains installed by directional drilling.
- B. This Section specifies the material requirements of Fusible Polyvinyl Chloride (PVC) pipe used for pressure mains and all ancillary work associated with the installation of pressure mains by Horizontal Directional Drilling (HDD) pursuant to Section 02781.

1.2 CONFORMANCE WITH DOCUMENTS

- A. All pressure main and appurtenant construction shall be performed in accordance with the Drawings and Specifications.

1.3 SPECIFICATIONS

- A. All Standard Specifications, i.e., Federal, ANSI, ASTM, etc. made a portion of these Specifications by reference, shall be the latest edition and revision thereof.
- B. All Fusible Polyvinyl Chloride (PVC) pipe furnished under these Specifications shall conform to all applicable requirements in the latest revision of the following standards, unless otherwise specified herein:
 - 1. ASTM D1748-08 Standard Specification for Rigid PVC and CPVC Compounds.
 - 2. AWWA C900-07 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100mm through 300mm), for Water Distribution.
 - 3. AWWA C905-10 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350mm-1200mm) for Water Transmission.
 - 4. AWWA C605-05 AWWA Standard for Underground installation of Polyvinyl Chloride (PVC) Pressure Pipe Fittings for Water.
 - 5. NSF-61 Drinking Water System Components - Health Effects.
 - 6. PPI PVC Range Composition Listing of Qualified Ingredients TR-2.

PART 2 - PRODUCTS

2.1 QUALIFICATION

- A. The manufacturer shall certify that all Fusible PVC pipe and fittings are manufactured pursuant to this Specification, specifically the minimum requirements specified in Subsection 1.3 above.

2.2 MATERIALS

- A. Materials used for the manufacture of pipe and fittings shall meet the following requirements:
 - 1. Fusible C900TM and Fusible C905TM shall be marked per the appropriate sections of the AWWA Standard including normal size, PVC, Dimension Ratio, AWWA pressure class or rating, AWWA Standard designation number, NSF-61 Seal, mark verifying suitability or potable water service, extrusion production-record and the trade mark name of Fusible C900TM or C905TM.
 - 2. Cell Classification 12454B and/or PVC material code 1120 shall be included.
 - 3. Fusible PVCTM shall be marked with the nominal size, PVC, cell classification and/or material code, pressure rating, extrusion production-record code and the trade name of Fusible PVCTM.
 - 4. The NSF-61 mark will be included for potable water applications.
- B. Fusible PVC Diameters shall be as specified herein:
 - 1. Fusible C900TM sizes 4" through 12" nominal outside diameter shall have a maximum Dimension Ratio (DR) of 18 pursuant to Subsection 2.3 D below unless specifically approved by the Engineer or indicated otherwise on the Drawings.
 - 2. Fusible C900 and C905 pipe shall be in ductile Iron Pipe Sizes (DIPS).
 - 3. Fusible C905TM sizes 14" through 48" nominal outside diameter shall have a maximum Dimension Ratio (DR) of 18 pursuant to Subsection 2.3D below unless specifically approved otherwise by the Engineer or indicated otherwise on the Drawings.
 - 4. In circumstances where the Contractor and Pipe Manufacturer/Supplier can demonstrate to the Engineer that a higher DR (thinner wall thickness) will not compromise the integrity of the completed force mains, thinner wall pipe may be approved, albeit at the sole risk to the installing Contractor.
- C. Physical properties shall be as specified herein:
 - 1. The material properties of Fusible C900TM/C905TM/PVCTM shall be as defined in ASTM D 1784-02.
 - 2. The Cell Classification shall be 12454B.

2. The formulation for extrusion of Fusible C900TM, Fusible C905TM, Fusible PVCTM shall be compounded to the specific proprietary recipe for the Fusible pipe and meet the requirements of PPI TR-2.
 3. The pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer.
 4. The pipe lengths shall be standard lengths minimum.
 5. Any scratch or gouge greater than 10% of the wall thickness shall be considered significant grounds for rejection unless determined acceptable by the Project Engineer.
 6. Fusible PVCTM shall be **GREEN** for wastewater main applications and **BLUE** for water mains.
- D. All testing for material compliance shall be as specified herein and pursuant to applicable test procedures tabulated above. A certificate of compliance and report of each test shall be furnished by the manufacturer for all materials furnished. Pipe and fittings shall be rejected for failure to meet requirements specified herein.

2.3 PIPE AND FITTINGS

- A. Pipe and fittings shall be manufactured from identical material meeting the requirements of Subsection 2.2A.
1. The manufacturer shall certify that samples of production pipe have been tested in-house in accordance with applicable, specified ASTM standards.
 2. The Contractor shall certify that all pipe material and fittings supplied for the work meet or exceed all specified requirements of Subsection 2.2A.
 3. Pipe shall be extruded from compound formulation that meets the range requirements of PPI TR-2, Table 1 qualifying the pipe for an HDB of 4000 psi.
- B. Pipe pressure ratings shall be a minimum of 150 psi when determined in accordance with the following formula:

$$P = 2 \times HDB \times F / (SDR - 1)$$

Where:

- P = pressure rating, psi
HDB = Hydrostatic Design Basis pursuant to Subsection 2.02A, psi
F = Design Factor
SDR = Standard Dimension Ratio = OD/t
OD = Pipe outside diameter, in.
t = Pipe minimum wall thickness, in.

- C. Pipe Design: Fusible PVC Pipe DR shall be determined in accordance with the external hydrostatic load conditions and the tensile stress conditions encountered during pull-back and shall have a maximum SDR/DR of 18 unless indicated otherwise on the Drawing or approved by the Engineer pursuant to Subsection 2.2, B above.
- D. Nominal pipe diameter shall be as indicated on the Drawings.
- E. Fusible PVC pipe shall be handled in accordance with manufacturer's recommendations.
- F. Fusible PVC pipe shall be joined per the supplier's recommendations.
- G. Fusible PVC pipe shall be installed in a manner not to exceed the supplier's recommended bending radius.
- H. Where fusible PVC pipe is installed by pulling in tension, the supplier's recommended Safe Pulling Force shall not be exceeded.
- I. Pre-Construction Submittals
1. The following product data shall be provided by the pipe supplier and/or fusion provider to the Engineer for approval prior to delivery of materials to the worksite:
 - a. Pipe Size
 - b. Dimensionality
 - c. Pressure Class per applicable standard
 - d. Color
 - e. Recommended Minimum Bending Radius
 - f. Recommended Maximum Safe Pull Force
 - g. Pipe and fusion services warranty information.
 - h. Written procedural documentation for piping products including proper handling and storage, installation, tapping, and testing.
 - i. Fusion technician qualification indicating conformance with this specification.
- J. Post-Construction Submittals
1. The following as-recorded data shall be provided by the Contractor and submitted to the Engineer for review and approval prior to the Engineer's Certification of Substantial Completion:

- a. Fusion report for each fusion joint performed on the project, including joints that were rejected. Specific requirements of the Fusion Technician's joint report shall include:
 - 1) Pipe Size and Thickness
 - 2) Machine Size
 - 3) Fusion Technician Identification
 - 4) Job Identification
 - 5) Fusion Joint Number
 - 6) Fusion, Heating, and Drag Pressure Settings
 - 7) Heat Plate Temperature
 - 8) Time Stamp
 - 9) Heating and Cool Down Time of Fusion
 - 10) Ambient Temperature

PART 3 - EXECUTION

3.1 DELIVERY AND OFF-LOADING

- A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Engineer at no cost to the Owner.
- B. Each pipe shipment shall be inspected prior to unloading to determine if the load has been shifted or otherwise damaged. Notify Engineer immediately if more than immaterial damage is found. Each pipe shipment shall be checked to verify the required quantity and proper pipe size, color, and type.
- C. Pipe shall be loaded, off-loaded, and otherwise handled in accordance with AWWA M23. All applicable pipe suppliers' guidelines shall be followed.
- D. Off-loading devices including chains, wire rope, chokers, or other sharp-edged pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
- E. During removal and handling, prevent pipes from striking anything. Significant impact will cause damage, particularly during cold weather.
- F. If appropriate unloading equipment is not available, pipe shall be unloaded by manually removing individual pieces. Care shall be taken to insure that pipe is not dropped or damaged. Pipe shall be carefully lowered, not dropped, from trucks.

3.2 HANDLING AND STORAGE

- A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work site. Damaged areas, or possible areas of damage may be removed by cutting out or removing the suspected incident fracture area. Limits of acceptable length of pipe shall be determined by the Engineer.
- B. Any scratch or gouge deeper than 5% of the wall thickness shall be considered significant and rejected unless specifically determined acceptable by the Engineer.
- C. Pipe shall be stored and placed on level ground. Pipe shall be stored at the job site in the unit packaging provided by the manufacturer. Caution shall be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.
- D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.
- E. Pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe will be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

3.3 HEAT FUSION

- A. Pipes shall be joined to one another and to Polyvinyl Chloride (PVC) fittings by thermal butt fusion, in accordance with Engineer approved procedures published by the pipe manufacturer.
 1. Both installers and joint inspectors shall be trained by the manufacturer or his authorized representative. The Contractor shall provide the Engineer with the names of installers, fusion welders and joint inspectors and applicable documentation indicating appropriate training for each.
 2. Butt fusion joining of unlike DR's shall not be permitted. Transition from one DR to another shall be accomplished by the use of mechanical couplings.
 3. Sections of Fusible PVC pipe shall be assembled and heat fusion joined on-site above ground and positioned for continuous, uninterrupted pull-back pursuant to Section 02781.
 - a. The contractor may be directed to perform a low pressure air test, not to exceed 5 psi, before pullback begins. The pipe string shall be deemed acceptable if pressure does not drop by more than ½ psi over 10 minutes.

4. All leaking joints shall be repaired or replaced at Contractor's expense and retested. Leakage that occurs after inspection but before final acceptance shall be repaired or replaced at Contractor's expense.
 5. Pressure testing of completed sections shall be in accordance with Subsection 3.5, TESTING.
- B. Sleeve-Type Couplings:
1. Sleeve-type mechanical couplings shall be manufactured for use with PVC pressure pipe, and may be restrained or unrestrained as indicated on the Drawings.
 2. Sleeve-type couplings shall be rated at the same or greater pressure carrying capacity as the pipe being joined.

3.4 MECHANICAL JOINTS

- A. Fusible Polyvinyl Chloride (PVC) pipe shall be connected to systems of fittings of other materials by means of restrained mechanical joints rated for the same pressure service as the piping.
- B. Mechanical restrained joints shall be Series 2000 PV Restrained Joint (C900/C905 DIPS) Flange by EBAA IRON or approved equal, installed in accordance with Engineer approved manufacturer's published procedures.
- C. All Mechanical Joint Fasteners shall be AISI Type 316 stainless steel bolts and Type 304 nuts.
- D. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record all parameters required by the pipe supplier and as specified herein. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's Joint Report.
- E. After installation, connections to other materials shall be by mechanical joint fittings as noted above. PVC pipe ends shall not be bent into position with heavy equipment; instead, alignment shall be accomplished by the use of fittings.

3.5 TESTING

- A. Completed sections of completed FPVC pressure main shall be pressure tested as specified below:
 1. Joints shall be exposed to inspect for leakage. Expansion joints and expansion compensators, if installed, shall be temporarily restrained, isolated, or removed during pressure testing. The temperature of the test liquid and the pipe test section shall both be stabilized at ambient temperature.
 2. WARNING: Pressure testing may cause unknown material/workmanship flaws to fail by leaking or rupture resulting in catastrophic failure; rupture may result in the sudden, forcible, uncontrolled movement of piping, fittings, and/or ancillary components. Pipe sections and fittings under test shall be restrained against sudden, uncontrolled movement from catastrophic failure. Test equipment shall be examined before pressure is applied to insure all components are tightly connected. Take all applicable precautions to eliminate hazards to personnel near sections being tested. Keep all personnel a safe distance away from test sections during testing.
 3. Testing procedures shall conform to applicable requirements of the latest editions of the following standards unless specified otherwise:
 - a. Fusible C900TM/C905TM/PVCTM pipe shall be tested at the extrusion facility for the pipe properties required to meet AWWA Standards for C900 and C905.
 - b. Tests during extrusion shall be done at the frequency as determined by AWWA Standards C900 and C905.
 - c. For each extrusion run, the test results shall be summarized and reported. Copies of each test shall be provided to the Engineer.
 - d. Tests to be included for each extrusion run shall meet or exceed AWWA C900/C905 requirements for Dimensional Checks, Acetone Immersion, Flattening, and Burst Pressure.
 - e. After installation, the required pressure test shall be a hydrostatic test with a minimum duration of three (3) hours.
 4. Hydrostatic Testing and Leakage Testing:
 - a. Hydrostatic and leakage testing for piping systems that contain mechanical jointing as well as fused PVC jointing shall comply with AWWA C605.
 - b. Unless agreed to or otherwise designated by the Engineer, for a simultaneous hydrostatic and leakage test following installation, a pressure equal to 150% of the pipe's certified working pressure at point of test, but not less than 125% of certified working pressure at highest elevation shall be applied. The duration of the pressure test shall be a minimum of two (2) hours.
 - c. If hydrostatic testing and leakage testing are performed at separate times, follow procedures as outlined in AWWA C605.
 - d. In preparation for pressure testing the following parameters shall be followed:

- 1) All air shall be vented from the pipeline prior to pressurization. Venting may be accomplished with the use of non-compensatory air relief valves or corporation stop valves, vent piping in the testing hardware or end caps, or any other method which adequately allows air to escape the pipeline at all high points.
- 2) Venting may also be accomplished by 'flushing' the pipeline in accordance with the parameters and procedures as described in AWWA C605.
- e. The pipeline shall be fully restrained prior to pressurization, including complete installation of all mechanical restraints per the restraint manufacturer's guidelines, whether permanent or temporary to the final installation. Proper restraint shall also include the installation and curing of any and all required thrust blocking. All appurtenances included in the pressure test, including valves, blow-offs, and air-relief valves shall be checked for proper installation and restraint prior to the beginning of each test.
- f. Temporary pipeline alignments that are being tested, such as those that are partially installed in their permanent location shall be configured to minimize the amount of potentially trapped air in the pipeline.
- g. Segments of the pipe may be tested separately in accordance with standard testing procedure, as approved by the Engineer.

END OF SECTION

SECTION 15510 FIRE HYDRANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dry-barrel fire hydrant.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 1 - General Requirements.
 - 3. Section 02660 – Water Main Construction
 - 4. Section 15060A - Pipe and Pipe Fittings: Basic Water Main Requirements.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Waterworks Association (AWWA):
 - a. C502, Dry-Barrel Fire Hydrant.
 - b. C550, Protective Interior Coatings for Valves and Hydrants.
 - c. M17, Installation, Operation and Maintenance of Fire Hydrants.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Acknowledgement that products submitted meet the requirements of the standards referenced.
 - b. Manufacturer's installation instructions.
 - c. Acknowledge and verify dimensions and provide list of integral parts and materials.
- B. Operation and Maintenance Manuals:
 - 1. See Section 01340 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Mueller Centurion, Model A-423 (5-1/4" main valve) with 5" Storz pumper nozzle
 - 2. Waterous Pacer, Model W-B67 (5-1/4" main valve) with 5" Storz pumper nozzle.

2.2 FIRE HYDRANT

- A. Design and Fabrication:
 - 1. Conform to AWWA C502.
 - 2. Provide with either compression or gate design.
 - 3. Provide with a 5¼ IN valve opening, nozzle section consisting of two (2) 2 ½ IN hose nozzles and one (1) 5 IN steamer nozzle with an integral Storz connection.
 - 4. Provide with water passages to permit full flow of water to minimize friction loss.
 - 5. Furnish with multiple weep holes for positive draining to allow water to escape readily from standpipe when hydrant valve is closed.
 - 6. Designed to throttle flow when partially opened.
 - 7. Designed to allow removal of valve and valve stem without digging up hydrant.
 - 8. Suitable for 4 FT of bury.
 - 9. Furnish with mechanical (gland type) joint inlet connections.
 - 10. Design to break off at ground line when struck by a vehicle.
 - 11. Furnish with O-ring packing only.
 - 12. Furnish hose and steamer nozzles with threads conforming to standard threads used by local Fire Department.
 - 13. Furnish with direction of opening counterclockwise as required by local Fire Department with direction of opening cast on dome.
 - 14. Provide 6-IN valve and box and connecting 6-IN piping to main connection and include in hydrant price.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install hydrants at locations indicated in accordance with AWWA M17 and the following:
1. Remove foreign material from barrel of hydrant before placement.
 2. Install plumb and at same elevation as connecting pipe and main.
 3. Place each hydrant on a 9"x 9" bed of 57 stone with a minimum depth of 6".
 4. Provide restrained joints at all joints between main tee, gate valve, and hydrant. Restrained joints may be retainer glands with megalugs.
 5. Polyethylene encasement: All ductile iron and cast iron material associated with the installation of fire hydrants (including all below-grade hydrant barrels and risers, valves, fittings, restraint couplings and pipe) shall be wrapped in accordance with ANSI A21.5 (AWWA C105), Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids. Thickness shall be 8 Mils.
 6. Place granular bedding material around weep holes of hydrant. Refer to latest MPW Construction Detail W-16.
 7. Firmly tamp carefully compacted backfill around hydrant to surface of ground and to a distance of 5 FT in front of hydrant.
- B. Hydrant Usage Prior to SCDHEC Approval:
1. Once pressure and bacteriological testing has been completed, MPW allows the use of fire hydrants for fire-protection and non-potable purposes (using a MPW-issued hydrant meter) prior to the issuance of a Permit to Operate (MPW Guidelines for Development). If a MPW hydrant meter is to be installed under these conditions, the Contractor shall post a warning sign indicating that the water is for "NON-POTABLE USE ONLY". This sign shall remain affixed to the hydrant meter until the SCDHEC Permit to Operate is issued.
 2. All hydrants, which have been activated for fire protection or hydrant meter use shall have the isolation valve, opened completely and shall be tested for proper flow by the Contractor prior to removal of the "Hydrant Out of Service" bag
- C. Inactive Hydrants:
1. Immediately following installation, all fire hydrants shall be securely covered with a polyethylene bag bearing the words "Hydrant Out of Service", or some other indication that the fire hydrant is not active. Hydrant bags shall be as manufactured by Joseph G. Pollard Co., or equal. Plastic "garbage" bags are not acceptable. If, during flushing operations, the bag is removed, it shall be replaced immediately after the hydrant is shut down. The hydrant bag shall remain in place until a SCDHEC Permit to Operate is issued unless other provisions have been made by MPW.

3.2 COATINGS AND FINISHES

- A. Provide hydrant with below grade and above grade coatings as per Section AWWA C502.
1. Paint above grade with color conforming to the requirements of the local Fire Department and as selected by Owner.
 2. Apply one finish coat to the hydrant after it is installed and tested, finish coat shall be silicone alkyd, Tnemec, or approved equal.

END OF SECTION